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Assessment of functional qualities of freeze-dried avocado fruit powder (cultivar-purple hybrid)

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Abstract
This study investigated the functional properties of freeze-dried avocado powder, that were grown in Wayanad district of Kerala. For producing the freeze-dried avocado powder, frozen mashed avocado pulp sample were dried in Tray freeze dryer facility. Samples were dried until constant weight was achieved after they were blended into powders and analysed the functional properties of the powder. Colour of the powder was green to purple, yield ratio was 96.50, water absorption index 3.2 %, bulk density 0.285 kg/m^3 and rehydration ratio was 0.75. The freeze-dried pieces of avocado were easier to blend to a light, free flowing powder which easily dehydrated to form which closely resembled fresh avocado puree. Freeze drying is therefor an attractive option to produce a high quality Purple hybrid avocado powder, without the use of heat or the application of chemical preservatives to preserve colour.

Keywords: Lyophilization, microbiological, avocado, agriculture

Introduction
The mechanical property of food largely depends on food composition and processing. Lyophilization has been considered a processing method widely indicated for the maintenance of the mechanical properties of food (Esteller *et al.*, 2005) [2]. Saucedo *et al*. (2014) [1] reported that freeze drying technology is the best dehydration process to preserve shelf-life and allowing avocado to maintain its sensorial and nutritional characteristics. Freeze - drying or lyophilisation is often regarded as the best method of water removal to obtain final products of the highest quality (Souza *et al.*, 2015) [8]. Because of the absence of liquid water and the low temperatures required for the process, most of the deterioration reactions and microbiological activities are prevented, which gives a final product of excellent quality. Freeze dried powder is an ingredient to formulate variety of end products (Morris *et al.*, 2004) [4]. Freeze dried powder keeps the essential fatty acids of the fruit intact. The powder is instantly rehydrated with cold water to go back to the original state. The product retains the original organoleptic parameters of the fruit (Sodeke *et al.*, 2005) [7]. Quality studies are very important parameters for rating a product. Freeze dried avocado powder were further evaluated for its functional, chemical, nutritional, and shelf-life qualities (Saucedo *et al.*, 2015)
Even though avocado fruit is rich in nutrients and phytochemicals the keeping qualities of avocado fruits are limited due to its high rate of postharvest respiration. The enzyme polyphenol oxidase, present in the fruit easily oxidize, making it susceptible to browning. Due to the perishable nature and high nutrients present, there arises a need to develop alternative processing technologies to reduce its wastage. Lack of organized marketing system, involvement of middlemen and lack of value adding activities, compel farmers to sell fruits to traders at very low cost. The fruit values ten times higher in metros. To reduce postharvest wastage and to improve the income of households, new processing technologies need to be developed. No shelf-stable products are available in Indian markets. Avocado fruits are highly perishable and high temperature processing methods will develop off flavour and bitter taste against the nutty flavour of fresh fruits. Hence freeze drying of avocado at lower temperature is more appropriate for developing new products from avocado. The aim of the study was to assess the functional properties of the freeze-dried avocado powder and to check the suitability of the avocado powder for food formulations.

Materials and Methods
The cultivar purple hybrid, which is commonly cultivated in Wayanad District of Kerala was selected for fruit powder development. Functional qualities like colour, pulp yield ratio, rehydration ratio, bulk density and water absorption index of the powder were studied to test its suitability in product development. The studies were carried out in the Food Science Laboratory, Department of Community Science, College of Agriculture, Vellayani, Thiruvananthapuram. The freeze-drying process was carried out in Agro-Processing Division, CSIR-NIIST, Pappanamcode, Thiruvananthapuram.

1. Colour
Colour of the powder were studied to test its suitability in product development.

2. Pulp yield ratio
The weight of the product in relation to the raw material used was calculated using the formula,

$$\text{Pulp Yield Ratio} = \frac{\text{Weight of the freeze-dried avocado}}{\text{Weight of fresh avocado}}$$

3. Bulk density

Bulk density is the ratio of the weight of the sample to the weight of an equal volume of water. The sample was taken in a measuring cylinder and was levelled without compressing. Then the weight of the sample with the beaker was recorded. Then the sample was removed from the beaker and water was filled to the same level. The weight of the water with the beaker was recorded and calculated using the formula.

$$\text{Bulk density} = \frac{\text{Weight of the sample}}{\text{Weight of equal volume of water}}$$

4. Water absorption index

A known volume of freeze dried (1g) and distilled water (10ml) was mixed in a centrifuge tube. The suspension was allowed to stand at room temperature and is centrifuged for 30 minutes. The volume of drained water and sediment was measured.

$$\text{Water absorption Index} = \frac{\text{Weight of water absorbed (g)}}{\text{Weight of the freeze-dried powder}} \times 100$$

5. Rehydration ratio

10g of freeze-dried avocado powder mixed with 100 ml of distilled water, stirred, and kept for 5 minutes. The contents were filtered using a filter paper. The rehydrated sample was weighed, and rehydration ratio was calculated using the formula.

$$\text{Rehydration ratio} = \frac{\text{Initial weight of the sample}}{\text{Drained weight of the sample}}$$

Results &Discussion

Table 1: Functional qualities of freeze-dried avocado powder

Cultivars	Pulp Yield Ratio (%)	Water Absorption Index (%)	Bulk Density (Kg/m3)	Rehydration Ratio (%)	Colour (Visually)
Purple hybrid	4%	3.2	0.285	0.75	Greenish yellow to green

1. Pulp Yield Ratio

Drying removes moisture, the food shrinks and decreases in size and weight, thus requiring less space in storage. Pulp yield of dried products is directly related to how much water is in the original product. It was observed that when 100g of fresh avocado pulp freeze dried it yields 4g of fruit powder. Mujaffar *et al* (2020) [5] studies the pulp yield ratio of the cultivar Pollock and reported that the pulp yield ratio was 71.2% and also added that the yield of dried pulp from fresh pulp averaged 17.1 % for freeze dried pollock cultivars.

