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Production and quality evaluation of canned tomato paste prepared from pre-treated sun-dried tomato slices and leather (Salsadeen).

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ABSTRACT

The aim of this study was to preparing canned tomato paste from pretreated sun-dried tomato slices and leather (Salsadeen). Fresh, mature and ripe tomato sample (*Lycopersicun esculentum*) purchased from Omdurman local market was used in this study. The bulk of tomatoes were divided into three portions used for preparation of fresh tomato paste, sun-dried tomato slices and leather (Salsadeen). The portion used to prepare pretreated sun-dried tomato slices was divided into three groups, the first was dipped in 10% sodium chloride (salt solution) for 3 minutes, the second was dipped in 10% sodium chloride (salt) and 0.9% sodium metabisulphite solution for 3 minutes, the last was left un treated. The tomato pulp used to prepare tomato leather (Salsadeen) was divided into two portions one was treated with 1.5% sodium metabisulphite and the other was left untreated. Treated tomato slices and pulp was sun-dried for 24 hours and the experiment was replicated 3 times. Tomato paste was prepared from reconstituted sun-dried tomato slices and leather (Salsadeen) as well as from fresh tomato pulp. The quality characteristics (Total Soluble Solids, color, Titerable Acidity, pH, Salt content, Viscosity and panel test) of tomato paste prepared from fresh and pre-treated sun-dried tomato slices and leather (salsadeen) was evaluated in this study. Results indicated that tomato paste prepared from dried tomato slices dipped in 10% sodium chloride and 0.9% sodium metabisulphite solution was superior in quality except in salt content. The main recommendations of this study were that dried tomato slices and leather can be used to prepare tomato paste after reconstitution, and it will be of interest to get advantages of tomato during the season to prepare dried tomato slices or leather and use it off-season to prepare tomato paste. The dried tomato slices or leather (Salsadeen) must pretreat to prepare good quality tomato paste. Salt content in dipped solution of tomato slices must be decreased.

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1. Introduction

Tomato (*Lycopersicon esculentum*) has a limited shelf life at ambient conditions and is highly perishable. It creates glut during production season and becomes scanty during off-season. Short shelf life coupled with inadequate processing facilities results in heavy revenue loss to the country. The demand for dehydrated tomato is increasing rapidly both in domestic and in the international market with a major portion of it being used for the preparation of convenience food. Thus, there exists a need to develop a suitable technology for processing and preservation of this valuable product in a way that will not only check losses but also generate additional revenue for the country (Mohseni and Ghavidel, 2011). In Sudan, the tomato is considered as the most important vegetable crop due to its economics and nutritional value. It occupies about 28% of the total area under vegetable production (Ahmed, 2009). Even though the tomato is grown in different states in Sudan, most of these states have no processing facilities; as a result, a lot of waste is usually encountered specially during the season. In recent years, the demand for *tomato paste* in Sudan has increased considerably. The local annual demand for tomato paste was estimated to be about 6000 tons, which is imported annually from European countries with hard currency (Suliman, Awn and Yousif 2011).

The main objective of this study was to taking advantage of surplus production during the season to produce dried tomatoes (slices and leather) and later use to produce tomato paste.

2. Material and methods

Tomato samples used in this study were purchased from Omdurman local market/Sudan. The bulk of the tomato was divided randomly into three portions, one of them was used to prepare fresh tomato paste, the second was used to prepare pretreated sun-dried tomato slices and the last was used to prepare pretreated sun-dried tomato lather (Salsadeen).

2.1 Preparing of sun-dried tomato slices

The tomato fruits were firstly weighted washed, trimmed and slices. The bulk of slicing tomatoes was divided into three portions. A random 1000g of tomato slices were weighted from each portion. The first one was dipped in 10% sodium chloride (salt solution) for 3minuts, the second was dipped in 10% sodium chloride (salt) and 0.9% sodium metabisulphite for 3 minutes, and the last was untreated. The three groups were sun-dried for 24 hours.

2.2 Preparing of sun-dried tomato leather (Salsadeen)

After weighted, washed and trimmed, the fresh tomato fruits were cut into thin slices. The sliced tomatoes were subjected to low heat treatment in a normal stove for 15 minutes and then pulped using hand pulper. The pulp was divided into two portions .1000g was weighted from each portion, one of them was treated with 1.5% sodium metabisulphite and the other was left untreated The pulp was then uploaded onto drying metal trays with a solid base

covered with polyethylene case. The two samples were sun-dried for 24 hours (as recommended by Eisa, 2013).

