Xi'an Shiyou Daxue Xuebao (ZiranKexue Ban)/
Journal of Xi'an Shiyou University, Natural Sciences Edition
ISSN: 1673-064X
E-Publication: Online Open Access
Vol: 65 Issue 06 | 2022
DOI 10.17605/OSF.IO/P9DT7

THE EFFECT OF DIFFERENT PRETREATMENTS ON THE PHYSIOCHEMICAL PROPERTIES OF AVOCADO AND ITS STORAGE STABILITY

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ABSTRACT

The purpose of this study was to investigate the chemical components of *Persea americana* (West Indian race) after exposure to various pretreatments, as well as its stability on storage for six months at 4°C and -20°C. Ripe *Persea americana* fruit were chosen and exposed to pre-treatments such as water blanching at 75°C, stem blanching at 70°C, 2 % brine at 50°C, and 2 % brine and citric acid at 50°C.The fruit pulp was then stored in pet containers at 40°C. and polypropylene containers at -20°C. For the following six months, the impact of various pre-treatments settings on pulp quality was studied every other month. The carbohydrate content of the West Indian race avocado was 10.75 %. Despite this, after six months of storage at 4°C, the carbohydrate level dropped to 6.32 %. The avocado pulp, on the other hand, contained the same quantity of carbohydrates after six months in the deep freezer. The avocado from the West Indian strain has a fat content of 13.63+0.60. For all of the pre-treatments, the fat content decreased when kept chilled. During storage, however, the protein level (2.57 +0.42) declined dramatically. It has been reduced to 1.41 %. On day zero, the samples' acidity varied from 0.30 % to 0.38 % citric acid. In the storage research, the change in acidity was larger for refrigerated storage than for deep freezer storage. On the control samples, the pulp had higher L* and b* values after fast pulping. This indicates that the pulp is yellower in color and contains more flavonoids and carotenoids. Furthermore, a negative 'a' value in the pulp (- 9.93) suggests the presence of green pigments such as chlorophyll. In refrigerated storage, the 'L' value decreased with time, reaching 38 in the sixth month. The value of 'a' increased from -9.93 on the first day to +8.44 by the sixth month. Even after 6 months in the refrigerator, scalding at high temperatures in water for 5 minutes kept the green color and brightness of the pulp, avoiding enzymatic browning.This research demonstrated that it is technologically feasible to preserve fruit for six months when properly handled.

Keywords: *Persea americana*, Blanching, Enzymatic browning, Storage.

Avocado (*Persea americana*) is a popular fruit in salads and meals all over the globe. Avocado is originally from Central America and Mexico, where it has been a main nutritional component for at least 9000years (Galanakis, 2019). Avocado is a small fruit compared to other major tropical fruits, making up only 6% of total production in 2018, and Mexico, the world's leading producer, contributes about 30% of global output [FAO, 2018]. The trees are medium-sized with shallow roots and have a proportionately thinner and asymmetrically erect canopy. The leaves are arranged alternately and vary from oval to elliptic to lanceolate. The avocado tree is a dicotyledonous shrub with yellowish-green blossoms on panicles. It may also produce inflorescence blooms on the stalk tips (Emelike et al., 2020).

The commercial avocado is the fruit of *Persea americana,* the most significant and well-studied member of the Persea genus. Within *P. americana*, three distinct ecological races

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exist: Mexican, Guatemalan, and West Indian (or Antillean). Each race has distinct leaves, fruits, and blooming features. The common English name for this fruit is "avocado," although it is also known as “alligator pear” and “butter pear” (Galanakis, 2019). Some types have exterior skins with brown-black hints. Depending on their age at harvest, they may be seen on certain types in hues ranging from dark charcoal grey to light charcoal grey. The fruit may weigh up to 500g, and the ovoid-shaped seed size becomes larger as the fruit develops. The fragrant mesocarp of the fruit fills your tongue with a wonderful buttery taste (Gupta et al., 2018).

