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Research Article

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Development of Tomato Bar for Different Culinary Uses

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ABSTRACT

In this study the main aim is to develop a tomato bar for different culinary uses. Standard procedures were adopted for preparing the fruit bar. Tomato bar (15.33%Moisture) is a unique product,as for the extension of research fruit bars available only on fruit based and this tomato bar is value added produced from vegetable. Various analysis (proximate composition, lycopene content, physio-chemical parameters, sensory quality evaluation, packaging parameters, reducing sugars) were performed to evaluate the overall virtues of tomato fruit bar. Results showed that the tomato bar to be rich in protein, low calorie (0.02g/100g), enriched with vitamin C(62.34mg/g) and carbohydrates with good energy value. Textural quality of tomato bar was observed to be good due to its reducing sugar content (36.66%), thus rendering it suitability for chewing and bite. The rehydration ratio (1.003) is also found to know the dissolving nature during cooking. The prepared tomato bar was incorporated in culinary forms like sambhar, chutney, sauce, sandwich preparations and the sensory evaluation was performed. Results generated in this study suggest that the tomato bar may be expected to fulfil the requirements of health conscious consumers, satisfy fast food eaters, reduce post-harvest loss, and increase in economic returns of farmers and producers.

Keywords: *Tomato bar, Sensory, Low calorie, Rehydration ratio*

INTRODUCTION

Tomato (*Lycoperiscon esculentum*) belongs to the genus *Lycoperiscon* under *Solananceae* family. Tomato is one of the most important "protective foods" because of its special nutritive value. Tomato is one of the most versatile vegetable with wide usage in the Indian culinary tradition. Tomatoes are used for various purposes, as soups, salads, pickles, ketchup, puree, sauces and in many other ways. Tomato has very few competitors in the value addition chain of processing. Tomato is world's third largest producing vegetable crop after potato and sweet potato, but it's at top list of the canned vegetable. In 2016, world production of tomatoes was 177 million tonnes, china accounting 32% of total, followed by European Union about 24.2%, India is about 1.4%, United states is 12% and Turkey about 12.6% global tomato exports were valued at 85 billion US dollars in 2016 (FAOSTAT, United Nations, 2017).

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Quality of fruits in pre and post-harvest influence the consumer acceptance (Agarwal & Manaraj, 2005). The demands of fast nutritious and safe foods are growing around the worldwide. As balance diet is the best way for preventing the health issues like obesity, diabetes, malnutrition, etc. The new invention for convenience food is growing and one such product is the fruit bar. The bar made out of tomato is a versatile product that enhances change in lifestyle of consumer and health awareness. The ingredients are combined appropriately to ensure their complement in flavour, texture and other physio-chemical properties. In order to reduce the post-harvest losses there is a need to develop a low cost technological product that ensure the farmers get an assured price for the produce at all times. Development of healthy product is a priority for food industry (Borges et al., 2015). Fruit bars are highly accepted products that have been already developed from many other types of fruits. Fruit bar is a concentrated product that has superior nutritive and energy values. In addition, compared to fresh fruits, fruit bars have extended shelf life (Ong Joo Parn et al., 2014). Fruit bars can be served as wholesome nutritious food for all age groups. This tomato fruit bar helps out to overcome the cooking process as an easier one. Tomato bar is used for different culinary purpose as an alternate of tomato fruit in sambhar, sandwich, sauces and chutneys.

This study aims to develop a fruit bar from tomato and to study the various physio-chemical parameters and sensory attributes were analyzed for the final packed product. To reduce the post harvest losses of tomatoes by processing it to a new product for convenient and fetch more requirements

MATERIALS AND METHODS

2.1. Raw Materials:

Fresh ripened tomatoes (without any damages) were purchased from local Krishnagiri market in Tamil Nadu. The other ingredients such as pectin, sugar, invert syrup, malto dextrin for tomato fruit bar was purchased from MCI Agro Industries Krishnagiri.