2.3 Preparing of tomato paste from fresh and dried tomato slices and leather (Salsadeen)

A home method was used in this study to prepare tomato paste from fresh tomatoes and reconstituted tomato slices and leather (Salsadeen). Tomato fruits were weighted, washed and trimmed, and then the bulk of tomato fruits were sliced. The prepared tomato slices were exposed to heat treatment for 30 minutes in normal stove then the pulp was extracted using a hand pulper. The pulp was placed in a cloth case to drip out the serum. The collected serum was concentrated using normal stove to 20° Brix TSS. The solid part of tomato was then added and mixed to concentrated serum and mix was concentrate to 24° Brix TSS. The tomato paste was filled into tin cans, closed and sterilized at 95°C for 15 minutes and suddenly cooled to 27°C. The sun-dried tomato slices and leather (Salsadeen) was dipped into 1:8 of hot water 80-85°C for 80 minutes and then pulped using the same hand pulper. The same previous method was used to prepare and fill the tomato paste.

3. Analytical methods

Total soluble solids (TSS): Total soluble solids (TSS) was determined using manual master refractometer (Type ATAGO®) with a range of 0-32° Brix

Color: The color was determined using a computerized colorimeter (Type LANGE LICO 100 model LMG175.00).

Titerable acidity: Titerable acidity was determined via titration method using NaOH 0.1 N and phenolphthalein as indicator according to AOAC 1992.

pH value: pH value was determined using pH meter Type JENWAY model 3510.

Salt content: Percentage of salt was calculated using titration method, the method presented by (Ranganna, 2001).

Consistency: the consistency was determined using Bostwick consistometer which depends upon the theory of the degree of diffusion in cm/30 seconds.

Panel test: The six samples of this experiment were determined for its organoleptic quality using the scoring test described by (Abdelrazig, 2002). Thirty untrained panelists were determined five organoleptic quality attributes of tomato paste, which was color, flavor, viscosity, taste and total acceptability.

Statistical analysis: The treatments of this study have been subjected to statistical analysis to determine the significant differences between treatments. ANOVA table analysis was used in the present study; mean separation was done via Duncan method

4. Results and discussion

The **Total Soluble Solids** (TSS) of tomato paste prepared from fresh tomatoes in comparison with the TSS of tomato paste prepared from reconstituted sun-dried tomato slices and leather Salsadeen was shown in Fig. 1. The TSS of fresh tomato was ranged between 4.0–4.5° Brix. However, (Koh, Charoenprasert and Mitchell, 2011) reported that the TSS of fresh tomatoes was 4.9 ±3° Brix, the results obtained in this study also agree with (Wilber, 1983 and Tigist, *et al.,* 2013). Even more, Campos *et al.,* (2006) reported that minimum value of soluble solid around 4.5% is considered low for industrial tomatoes. The TSS of reconstituted tomato slices and leather present in this study was ranged between 7.2–10.0° Brix, and then, all of the samples were concentrated to 24° Brix. However, Suliman, Awn and Yousif (2011) reported that the TSS of tomato paste prepared from some Sudanese cultivars was 24° Brix. the results obtained in this study was also agree with the Syrian standard specifications No 180 for the year 1979 that the TSS must not be less than 24% in light tomato paste. No significant differences were observed in TSS of tomato paste after one month of storage