Avocados are popular because of their rich, creamy, velvety texture and mild taste. High-fat content generates a quick sense of "fullness," which helps people lose weight by limiting overeating. As compared to saturated fat, monounsaturated fat increases metabolic rate (Maitera et al., 2014). Avocado has a high content of monounsaturated fatty acids (oleic acid, palmitoleic acid), a low content of linoleic acid, a significant amount of saturated fatty acids like stearic acid and palmitic acids, as well as the presence of myristic, linolenic, and eicosenoic acids, making it a significant amount of fatty acids that are beneficial to human health and wellness (Duarte et al., 2016). The fruit contains 9% carbohydrates, 7 % of which will be fiber, making it a low carbohydrate plant diet that is beneficial to diabetics (Majid et al., 2020). The spongy mass of fibre enables consumers to fulfil their appetites while also assisting food passage through the alimentary canal by supporting the muscular activity of the colon, lowering the danger or incidence of constipation (Egbuonu et al., 2018).

The industrialization has started, with the fruit being processed (avocado purée or guacamole, packaged into slices and pieces, dry or dried avocado) or oil extracted from entire logs. Avocados generate a significant quantity of waste, including peel (Arukwe et al., 2012) and seeds (Bahru et al., 2019)that make up 11 and 16 percent of the fruit's total weight, respectively. Avocado fruit quality can be retained with temperature management and rapid freezing after harvesting. It obtains greater efficiency when hydro-cooled to 12°C upon arrival and then forced-air cooled after packing. This approach will result in an excellent final temperature of 4°C to 6 °C. However, avocados’ high respiration rate hampers temperature regulation (Bustos Shmidt et al., 2014). To preserve quality, exporters need a unique temperature management system to keep fruit at ideal temperatures thereby avoiding chilling damage. A step-down strategy will enable them to lower the temperatures of the fruit during transportation without causing any injury or stress (Shikwambana, 2016).

Changes in the environment of a storage facility may have a substantial impact on items. However, managing the cool chain and the fruit degradation due to pressure is tough. Fruit coatings are being investigated more extensively, although there are substantial obstacles such as equal dispersion, altering formulas with maturity, and variances in fruit physiology (Grewal et al., 2019). Customers' preference for uncoated fruits may be attributed to fruit-ripening firms' lack of commercial success. Coating causes ripening to be delayed and even results in unevenly developed kinds inside the same container. As

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a result, neither MA storage nor coatings have gained widespread commercial usage. The maximal storage time for "Hass" in the air is 4–4.5 weeks and 5.5–6 weeks in the CA (Gil & Beaudry, 2020).

The comment "avocados are a challenging crop to obtain maximum quality" is an often-overlooked fact. Fruit storage conditions may have a significant impact and thorough evaluation of these elements by educated specialists in the industry who can assist farmers in maintaining their reputation for a high-quality product. Despite changing times in which customers have more access than ever before throughout harvesting or distribution operations, post-harvest temperature management is critical in preserving quality, and controlled environment storage may be utilized as insurance against rotting. This issue may be handled by processing the versatile fruit into semi-processed intermediate goods, like pulp, which is still nutritious. Just like in any other sector, these stored commodities will then have the opportunity to be transformed into valuable things when processors or customers require them.

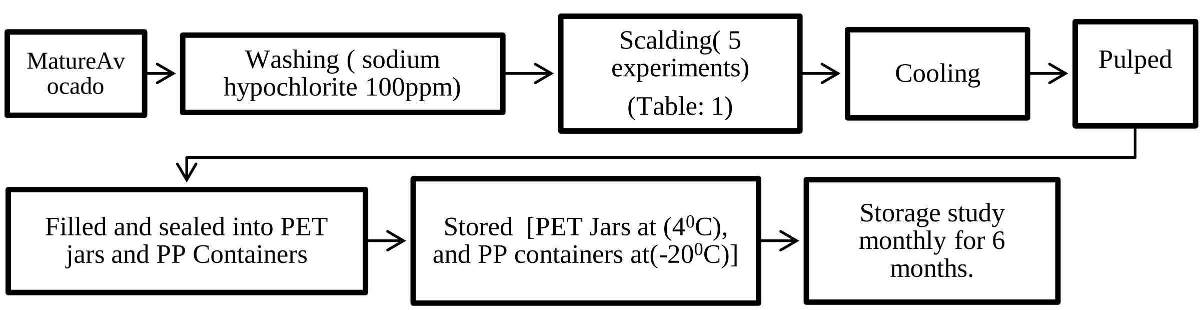
Methods and materials:

