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## Physico-chemical properties raw avocado pulp and optimized spray dried avocado milk shake powder

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### Abstract

A study was conducted on formulation of spray dried avocado milk shake powder. Avocado pulp were blended with skim milk, skim milk powder (SMP) and honey were prepared & spray dried. The raw avocado fruit pulp contains moisture 72.5%, bulk density 0.712 g/cc, color value ( $L^*$ ,  $a^*$  &  $b^*$ ) 49.35, -3.42 & 34.95, pH (6.35), protein (2%), fat (15.31%), fibre (6.8%), ash (1.54%) and carbohydrate (1.85%), respectively. While the optimized avocado milk shake powder had the moisture 4.32%, bulk density 0.371 g/cc, color value ( $L^*$ ,  $a^*$  &  $b^*$ ) 93.9, -0.501 & 4.35, pH (6.32), protein (24.30%), fat (1.20%), fibre (1.39%), ash (6.20%) and carbohydrate (62.59%), respectively. The powder was stored in Metalized polyester pouch under ambient conditions physico-chemical properties, sensory and microbial analysis were studied. It was observed that the quality of the powder had not deteriorated compare to raw avocado pulp it has higher nutritional quality.

**Keywords:** Avocado pulp, skim milk, skim milk powder, spray dryer

### Introduction

Avocados are native to Central and South America they have been cultivated in this region since 8,000 BC. In the mid-17th century, they were introduced to Jamaica and spread through the Asian tropical regions in the mid-1800s. According to scientific classification, the avocados belong, to the kingdom: *plantae*, family: *lauraceae*, genus: *persea*, species: *americana* with binomial name *Persea americana* Mill (Orhevba *et al.*, 2011) [18].

The avocado is useful in human nutrition as a source of various nutrients and especially as source of energy and monounsaturated fatty acids. At about 70% of total fruit weight correspond to the pulp with an average of 6.94 g of carbohydrates, 17.34 g of fat, 2.08 g of proteins, 2.72 g of fibers, in 100 g of fresh pulp (Favier *et al.*, 1999) [11].

Avocados are good source of Vitamin K, dietary fiber, Vitamin B6, Vitamin C, Folate and copper. Avocados are also a good source of potassium: they are higher in potassium than a medium banana. Avocado also contains essential nutrients such as carbohydrates, sugar, soluble and insoluble fiber; avocado is also good source of oil containing monounsaturated fat, its oil contents varies depending on its varieties and the period of extraction of oil by cold-press process. Avocado is a rich source of mineral (Batista *et al.*, 1993) [6]. High avocado intake has been shown to have a beneficial effect on blood serum cholesterol levels (USDA, 2011) [26].

The spray dryer operating conditions and response variables are very important to produce the maximum powder efficiency and yield. These response variables were selected as they were important indicators of microsphere functionality and process efficiency. Factors that can significantly affect the spray drying process and product characteristics include the feed rate, atomizing wheel speed, dryer inlet and outlet air temperatures and drying air humidity. Spray dryer inlet temperatures had a more direct effect on the drying process, with droplet drying rates positively related to inlet air temperatures used (Phisut, 2012) [20].

Fruit milk shake is dried using a variety of methods, including hot air drying, freeze drying, drum drying, foam mat drying, spray drying, and vacuum drying. The process of spray drying is widely employed in the food industry to turn a variety of fruit milk shake into powder. Spray drying preserves nutritional properties, producing powders of high quality. By applying heat to the feed product and regulating the humidity of the drying medium, spray drying works by removing moisture, the feed is sprayed into a heated environment to encourage the evaporation of moisture, which improves the drying rate (Anandharamakrishnan *et al.*, 2007) [2].