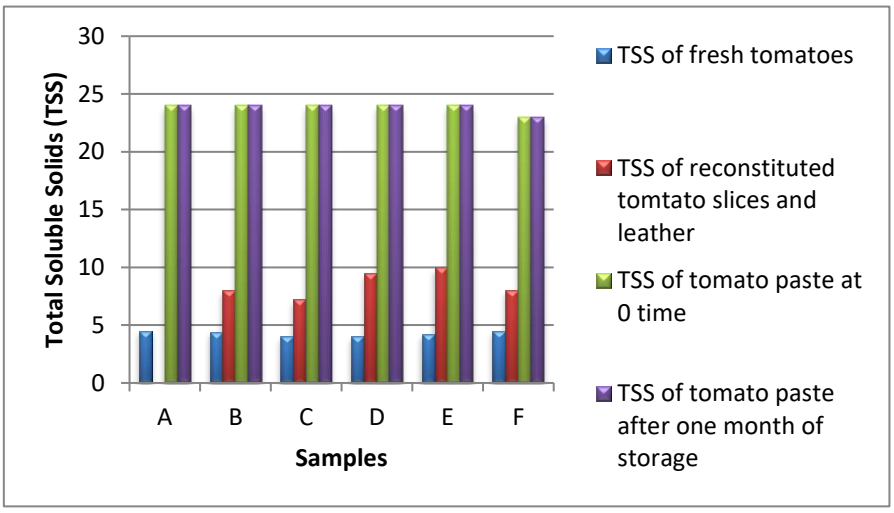

Fig. 1. Total Soluble Solids (TSS) of fresh, reconstituted sun-dried tomato slices and leather and tomato paste at 0 time and after one month of storage Where:

A: *Tomato pastes prepared from fresh tomatoes.*
B: *Tomato paste prepared from dried tomato leather treated with 1.5% sodium metabisulphite.*
C: *Tomato paste prepared from untreated dried tomato leather.*
D: *Tomato pastes prepared from dried tomato slices dipped in 10% sodium chloride (salt).*
E: *Tomato pastes prepared from dried tomato slices dipped in 10% sodium metabisulphite (salt) and 0.9% sodium metabisulphite.*
F: *Tomato paste prepared from untreated dried tomato slices.*

The **color** of fresh reconstituted tomato slices and leather (Salsadeen) and tomato paste at 0 time and after one month of storage was demonstrated in Fig. 2. The color of fresh tomato was ranged between 5.8–6.6 Gardner color scale. However, Nguyen and Schwartz (1999) reported that the color of foods is one of the most important sensory attributes for the product acceptance. Lycopene is responsible for the red color of the tomatoes. Eisa (2003) reported that the tomato for processing must be uniform in maturity and color. The color of pretreated sun-dried tomato slices and leather (Salsadeen) after reconstitution was ranged between 5.5–9.1 Gardner color scale, Toyin (2010) reported that the red color of tomato gradually changed to brick red and then brown after dehydration. A significant difference in color was observed in tomato paste prepared from different pretreated tomato slices and leather (Salsadeen). The color of tomato paste at 0 time and after one month of storage was ranged between 6.0–9.3 and 6.0–9.6 Gardner

color scale respectively. WFP Technical Specification for tomato paste (2011) reported that the color of tomato paste must be two minimum Gardner color scale. No significant difference was observed after one month of storage.

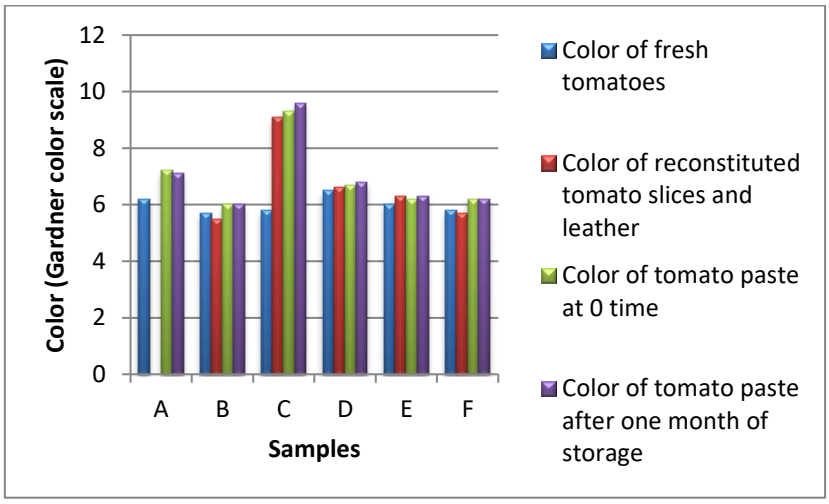

Fig. 2. The color of fresh reconstituted sun-dried tomato slices and leather and tomato paste at 0 time and after one month of storage