Preparation of samples

Avocados from Dindigul (10° 14' 21.30" N, 77° 29' 21.55" E) in India's Kodaikkanal area (weight 200 g) were selected for the study. Avocados of the West Indian race were chosen from a lot based on their maturation stage (green, mature, and over-ripe).

Process of Elaboration: Mature, ripe avocados were chosen, washed and then subjected to various pretreatments as shown Table 1. The immediate immersion of the entire fruit with skin in hot water aids the scalding process. In the case of scalding, a thermometer was used to monitor the temperature of the water. After immersing the fruit in hot water, the scalding duration is kept at 5 minutes. To prevent heat- burn on the avocado, it is immediately submerged in cold water after being removed from the hot water (Figure 1).

Figure 1. Diagram of elaboration process of avocado pulp.



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Avocado pulp's quality characteristics

During storage, variations in the quality characteristics of experiments were observed. The natural fruit avocado, when going through the pulping process, enzymatic reactions accelerate (Tremocoldi et al., 2018). The treatments are combined to check its efficiency to prolong the shelf-life. The pre-treated pulp was split into two lots. One lot was kept in PET jars and placed in a refrigerator at 4^0C and the second lot in a deep freezer (-20^0C) in polypropylene containers. The treated pulp was evaluated for Physio-chemical (Carbohydrates, Proteins, Fat, Crude fiber, TSS, and Browning) and Sensory parameters (Color, Appearance, Mouthfeel, Taste, and Overall acceptability). The sensory evaluation was performed only in the 0th and 6th months for the samples kept in a deep freezer. At the same time, the effect of the different scalding parameters on the pulp quality was evaluated in alternate months for six months.

Dean and Stark's method (Aggarwal, 2018) determined the moisture content of the avocado pulp. Total soluble solids (TSS) were assessed at ambient temperature by hand refractometer (0–32%) and the values were expressed as percent TSS. Browning by Hunter lab Colorimeter (Schelkopf et al., 2019), the titratable acidity, crude fat, protein (Kjeldahl method), crude fiber and mineral content (sodium, potassium, calcium, and iron) were evaluated (Nielsen, 2017). The physical parameters of the fruit were also evaluated. A sensory study of avocado pulp: A preference analysis test was conducted with 20 customers aged 19 to 28 years old, utilizing a 9-point hedonic scale. The overall acceptability of prepared products was based on the mean score of all sensory characteristics. The sensory attributes of products were evaluated on the first day of storage and at alternate month intervals for six months of storage.

Results and Discussion

Avocado pulp output was 73.76 % on average. The remainders, such as seeds and peel, accounted for 15% and 10.52 %, respectively According to (Jimenez et al., 2021), a study on avocado industrialization supported by Chile's Corporation of Production and Development evaluated the avocado pulp yield from various cultivars, finding the maximum performance in Fuerte and Hass varieties, with 69.8%, as they have a smaller and lighter seed than other cultivars. The samples yielded 71.37 % of the pulp yield in Hass avocados (150 to 300 g) (Ejiofor et al., 2018). On the other hand, a 50% pulp output owing to losses caused by equipment in their project of developing an avocado pulp processing facility (Lara-Flores et al., 2018). When comparing the data, we found that our research produced a pulp yield that was 3% greater. Despite the fact that West Indian race avocados had a larger seed and peel weight than other varieties, the fruit weight was also higher, resulting in a higher pulp yield (Table 2).