2.2. Methods: Preparation of tomato bar

Fruit bar is a nutritional product, has chewy texture and taste.The procedure for tomato bar is as follows

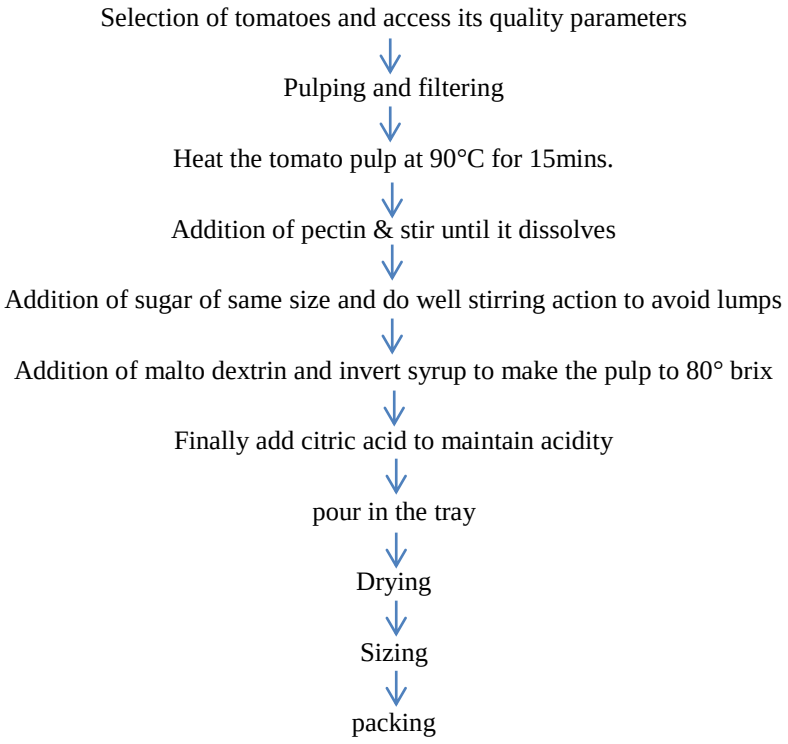

Fig. 1: flow chart for preparation of fruit bar

2.3. Analysis of Physio-chemical parameters of tomato bar:

Water activity was determined using aqua lab dew point water activity meter 4TE (Balasubramanian, Vishwanathan, 2007). Colour was determined using hunter lab colour flex model (Das, Raycaudhuri & Chakraborty, 2013). pH of bar was determined using digital pH meter (Raghavendra & Ragahav rao, 2010). Titrable acidity is determined using ADMI 1990 method. TSS was measured using digital refractometer (Abid et al., 2013). Moisture content of bar was determined by hot air oven method. Rehydration ratio was determined by the method used for rehydration test for fruits and vegetables (Ranganna, 1986). Lycopene content was estimated using spectrometric method (Sadasivam, Manickam book on biochemical methods). Reducing sugars concentration was estimated by DNS method.

2.4. Proximate Analysis:

The proximate composition (moisture, fat, protein, ash and calories) of tomato bar was done as per relevant AOAC method (20Th edition) of food analysis. Vitamin C was determined by colorimetric method using 2,4-dinitrophenylhydrazine.

2.5. Packaging methods:

The tomato leather was packed in a flexible packing material and the physical barrier properties of the packing material was tested as per the standard procedure. The bar is sliced into standard length based on its culinary uses and hence it is packed with flexible material by form laminated pouch packing machine

2.5.1. Bursting strength:

Bursting strength is widely being used to measure the resistance to rupture in various packing materials. The bursting strength of packing materials is a composite measure of certain properties of the sheet structure, principally tensile strength and elongation. Auto burst machine works on the principle of hydraulic pressure of fluid which raises the rubber ball and burst the sample placed over it. The calculations of bursting strength of packing material is given below (ASTM, D3786)

Bursting strength=kg/cm^2

Burst factor= (Bursting Strength X 10^7) / GSM (oven dry GSM)