Shelf life is generally defined as a definite length of time after processing and packaging during which the food product attains a required level of quality under well-defined storage conditions (Nicoli, 2012) <sup>[16]</sup>. This required quality level makes the product acceptable for consumption. Shelf -life analysis is a common practice used to evaluate the quality and stability of a given food during the storage period. In fact, careful evaluation of shelf life ensures the consumers in getting a high-quality experience from food (Tian *et al.*, 2019) <sup>[25]</sup>. The food industry often processes liquid products into powder for facilitating easier transportation, preservation, and storage (Nnaedozie *et al.*, 2019) <sup>[17]</sup>.

### Materials and Methods

The present study was planned and carried out after detailed review of published literature as discussed in the previous chapter. The materials used and the methodologies adopted for avocado milk shake, spray drying process, estimation of physico-chemical properties, optimization process of spray drying and storage studies of the avocado milk shake powder are described in this chapter.

### Raw materials

#### Avocado fruit

Fresh avocado (*Persea Americana* Mill) was procured from the local market, Bengaluru, Karnataka, India. The fruits were selected according to the uniformity in size, ripeness, colour and freshness.

#### Skim milk powder

Commercially available “HERITAGE” brand of skim milk powder manufactured by Heritage foods limited. The carrier material used for experiments are skimmed milk powder were procured from local market Bengaluru.

#### Spray dried avocado milk shake powder extraction

The avocado milk shake (plate 1) was spray dried at different levels of total solids (17, 19 and 21 per cent), and homogenized. To achieve best quality product, the spray dryer (plate 2) was operated at predetermined spray drying conditions at different inlet air temperatures (140, 150 and 160 °C) different feed rate (10, 11 and 12 rpm). The Spray dried avocado milk shake powder was collected from stainless steel cyclone in a metalized polyester packaging material plate 3. It was packed in pouch and stored at room temperature for further analysis.



Plate 1: Avocado milk shake



Plate 2: Tall type spray drier



Plate 3: Metalized polyester pouch

### Analysis of powder properties

#### Bulk density and pH

The bulk density of spray dried avocado milk shake powder obtained from different treatments was measured according to the procedure described by Caparino *et al.* (2012) <sup>[9]</sup> and Lebrun *et al.* (2012) <sup>[15]</sup>. The pH of spray dried avocado milk shake powder was measured by using digital pH meter by following standard method (Arab *et al.*, 2011) <sup>[4]</sup>. Bench-top spectrophotometer (Model: Konica Minolta; spectrophotometer CM-5) was used for the measurement of colour.

#### Water activity

For the water activity determination (Hygro Lab C1 bench-top meter), powder was filled in the disposable cups of the water activity meter and the sample drawer knob was turned to open position and the drawer was opened. The prepared sample was then placed in the drawer. Checked the top lip of the cup to make sure that it was free from sample residue (an over filled sample cup may contaminate the chamber's sensors). After placing the sample, reading was noted on the LCD display of the water activity meter.

### Colour

Bench-top spectrophotometer (Model: Konica Minolta; spectrophotometer CM-5) was used for the measurement of colour of avocado milk shake powder. It works on the principle of focusing the light and measuring energy reflected from the sample across the entire visible spectrum. The 3-dimensional scale  $L^*$ ,  $a^*$  and  $b^*$  was used