The following results show the changes in moisture, total soluble solids (TSS), titratable acidity, browning reaction, carbohydrate, protein, and fat content of the pre-treated avocado pulp during a six-month period.

The moisture content (Table 3) of food determines its perishability and solid content. The avocado pulp had a high moisture level of 67%. These data imply that West Indian race avocado fruit should be adequately handled to retain quality and increase shelf life. The present study's findings agreed with those of (da Vinha et al., 2013) who revealed that the peel, pulp, and seed of Hass avocado fruit exhibited a high moisture content (> 50%). There was not much difference in the moisture percentage among the treatments; however, when the treated samples were stored for the shelf-life study and were thawed for additional research, their moisture percentage increased. The moisture content increased greater in refrigerated samples than in frozen ones.

The ash constituents of the studied samples could be attributed to their mineral contents, and these minerals, which are mostly in the form of chemical compounds, could have substantial health benefits. The fresh avocado pulp has a total ash content of 0.92 $\pm$ 0.24. There was evidence of sodium (4.10 mg/100g) and iron (1.63 mg/100g) in the pulp.

The flesh of the West Indian race avocado was dotted with visible bundle fibers. When the flesh was disturbed during the pulp elaboration process, the bundle fibers broke readily, and there was no physical presence of these bundle fibers. These bundled fibers may have a greater water-holding capacity, resulting in higher moisture content in the West Indian race than in the other variants. Avocado pulp has a crude fiber content of 2.01 $\pm$ 0.33. The storage analysis does not include a fiber content assessment. According to the (Nnaji & Okereke, 2016) comparative research on Choquette, Brogdon, and Russell avocado cultivars, all three variations have a crude fiber of 4%, which is high when compared to the West Indian race.

Though, untreated samples of West Indian race avocado had a carbohydrate level of 10.75 %, the carbohydrate content substantially decreased to 6.32 % after six months of storage at 4^0C. The treatment 'BC' also followed a similar pattern, but the WB pulp retained 8.87 % carbohydrates after six months. The treatments 'BC' exhibited the similar trend as that of the untreated pulp, which indicated that the treatment was not effective as the others. However, after six months in a deep freezer, the avocado pulp preserved the same percentage of carbohydrates (Table 4). The decrease in the carbohydrates may be due to the breakdown of the polysaccharides into simpler components(Chauhan et al., 2013) as and later its conversion, which evidenced by a rise in acidity.

The fat content of the avocado from the West Indian race is 13.63% which was dropped to 11.82% on the sixth month. There was only a marginal difference between the fat percentage between the treatments and on the storage study. For all of the pre-treatments, the fat content decreased when kept chilled. The results on the change un the fat content was in compete agreement with the other studies(Akhtar et al., 2010). (Table 5).

With respect to the protein content, the untreated one had a protein level of 2.57 % (Table 6). The protein, on the other hand, decreased significantly during storage. It was cut down to 1.41%. All of the pre-treatments in the refrigerator followed the same pattern. However,

ISSN: 1673-064X
E-Publication: Online Open Access
Vol: 65 Issue 06 | 2022
DOI 10.17605/OSF.IO/P9DT7

for storage at -20^{0}C. Except for the 'WB,' all of the pre-treatments shows a slight decline. (Aletan, 2018).

Titratable acidity: The acidity of avocado pulp is a crucial metric since it indicates the degree of oxidation or rancidity (Krumreich et al., 2018). The acidity of the samples ranged from 0.30 % to 0.38% citric acid on day zero. The change in acidity was greater for refrigerated storage than for deep freezer storage in the storage trial. The acidity of the WB treatment was lower than that of the other treatments. Avocado pulp samples subjected to low scalding conditions are expected to have higher acidity due to lipolytic oxidation (Santana et al., 2015) . However, since this enzyme-catalyzed process is hindered at high temperatures, treatments carried out above 78 °C are unaffected. (Table 7), reveals the nature of acidity on storage. All trials showed an increase in pulp acidity in various amounts.