Burst index (kPa. m^2 / g) = (Bursting Strength x 98.0665) / GSM (room temp GSM)

2.5.2. Water absorption value/ Cobb Value:

Cobb value is the grams of water absorbed by 1m² paper surfaces during flooded contact with 1cm of 0.4 inch of water column for 60 to 120seconds. The one-minute Cobb is quite common. Cobb tester measures the amount of liquid penetration into sheet of packaging materials. The Cobb index was calculated using the following formula. (ISO 535)

Water absorptiveness or Cobb value (g / m^2) = difference in weight of the paper × 100

2.5.3. Water vapour permeability:

It is the barrier property of packaging material which permits the passage of water vapour through it. It is defined as the time rate of water vapour transmission through a unit area of flat material of unit thickness induced by a unit vapour pressure difference between two specific surfaces, under specified temperature and humidity conditions (ASTM, D3875).

2.5.4. Vertical drop test:

The vertical drop test is done because if any case of falling of sample from any of height there may be break or leak over the packing material hence that cause damage to the final product. Hence in order to know the sealing integrity of the packing material this is being done. The principle is that the filled food package is railed above the rigid plane surface and released to strike this hard surface after a free fall, the height of drop and position of the package being predetermined. The food packaging shall be filled with the intended commodity but, if this is not possible, with a similar material, taking into account type and size of granules etc. The food packed is dropped by all directions. The readings are tabulated. Drop height is calculated using the formula H=0.85+0.15(n-1) and 0.3+0.05(n-1). Where 'H' is the height in centimeters and 'n' is number of droppings.

2.5.5. Sealing test:

Sealing test is done to know the efficiency of packing of the food material. This is done

using leak test apparatus machine where the pressure is given at different pressure to know the sealing integrity.

2.6. Sensory test:

Tomato bar samples were subjected for sensory evaluation through 7point hedonic scale rating test. A semi-trained panel consisting of 15 judges evaluated the sample products on different attributes such as appearance, aroma, colour, taste, texture and overall acceptability. The tomato bar was incorporated to different products like sambhar, sandwich, sauce, soups and assessed by the panellist based on the attributes.

RESULTS AND DISCUSSION

2.8.1. Optimization of tomato fruit bar:

The tomato pulp is poured in a tray and sun dried for 44 hours at 46°C. This temperature is taken as standard after different trails of drying the bar. Since the bar is dried in solar drier the temperature during drying was expected to be around an average of 46°C and the time is optimized by attaining the final moisture of bar. The length, breadth and height of tomato bar are mentioned in Table 1. The average weight of one bar is 7.29±0.057g. The moisture of range 12-13% with respective the water activity (aw) of 0.45 indicates that the safe limit for good texture product, lower risk of microbial proliferation and increase in shelf life. Colour is the most important product intrinsic sensory parameter that tends to set people expectations of the product. The reducing sugar is most important factor for determining the bar strength. This is because the reducing sugar of bar having less than 35% indicates that the bar gets soggy and attain more moisture simultaneously if the reducing sugar is more than 3% makes the bar to be hard, hence insufficient to lose its textural property.

Table 1: Physical parameter of tomato bar

Parameter	Values
Drying temperature(°C)	46.033 ± 0.577
Drying time(hours)	44
Bar length(cm)	7.166 ± 0.057
Bar breadth(cm)	2.6 ± 0.1
Bar thickness(cm)	0.2
Water activity(aw)	0.633 ± 0.005
Moisture content(%)	15.33 ± 0.208
Colour(ΔE)	26.608 ± 0.013
Reducing sugar(%)	36.66 ± 0.577

2.8.2. Physio-chemical parameters:

The brix value of tomato bar before pouring into tray found as 74° brix. This helps to maintain the sugar level of the sample during complete drying process. pH has influence over the product shelf life as at the pH of below 7, it helps in maintaining the product stability and shelf life. Titrable acidity helps to know the amount of total acid content present in the food. Lycopene amount usually varies on the maturity index of tomato but it is about 80 - 90% in matured tomato (Hart & Scott, 1995). Lycopene intake was found to have benefits over the body by preventing cancers especially, digestive tract, pancreases, bladder (Gerster, 1997). Rehydration ratio indicates that the tomato bar once dissolved in water at the time of cooking it has good ability to dissolve in water for making the recipe of *sambhar*, as well it tends to be useful in making tomato sauce and other purpose.