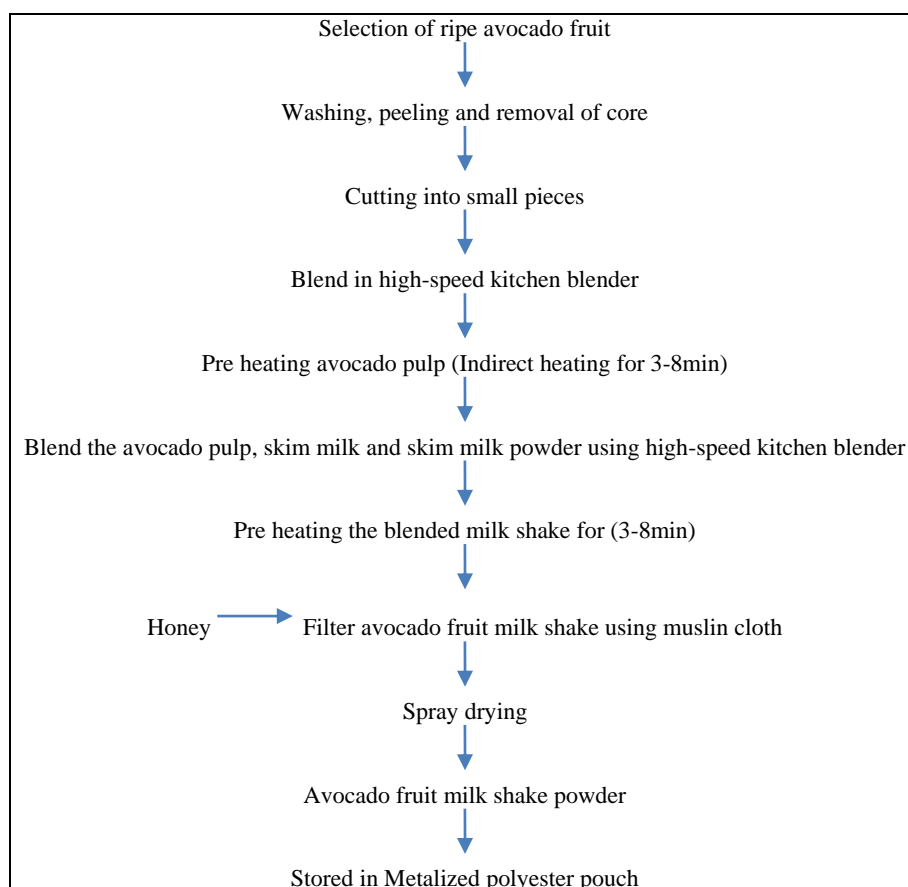
### Proximate composition

The fresh avocado pulp was characterized by physicochemical methods, according to official (AOAC 2000) [3] method through the determination of moisture, protein, fat, and ash contents in triplicate for each sample. Carbohydrates were obtained by difference  $100\% - (\% \text{protein} + \% \text{moisture}$

$+ \% \text{lipid} + \% \text{ash})$  (Sadasivam manickam *et al.*, 1992) [22].

### Statistical analysis

The data obtained on effect of inlet air temperature, feed flow rate and total solids on the spray dried avocado milk shake powder characteristics were statistically analyzed as per the design (CRD) to determine the significant differences among treatments using OPSTAT Software. The data for the storage studies like moisture content, bulk density, water activity, pH, colour values, microbial analysis and sensory properties of developed products was statistically analyzed according to the design CRD, in order to determine the significant differences in the response's comparison.



**Fig 1:** Flow chart for the preparation of Avocado fruit milk shake powder

### Result and Discussion

**Table 1:** Physico-chemical properties raw avocado pulp and optimized spray dried avocado milk shake powder

Physico- chemical properties		Raw avocado pulp	Avocado milk shake powder
Bulk density (g/cc)		0.712	0.371
Water activity		0.701	0.200
Color	$L^*$	49.35	93.11
	$a^*$	-3.42	-0.501
	$b^*$	34.95	11.35
Moisture content (%)		72.50	4.32
Protein (%)		2.00	24.30
Total carbohydrate (%)		1.85	62.59
Fat (%)		15.31	1.20
Ash (%)		1.54	6.20
Crude Fibre (%)		6.80	1.39
pH		6.35	6.32



### Bulk density

The average bulk density value of raw avocado pulp and spray dried avocado milk shake powder was found to be 0.712 g/cc to 0.371 g/cc as shown in (Table 1). Compared to raw pulp the spray dried avocado milk shake powder found to be less due to evaporation of moisture and the high drying rate obtained at higher drying temperatures produces a higher ratio of surface to volume for the spray dried capsules, thus causing lower bulk density of the powders Karaaslan *et al.* (2014) [14]. Similar results obtained by (Pandey *et al.*, 2020) [19] where the untapped density known as bulk density were found to be 0.492 g/cc freeze dried Avocado fruit milk shake powder. Similar result that to be found (Dantas *et al.* 2018) [10] For bulk density, values is 0.377 g/cm<sup>3</sup> in spray dried avocado powder drink with maltodextrin.