Enzymatic Browning: After quick pulping, the pulp displayed greater L* and b* values on the control samples. This means the pulp is lighter in color and has more yellow pigments like flavonoids and carotenoids. Furthermore, a negative score in 'a' value (- 9.93) in the pulp indicates the existence of green pigments like chlorophyll. The 'L' value in refrigerated storage decreased with time, reaching 38 in the sixth month, whereas the a-value varied from -9.93 on the first day to +8.44 in the sixth. (Table 8)

Experiments carried out at temperatures as high as 75 °C kept their green hue, whereas those carried out at lower temperatures tended to become yellow-brown after extended storage. The main finding was that the browning of the avocado pulp was only evident on the crust, while the pulp retained its color at the bottom of the jar (Figure 2). The avocado pulp is changed by enzymatic browning processes during storage, which causes this behavior (Ospina et al., 2019). The dark hues typical of this reaction are caused by polyphenol-oxidase (PPO) (Campo et al., 2019). PPO, like other enzymes, is heat-sensitive; studies show that scalding procedures at temperatures ranging from 73 °C for 10 minutes to 85 °C for 4.6 minutes can inhibit it (Soliva et al., 2000). That is why the treatments for WB and SB maintained their shades. The temperatures and time used assured the inhibition of the PPO considerably, which was evident in the rate of browning. The samples in the freezer, on the other hand, showed relatively minor color changes.

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DOI 10.17605/OSF.IO/P9DT7

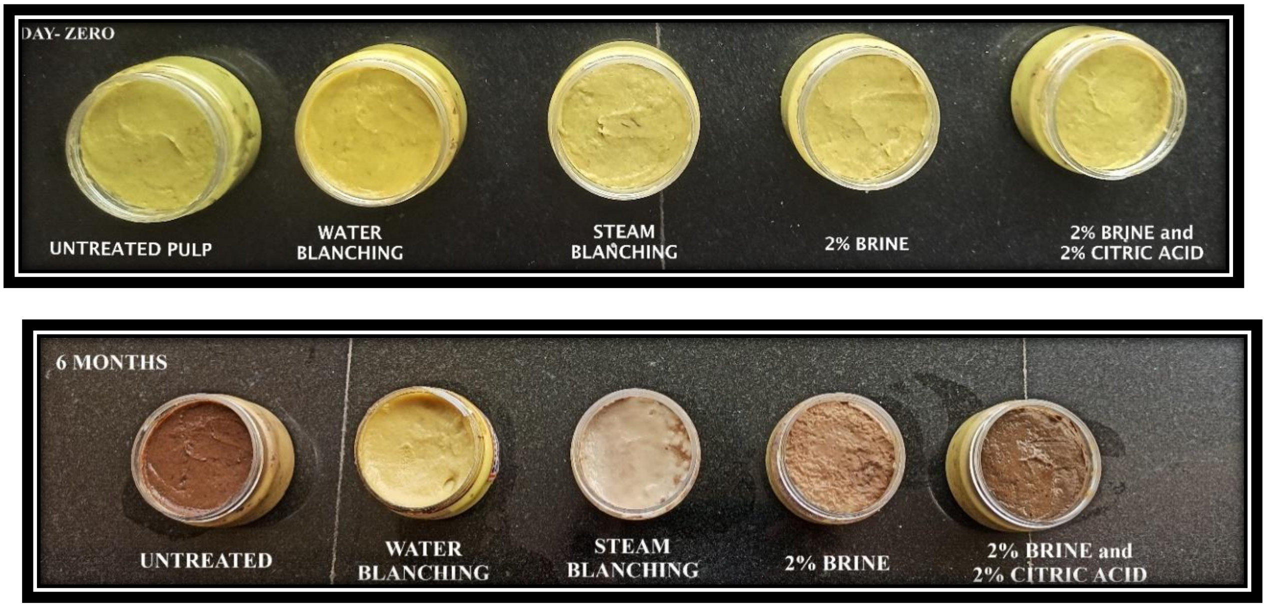

Figure 2: Change in pulp on zero-day and after 6 months.