Table 2: Physio-chemical parameter of tomato bar

Parameter	Values
Brix(°)	74
pH	4.366 ± 0.057
Acidity content(%TA)	0.766 ± 0.057
Lycopene content (mg/100g)	2.085 ± 0.019
Rehydration ratio	1.003 ± 0.577

The results of proximate composition of tomato fruit bar is enlisted in the Table 3. Pectin has essential significance over moisture and water activity (Huang & Hsieh, 2005). The ash content of tomato bar is also influenced by pectin concentration which might be attributed to increase total inorganic components in fruit bars. The tomato fruit bar exhibited the value of 328.38 kcal/100g in calorie value which is lower than existing fruit bar (man & sin, 1997). The tomato fruit bar was considered to have low calorie. This indicates that tomato fruit bar have ability to serve as nutritious snack as it has low calorie, moderate protein and vitamin C content and also for cooking purpose it helps to replace tomato during preparation of *sambhar*, *sandwich*, etc.

Table 3: Proximate composition of tomato bar

Parameters	Value
Moisture (g/100g)	15.84±0.45
Total ash (g/100g)	1.09±0.03
Fat (g/100g)	0.02
Protein (g/100g)	3.47±0.09
Carbohydrate (g/100g)	78.58
Energy (kcal/100g)	328.38
Vitamin C (mg/g)	62.34

2.8.3. Packaging material parameters:

The packaging aspect of tomato bar is as follows. The tomato bar is packed in a Poly Propylene (pp) packing material. The packaging parameters like bursting strength, vertical drop, leak test, Cobb value, and water vapour permeability were tested for the packing material. Packing material was tested and inferred that the PP has ability to protect the bar from mechanical damage, withstand the pressure from dropping at maximum height, no tear or damage to the final packed product quality. Cobb value is less so it indicates that the absorption is less and the packing material is suitable for the packing of tomato bar. Moisture control is a critical factor in many industries, moisture sensitive foods are put in a packaging with controlled water vapour transmission rate (WVTR) to achieve the required safety, quality and shelf life. There was no permeability of water through the product under the observation of one day.

Table 4: packaging parameter of tomato bar

Parameters	Bursting strength (kg/m^2)	Vertical drop (200cm)	Leak test (500mm/2min)	Cobb value (g/m^2)	WVTR(g/m^2/day)
poly propylene	0.07	No damage	No leak	3.9	No permeable

WVTR*- Water Vapour Transmission Rate

2.8.4. Sensory of tomato bar:

The results of sensory analysis are presented in the Table 5, which was based on the evaluation by semi-trained members in which the tomato bar was incorporated to make different products such as *sambhar, chutney, sandwich, sauce*. The 7-point hedonic scale was performed for evaluation of samples where 7 was given for 'like extremely', 6 is 'like very much', 5 is 'like moderately', 4 is 'neither like nor dislike', 3 is 'dislike moderately', 2 is 'dislike very much' and 1 is 'dislike extremely'.

Table 5: Sensory evaluation of tomato bar

Products	Colour	Appearance	Taste	Flavour	Mouthfeel	Overall acceptability
sambhar	6.1±1.2	6.2±0.8	6.2±1.2	6.2±0.9	6.1±1.2	6.16±1.0
sauce	6.6±1.0	6.3±0.9	6.1±1.1	5.9±1,1	5.8±0.2	6.14±0.8
chutney	6.2±1.1	5.6±0.9	5.1±1.2	5.3±1.1	5.1±0.9	5.4±1.0
sandwich	6.1±1.2	5.2±1.0	5.6±1.4	5.0±1.3	4.2±1.0	5.3±1.1

Hence the tomato bar incorporated in different dishes was made which were liked by many subjects. Every dish was analyzed by having control (without tomato bar but with addition of tomatoes). The panellist preferred *sambhar* with on bar was fine and equally matching to the control. The *sauce* was also preferred equally to s*ambha*r due to its good sour taste. The *chutney* and *sandwich* were like moderately but was to accepted level.