The **Titerable Acidity** (TA) of fresh reconstituted pretreated sun-dried tomato slices and leather (Salsadeen) and tomato paste at 0 time and after one month of storage illustrated in Fig. 3. (TA) of fresh tomatoes was ranged between 0.25–0.36 (as % of citric acid). The results obtained in this study were also agreed with Ringeisen, *et al.* (2014) who found that the (TA) of fresh tomatoes ranged between 0.38–0.42%. Koh Charoenprasert and Mitchell, (2011) reported that the (TA) of fresh tomatoes was ranged between 0.25–0.35 %. (TA) of reconstituted pretreated sun-dried tomato slices and leather was ranged between 0.28–0.41 (as % of citric acid). It is obvious that (TA) was decreased in tomato slices and leather (Salsadeen) pretreated with sodium metabisulphite due to the alkaline characteristics of sodium metabisulphite. TA of tomato paste at 0 time and after one month of storage was ranged between 1.28–1.55 and 1.22–155 (as % of citric acid) respectively. Suliman, Awn and Yousif (2011) found that the (TA) of tomato paste prepared from some Sudanese verities was ranged between 0.95 – 1.68 %. The same increase in TA was observed in tomato paste prepared from sodium metabisulphite pretreated tomato slices and leather (Salsadeen). No significant differences were recorded after one month of storage. However, in Syrian standard specification, No 180 for the year 1979 the (TA) of tomato paste must not exceeding 3.5% as citric acid.

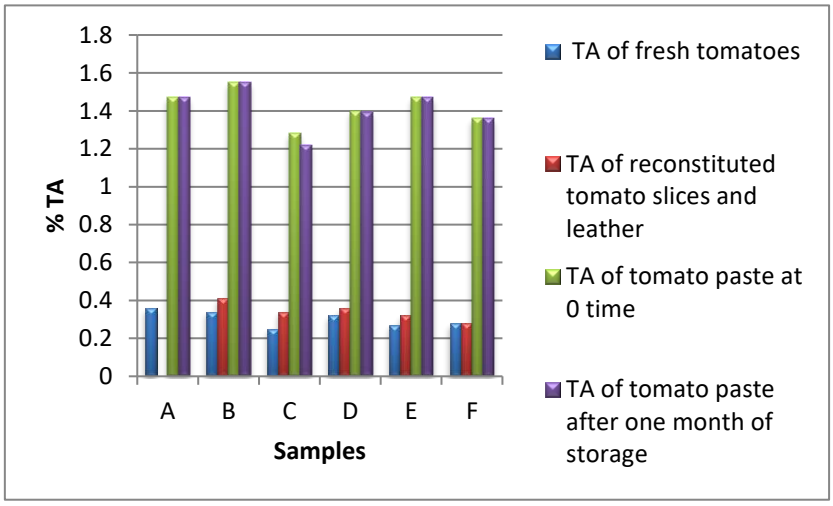

Fig.3. Titerable Acidity (TA) of fresh, reconstituted sun-dried tomato slices and leather and tomato paste at 0 time and after one month of storage

The **pH value** of fresh reconstituted pretreated sun-dried tomato slices and leather (Salsadeen) and tomato paste at 0 time and after one month of storage illustrated in Fig. 4. pH value of fresh tomato was ranged between 4.38–4. 45. This result was agreeing with Toyin (2010) and Ringeisen *et al.* (2014). Campos *et al.* (2006) reported that the pH value for industrial tomato varies was ranged between 4.3–4.4, so the results obtained in this study were within the reported values. pH value of reconstituted pretreated sun-dried tomato slices and leather (Salsadeen) was ranged between 4.22–4.45. It is obvious that the in samples treated with sodium metabisulphite pH value was increased. This is normal due base characteristics of sodium metabisulphite. The results obtained in this study in confirming with Toyin (2010) who found that the pH of dried tomato slices was in the range of 4.43 to 4.91. It is obvious that the in samples treated with sodium metabisulphite pH value was increased and this normal due base characteristics of sodium metabisulphite. The pH value of tomato paste prepared from fresh and reconstituted dried tomato slices and leather (Salsadeen) at 0 time and after one month of storage was ranged between 4.36–4.70 and 4.26–4.71 respectively. The CODEX STAN 57 -1981 reported that the pH of tomato paste must be below 4.6. Suliman, Awn and yousif (2011) found that the pH value of tomato paste prepared from some Sudanese varieties ranged between 4.26–4.50. How-

ever, Syrian standard specifications No 180 for the year 1979 reported that pH of tomato paste must be less than 3.9 and do not exceed 4.5. The pH is considered as a limiting factor for storage of tomato paste. The higher pH value obtained in this study was affected by the pretreated with sodium metabisulphite which lead to an obvious increase in pH value of tomato paste.