The sensory analysis findings revealed variances in consumers' preferences for the tests based on the appearance of the samples. Similarly, this rose according to the scalding circumstances, with WB receiving the highest score. This suggests that customers prefer avocado pulp with intense color, since this is an effect of high temperatures in avocado pulp (which intensify chlorophyll pigments). There were no apparent variations in preference across the tests investigated in terms of the ratings acquired by the samples regarding their odor. Several customers commented on the assessment form that the samples smelled powerful yet nice. Additionally, no texture preference was seen between the tests and the control. The temperature has little effect on the texture of avocados since temperatures transform a naturally soft and spreadable pulp into a lumpy and somewhat watery paste. The high scalding temperatures provide a harsh flavor to the avocado pulp, therefore temperatures over 78 °C and cooking periods longer than 5 minutes are not recommended (Zhou et al., 2016). The two most abundant soluble solids in fruits are fructose and glucose (Hurtado-Fernández et al., 2018). These soluble solids have an effect on the sensory characteristics of fruits, most notably on their flavor and sweetness.

The findings of the purchase intention survey reveal that customers favored the ‘WB’ and control samples. In comparison, a significant proportion of them answered that they would not purchase avocado pulp from ‘BE’ or ‘BC’. Within the five studies reviewed, SB earned a greater proportion of "Yes - would purchase" responses (79%) than ‘’WB’, which received a percentage of 5%. Additionally, this experiment yielded better results than the control group, which achieved an average of 80% "If I would purchase it," but also included 15% "I would definitely buy it" and 5% "maybe I would buy it." Consumers choose

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items with brilliant colors and a mild flavor (the closest approximation to natural food) and avoid those with strong tastes.

The current study established that avocados grown in Kodaikanal, Tamilnadu state, had a different composition than those grown in other geographical places. This variance might be explained by the temperature and soil conditions in which it flourishes. According to the study's findings, avocado fruit has a greater concentration of the majority of the chemical components. Additionally, it would be a beneficial dietary supplement.

Conclusion

The current study's findings led us to infer that West Indian exotic avocado are feasible for pulp production due to their high pulp output of 73.76 %. Additionally, the experimental design used to investigate the effect of scalding on pulp quality metrics and storage at 4^0 and -20^0 Celsius revealed the following:

- Scalding at high temperatures in water for 5 minutes preserved the green color and brightness of the pulp, preventing enzymatic browning even after 6 months at refrigerator conditions. SB is immediately followed by WB.
- 'WB ' and 'SB' pretreatments, added to the product's acid stability, hence extending its shelf life than the other three treatments.
- On the sixth month at 4^0C, the 'WB' likewise had a larger concentration of chemical components. Moreover, it is a simple pretreatment approach.
- Consumers scored lower for pretreatments in 2% brine and brine citric acid after six months of sensory investigation due to their perception of bitter tastes and unpleasant aromas in the pulp. Thus, the ideal duration and scalding temperature for preparing West Indian race avocado pulp were 75 °C for 5 minutes, since this treatment retard enzymatic browning, thus preserving the pulp's organoleptic features (taste, smell, and color).
- The pre-treated -20^0C samples also demonstrated a similar association. The chemical contents did not change significantly between the control and pre-treated avocado pulp; however, the browning effect was significantly different between the control and pre-treated avocado pulp.

  This research demonstrated that it is technologically feasible to preserve fruit for six months when properly processed. As a result, customers will have access to avocados throughout the year, which will aid in the development of high-value goods, resulting in increased revenue for growers and businesses.

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Table 1: The Scalding treatments on avocado fruit.