2. Water Absorption Index

The Water Absorption Index (WAI) measures the volume occupied by the granule or starch polymer after swelling in excess of water. The Water Absorption Index of the freeze-dried avocado powder was 3.2%. A study conducted by Nyguen *et al* (2015) reported that the ability for a powder to absorb water is due to a protein-water interaction, where the protein matrix absorbs and retain bound water molecules. The study also added that water absorbance may be affected by protein denaturation and unfolding as a result of heating. A low water absorption index affects the texture, mouthfeel, juiciness, taste, and shelf life of food formulations.

3. Bulk Density

The bulk density value is important for characterising, handling, and processing of powders (Valentina *et al.*, 2016) [9]. Bulk density depends on both the density and arrangement of the powder particles. Bulk Density is the property of flours and is defined as the mass of many particles of the material divided by the total volume they occupy. The total volume includes particle volume, inter particle void volume and internal pore volume. The bulk density of the freeze-dried avocado product was found to be 0.285kg/m3. Mujaffar *et al* (2020) [5] investigated the bulk density of oven dried and the freeze-dried avocado powder and indicated that the freeze-dried powder had lower bulk and tapped densities as an equivalent mass of freeze dried powder will occupy a large volume than the oven-dried powder.

4. Colour

Colour is the single most important product-intrinsic sensory cue when it comes to setting people's expectations regarding the likely taste and flavour of food and drink. Mujaffar *et al* (2020) [5] reported that the colour of the freeze-dried avocado powder was yellow/green colour similar to that of fresh puree. The colour of fresh avocado pulp was greenish yellow, and when it is subjected to freeze drying it converts to green colour. The freeze-dried powder of purple hybrid was greenish yellow.

5. Rehydration Ratio

Although drying is one of the oldest and most widely used methods of food preservation, its success largely depends on the rehydration (reconstitution) of dried products. The dried products will be acceptable food uses only if good colour, texture, flavour, and nutritive value are restored when these are reconstituted or rehydrated in water (Martin *et al*., 1999) [3]. The Rehydration Ratio of the freeze-dried avocado powder was found to be 0.75%.

Conclusion

Freeze dried powder resembled fresh avocado puree, when rehydrated, however, a slight bitter taste was detected due to the concentration of the polyphenols after freeze drying. Fresh freeze-dried avocado powder maintained the colour of the original fruit and maintained the colour during storage. After studying the functional qualities of freeze-dried avocado powder, it showed the clear potential for the use of freeze drying to produce high-quality freeze-dried powder, without the use of heat or the application of chemical preservatives to preserve colour.

References

1. Castañeda Saucedo MC, Valdés Miramontes EH, Tapia Campos E, Delgado Alvarado A, Bernardino García AC, Rodríguez Ramírez MR, *et al*. Effect of freeze-drying and production process on the chemical composition and fatty acids profile of avocado pulp. *Revista chilena de nutrición*,2014:41(4):404-411.

2. Esteller MS, Pitombo RNM, Lannes SCS. Effect of freeze-dried gluten addition on texture of hamburger buns. Journal of Cereal Science,2005:41(1):19–21.
3. Martin FW, Campbell CW, Ruberte RM. Perennial Edible Fruits of the Tropics: An Inventory. Agriculture Handbook No. 642, United States Department of Agriculture. Washington, DC, USA, 1999, 252-255.
4. Morris A, Barnett A, Burrows O. Food preservation. Food and Nutrition Resource Manual for the Small-scale Food Processor in the Caribbean,2004:37(3):7-9.
5. Mujaffar S, Dipnarine TA. The production of dried avocado (Persea Americana) powder, 2020.
6. Nguyen DQ, Mounir S, Allaf K. Research Article Functional Properties of Water Holding Capacity, Oil Holding Capacity, Wettability, and Sedimentation of Swell-Dried Soybean Powder, 2020.
7. Sodeke VA. Extraction of Oil from Watermelon Seed and Analysis. *Quarterly Res. Service*, 2005, 25-30.
8. Souza DS, Marques LG, Gomes EDB, Narain N. Lyophilization of avocado (Persea americana Mill.): effect of freezing and lyophilization pressure on antioxidant activity, texture, and browning of pulp. *Drying technology*,2015:33(2):194-204.
9. Valentina V, Pratiwi RA, Hsiao PY, Tseng HT, Hsieh JF, Chen CC. Sensorial characterization of foods before and after freeze-drying. Sensorial Characterization of Foods Before and After Freeze-drying,2016:1(6):1-5.