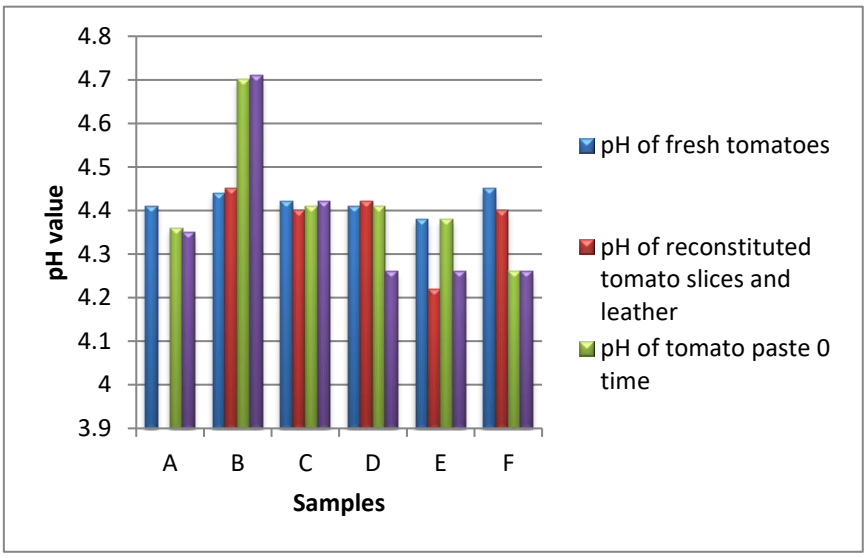

Fig. 4. pH value of fresh, reconstituted sun-dried tomato slices and leather and tomato paste at 0 time and after one month of storage

The **Salt content** of fresh, reconstituted pretreated sun-dried tomato slices and leather (Salsadeen) and tomato paste at 0 time and after one month of storage illustrated in Fig. 5. Salt content of fresh and dried tomato slice and leather (Salsadeen) ranged between 0.58–0.59% and 0.68–2.7% respectively. It is obvious that the salt content was significantly increased in salted samples than unsalted samples; this increase was also observed in tomato paste prepared from salted samples (1.46–4.21%) which was over the standard specifications. WFP Technical Specification for tomato paste (2011) reported that the salt content must be 25 maximum. Latapi and Barrett (2006) reported that both concentration and time were significant factors for the final salt content of sun-dried tomatoes. The present study confirmed that sodium metabisulphite had no any effect on increasing salt content after drying of pretreated tomato slices or leather (Salsadeen).

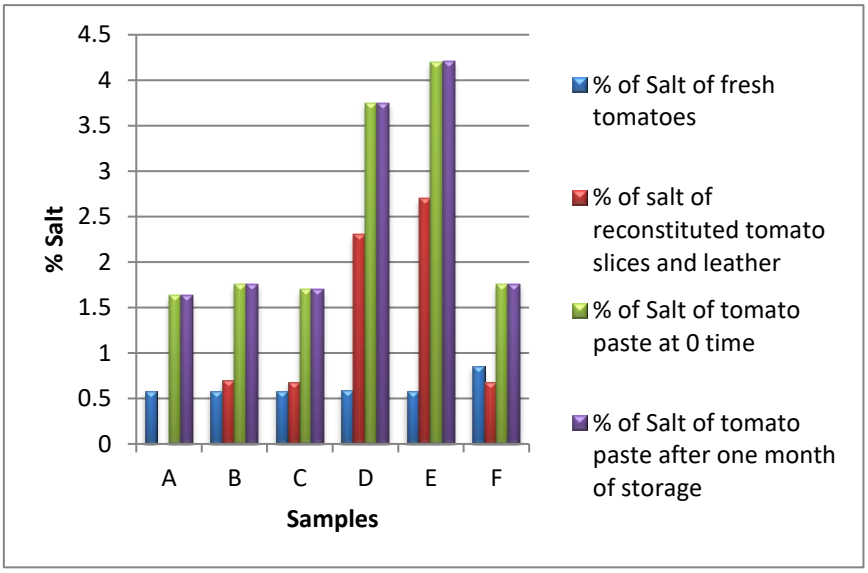

Fig. 5. Percentage of Salt of fresh, reconstituted sun-dried tomato slices and leather and tomato paste at 0 time and after one month of storage