Experimental code	Treatments	Temperature
EC	Control	---
WB	Water blanching	75^0C
SB	Steam blanching	70^0C
BB	2% Brine	50^0C
BC	2% Brine and Citric acid	50^0C

Table 2: Yield efficiency of the west Indian race avocado

Fruit parameters	Percentage
Fruit weight	264.71 ± 7.44
Seed weight	39.94 ± 5.35
Peel weight	27.87 ± 4.25
Pulp weight	195.25 ± 6.22
Seed yield	15.64 ± 0.52
Peel yield	10.44 ± 0.27
% Recovery	**73.50 ± 0.65**

Table 3: Effect of Moisture on pre-treatments on avocado fruit and its stability on storage

	Storage at 4^0C				**Storage at -20^0C**			
Treatments	**0**	**2**	**4**	**6**	**0**	**2**	**4**	**6**
Control	67.70± .67	68.91±0.47	70.80±0.67	71.03±0.43	67.70± 0.67	68.74± 0.60	68.66±0.72	68.03± 0.71
Water Blanching	67.61± .55	68.41± 0.45	70.54±0.52	72.40±0.34	67.61± 0.55	68.11± 0.35	68.71± 0.44	68.97± 0.14
Steam Blanching	66.90 ±0.55	67.11± 0.43	69.89±0.37	70.59±0.43	66.9 ±0.55	67.3 ±0.23	67.89 ±0.11	67.96 ±0.46
2% Brine	67.13±0.95	68.61± 0.48	71.40±0.24	72.99±0.75	67.13±0.95	67.49±0.85	68.33±0.41	68.13±0.15
2% Brine & Citric acid	67.88±0.32	69.21± 0.62	70.94±0.52	71.33±0.49	67.88±0.32	68.04±0.44	68.58±0.59	68.98±0.74

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E-Publication: Online Open Access
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Table 4: Effect of carbohydrates on pre-treatments on avocado fruit and its stability on storage

	Storage at 4^0C				Storage at -20^0C			
Treatments	**0**	**2**	**4**	**6**	**0**	**2**	**4**	**6**
Control	10.75±0.32	9.00±0.42	8.29± 0.71	6.32± 0.66	10.75±0.32	9.81± 0.36	9.28± 0.52	7.93± 0.62
Water Blanching	10.39± 0.47	9.81±0.41	9.10±0.60	8.87±0.25	10.39±0.47	10.05±0.56	10.16±0.43	10.14±0.23
Steam Blanching	10.13±0.59	9.17±0.25	8.40±0.47	7.76± 0.38	10.13±0.59	10.12±0.15	10.06±0.06	9.98±0.11
2% Brine	10.10±0.32	8.50±0.40	8.00±0.45	7.46±0.40	10.10±0.32	9.42±0.39	9.13±0.34	9.03±0.15
2% Brine & citric acid	10.23±0.58	8.60±0.28	7.31±0.36	6.57±0.29	10.23±0.33	9.28±0.08	9.02±0.06	8.73±0.36

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Table 5: Effect of Fat on pre-treatments on avocado fruit and its stability on storage

	Storage at 4^0C				Storage at -20^0C			
Treatments	0	2	4	6	0	2	4	6
Control	13.63±0.60	13.38±0.42	12.52±0.46	11.82±0.16	13.63±0.60	13.27±0.38	12.74±0.53	12.45±0.70
Water Blanching	13.30±0.66	12.50±0.50	11.78 ±0.78	11.76±0.38	13.30±0.66	13.26 ±0.53	13.19±0.28	13.01±0.08
Steam Blanching	13.31±0.68	12.83±0.32	12.31±0.80	11.79±0.48	13.31±0.68	12.99 ±0.33	12.97±0.32	12.64±0.47
2% Brine	13.33±0.40	12.90±0.16	12.39±0.66	11.77±0.73	13.33±0.40	13.19±0.28	12.90±0.22	12.60±0.51
2% Brine & citric acid	13.34±0.22	13.02±0.23	12.24±0.37	11.95±0.78	13.34±0.22	13.22±0.28	12.99±0.05	12.46±0.41

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Table 6: Effect of Proteins on pre-treatments on avocado fruit and its stability on storage