### Moisture and Water activity

The average value of moisture in spray dried avocado milk shake powder and raw avocado pulp were 4.32 and 72.50%, respectively and the average value of water activity in spray dried avocado milk shake powder and raw avocado pulp were 0.701 and 0.200, respectively as shown in (Table 1). The decreased in moisture content and water activity in spray dried avocado milk powder might be due to exposure of sample to the higher driving force of heat in the spray dryer. Similar results are obtained Pandey *et al.* (2020) [19] reported that the moisture content of the powder immediately after drying was found to be 2.9 per cent of spray-dried butter fruit milk shake with maltodextrin. And also, Vennila *et al.* (2020) [27] reported that the moisture content in musk melon powder obtained by spray dried was found to be 4.2 per cent.

### Color

The average color values of the avocado pulp was found to be 49.35 ( $L^*$ ), -3.42 ( $a^*$ ) and 34.95 ( $b^*$ ) While compared to spray dried avocado milk shake powder were 93.11 ( $L^*$ ), -0.501 ( $a^*$ ) and 11.35 ( $b^*$ ) this results are in line with the views of (Abilasha *et al.*, 2008) [28] and color value varied in spray dried powder might be due to incorporation milk and caramelization of honey in the drying process.

### pH

The average value of pH in spray dried avocado milk shake powder and raw avocado pulp were 6.2 and 6.32, respectively shown in (Table 1) the pH powder varied might be due to addition of skim milk powder. Similar results were obtained (Pandey *et al.*, 2020) [19] analyzed the pH of spray dried butter fruit milk shake powder added with Maltodextrin had pH of 6.71 and classified as acid food.

### Proximate composition

The average value of moisture, protein, fat, fibre, ash and carbohydrate in spray dried avocado milk shake powder and raw avocado pulp were 4.32, 24.3, 1.20, 1.39, 6.20, 62.59% and 72.50, 2, 15.31, 6.8, 1.54, 1.85%, respectively shown in (Table 1). While comparing raw pulp and spray dried powder the powder obtained higher value in proximate composition and the in-moisture content and water activity in spray dried avocado milk powder might be due to exposure of sample to the higher driving force of heat in the spray dryer and increased in the protein, ash and total carbohydrate in spray dried avocado milk shake powder might be due to incorporation of skim milk powder and skim milk. Whereas,

decreased in fat and fibre in spar dried avocado milk shake powder might be due to incorporation (SNF) skim milk in sample product.

Similar results are obtained Pandey *et al.* (2020) [19] reported that the protein content was found to be 17.2 per cent of spray-dried butter fruit milk shake with maltodextrin. Priyanka *et al.* (2018) [21], reported that the fat content was found to be 0.46 per cent of spray-dried mango milk powder. Bora *et al.* (2001), who reported that the avocado fruit had ash content of  $1.6 \pm 0.09$  per cent. The carbohydrates content of  $96.27 \pm 0.31$  per cent reported by Priyanka, (2018) [21] in instant mango milk shake powder in freeze dried. Pandey *et al.* (2020) [19] reported that the crude fiber content was found to be 0.84 per cent of spray-dried butter fruit milk shake with maltodextrin.

### Conclusion

Developed avocado milkshake power is healthy alternatives, storage able, and reasonable. Comparing to raw pulp and spray dried avocado milk shake powder of proximate composition and physical parameter were analyzed and concluded that the spray dried powder have higher amount of protein, fat, ash, and crude fibre in milk increased after avocado pulp was added, but its low moisture content and water activity indicated that it has a longer shelf life with a low wettability time and is instantaneously soluble in water. Further research is needed for can be tried with different flavors and various value-added food products can be made by incorporating avocado milk shake powder like in chocolate, milk bar.

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