Viscosity (cm/30 minutes) of tomato paste at 0 time and after one month of storage was illustrated in Fig. 6. The viscosity of tomato paste prepared from fresh and reconstituted pretreated sun- dried tomato slices and leather at 0 time and after one month of storage was ranged between 6.7–12.1 and 6.9–12.0 (cm/30 seconds) respectively. WFP Technical Specification for tomato paste (2011) reported that the consistency by Bostwick must be between 4–11 cm/30 seconds. Renquist and Reid (1998) reported that viscosity is the most important quality factor for assessing some products made from tomato paste.

Panel test: There were significant differences in values given by the panelist (Table 1). Tomato paste prepared from untreated slices was highly score in most tested attributes. It is obvious that untreated tomato leather was poorest score extremely in all tested attributes.

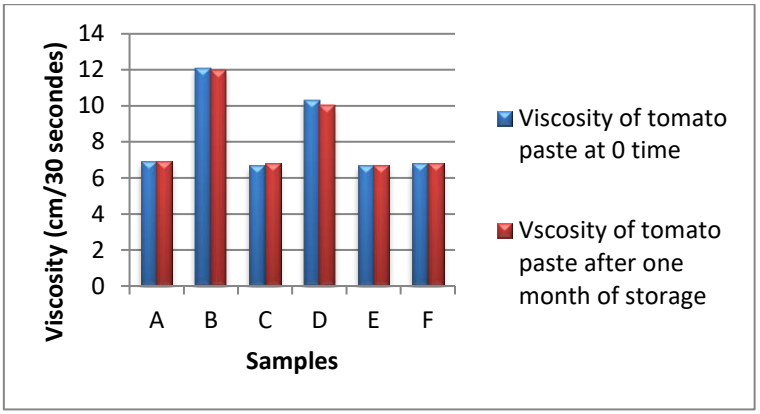

Fig. 6. The viscosity of tomato paste at 0 time and after one month of sto

Table 1
Statistical analysis of Panel Test

	Tomato paste from fresh tomatoes	Tomato paste from pretreated sun-dried tomato slices (10% salt)	Tomato paste from pre-treated sun-dried tomato slices (10% salt& 0.9 Na- metabisulphite)	Tomato paste from untreated sun-dried tomato slices	Tomato paste from pretreated sun-dried tomato leather (1.5% Na- metabisulphite)	Tomato paste from untreated sun-dried tomato leather
Color	5.40±1.13^{a}	2.73±0.94^{c}	3.07±0.98^{c}	4.20±0.98^{b}	4.60±1.22^{b}	1.00±0.0^{d}
flavor	5.00±1.51^{a}	3.40±1.43^{b}	3.63±1.40^{b}	3.73±1.26^{b}	4.03±1.30^{b}	1.17±0.59^{c}
Viscosity	5.13±1.14^{a}	3.27±151^{c}	3.10±0.99^{c}	3.63±1.33^{c}	4.30±163^{b}	1.47±1.71^{d}
Taste	5.10±1.24^{a}	3.63±145^{b}	2.93±1.11^{c}	4.20±1.06^{b}	3.90±1.56^{b}	1.23±0.82^{d}
Total acceptability	5.13±1.26^{a}	3.20±1.13^{c}	3.13±1.15^{c}	3.90±1.34^{b}	4.16±1.35^{b}	1.17±0.93^{d}

Mean ±SD bearing different superscript letters in a row are significantly different at (P<0.05). Scores: 5: excellent, 4: very good, 3: good, 2: bad, 1: very bad.

5. Conclusion

Although the experiment was carried out with the same raw material (fresh tomatoes), the quality of the final product (tomato paste) was different as affected by pre-drying treatments. The results obtained in this study indicated that sulphite pretreated treatment of sun-dried tomato slices or leather (salsadeen) obtained superior qualities in both color and salt content.

6. Recommendations

The main recommendations of this study were that dried tomato slices and leather can be used to prepare tomato paste after reconstitution, and it will be of interest to get advantages of tomato during the season to prepare dried tomato slices or leather and use it off season to prepare tomato paste. The dried tomato slices or leather (Salsadeen) must pretreat to prepare good quality tomato paste. Salt content in a dipped solution of tomato slices must be decreased.

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