CONCLUSION

In this study tomatoes were used as a basic raw material for preparation of tomato bar. The tomato bar has low moisture and water activity which helps the bar to retain good stability and shelf life. The other physio-chemical parameters like brix, pH, acidity, colour, etc are up to the standards of FSSAI and have enhanced quality of fruit bar. The rehydration time of the tomato bar was less hence this helps to reduce the time during cooking. The tomato bar is considered as high nutritional with low calorie by food industry. The tomato bar prepared by this process showed better textural, sensory, and storage stability. The tomato bar was packed in PP were sensory acceptable with respect to their packaging parameters. The product is rich with vitamin C and low calories hence can be served to all age groups. This indicates that tomato fruit bar can be served as nutritious snack and also for cooking purpose it helps to replace the tomato during preparation of *sambhar, chutney, sandwich,* etc. Tomato bar has better convenience rather than the raw tomato, as tomato bar has extended shelf life, sensory quality, and increased the scope of food processing, priority in cooking. This kind of tomato bar can be used as major ingredient in products like sambhar, chutney, sauce, soups, etc., where as it can also be served as topping over burgers, pizzas, wafers, etc. Hence people will consume the whole product without wasting over the seasonings and toppings. Tomato bar is a unique product in which, as for the extension of research fruit bars available are only fruit based and this tomato bar is such a vegetable based product. Since there are lots of products developed only for fruit based, by this kind of products can help increase economic returns for farmers and processors, and also demand for tomato producers increases and also to reduce post-harvest losses. The yield of processing bar was about 88 to 90%.

REFERENCES

Ahmad, S., Vashney, A. K., & Srivasta, P. K. (2005). Quality attributes of fruit bar made from papaya and tomato by incorporating hydrocolloids. *International journal of food properties*, 8(1), 89-99.

Balasubramanian, S., Vishwanathan, R., & Sharma, R. (2007). Post harvest processing of millets: An appraisal. *Agriculture Engineering Today*, *31*(2), 18-23.

Da Silva, E. P., Siqueira, H. H., do Lago, R. C., Rosell, C. M., & Vilas Boas, E. V. D. B. (2014). Developing fruit based nutritious snack bars. *Journal of the Science of Food and Agriculture*, *94*(1), 52-56.

Feldsine, P., Abeyta, C., & Andrews, W. H. (2002). AOAC International methods committee guidelines for validation of qualitative and quantitative food microbiological official methods of analysis. *Journal of AOAC International*, *85*(5), 1187-1200.

Krishnaveni, S., Balasubramanian, T., & Sadasivam, S. (1984). Sugar distribution in sweet stalk sorghum. *Food chemistry*, *15*(3), 229-232.

Nadeem, M., Haseeb, M., & Aziz Awan, J. (2012). Development and physico-chemical characterization of apricot-date bars. Journal of Agricultural Research (03681157), *50*(3).

Prasad, N. N., Siddalingaswamy, M., Parameswariah, P. M., Radhakrishna, K., Rao, R. V., Viswanathan, K. R., & Santhanam, K. (2000). Proximate and mineral composition of some processed traditional and popular Indian dishes. *Food chemistry*, *68*(1), 87-94.

Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education.

Vijayanand, P., Yadav, A. R., Balasubramanyam, N., & Narasimham, P. (2000). Storage stability of guava fruit bSharma, S. K., Chaudhary, S. P., Rao, V. K., Yadav, V. K., & Bisht, T. S. (2013).