	Storage at 4⁰C				Storage at -20⁰C			
Treatments	**0**	**2**	**4**	**6**	**0**	**2**	**4**	**6**
Control	2.57 ±0.42	1.68 ± 0.16	1.59 ± 0.14	1.41 ± 0.20	2.57 ± 0.42	2.07 ± 0.13	1.96 ± 0.13	1.95 ± 0.14
Water Blanching	2.35 ± 0.27	2.14 ± 0.26	1.51 ± 0.21	1.22 ± 0.13	2.35± 0.27	2.22 ±0.22	2.09± 0.14	2.05±0.09
Steam Blanching	2.11 ± 0.15	1.91 ± 0.12	1.75 ±0.25	1.38 ± 0.31	2.11 ± 0.15	2.05 ±0.15	1.71 ±0.34	1.44 ±0.46
2% Brine	2.17 ± 0.24	1.97 ±0.32	1.71 ± 0.19	1.46 ±0.19	2.17 ± 0.24	2.12 ±0.22	1.84 ±0.10	1.68 ±0.19
2% Brine & citric acid	2.04 ± 0.50	1.97±0.50	1.61±0.48	1.36±0.37	2.04 ± 0.50	1.83±0.23	1.69±0.38	1.59±0.26

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Table 7: Effect of Acidity on pre-treatments on avocado fruit and its stability on storage

	Storage at 4⁰C				Storage at -20⁰C			
Treatments	**0**	**2**	**4**	**6**	**0**	**2**	**4**	**6**
Control	0.30± 0.05	0.58± 0.09	0.86± 0.12	1.05± 0.11	0.30± 0.05	0.43± 0.11	0.58 ± 0.10	0.65± 0.12
Water Blanching	0.33± 0.10	0.41± 0.04	0.57± 0.12	0.84± 0.09	0.33± 0.10	0.37± 0.09	0.49 ± 0.10	0.50± 0.07
Steam Blanching	0.38± 0.06	0.47± 0.06	0.75± 0.06	0.90± 0.07	0.38± 0.06	0.41± 0.07	0.52± 0.09	0.58± 0.06
2% Brine	0.34 ± 0.06	0.52± 0.11	0.65 ± 0.11	0.93± 0.06	0.34± 0.06	0.45± 0.06	0.51± 0.08	0.74± 0.07
2% Brine & Citric acid	0.38± 0.09	0.53± 0.16	0.84± 0.10	1.00± 0.13	0.38 ± 0.09	0.45± 0.05	0.64± 0.06	0.75± 0.17

*Results are presented as mean ± standard derivation ** The values are mentioned in percentage.

ISSN: 1673-064X
E-Publication: Online Open Access
Vol: 65 Issue 06 | 2022
DOI 10.17605/OSF.IO/P9DT7

Table 8: Effect of Browning on pre-treatments on avocado fruit and its stability on storage at 4^0C

Months		0	2	4	6
Control	L	81.24	69.24	50.79	38.19
	a	-9.93	2.42	4.87	8.44
	b	64.39	56.81	37.63	20.65
Water blanching	L	77.19	70.03	65.39	59.83
	a	-8.48	-0.07	2.18	4.64
	b	62.89	43.96	40.39	39.45
Steam blanching	L	76.37	66.47	59.08	57.47
	a	-8.92	-7.10	3.89	5.12
	b	62.03	54.83	46.74	37.54
2% Brine	L	79.38	65.15	59.34	42.27
	a	-9.87	-6.08	3.99	6.84
	b	63.24	54.80	42.73	31.68
2% Brine and 2% citric acid	L	78.8	69.42	60.75	41.38
	a	-2.83	-0.30	4.83	7.69
	b	61.35	50.00	41.36	29.89

Conflict of Interest: “No conflict of interest associated with this work”.

Contribution of Authors: We, Anusha R and Dr. Jyoti Prabha Bishnoi declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors”.

The conception and design, analysis and interpretation of data, the drafting of the article, d was performed by Anusha R, while the critical revision and evaluation was performed by Dr. Jyoti Prabha Bishnoi

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