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Standardization, physico-chemical and organoleptic evaluation of avocado bar value added with desiccated coconut powder and dry fruits

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Abstract

The study was conducted to prepare fruit bar from avocado value added with desiccated coconut powder and dry fruits. The objective was to assess the physico-chemical properties and organoleptic properties of the prepared avocado bar. The experiment was conducted in Post-harvest Technology Laboratory, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, Uttar Pradesh, India. The experiment was conducted in Completely Randomized Design (CRD), with ten treatments and three replications. Based on the results of assessment, it was concluded that the treatment T₇ (Avocado pulp 75% + DCP 20% + Dry Figs 5%) performed best in terms of physico-chemical properties viz., moisture (15.10%), ash (1.44%), fat (10.09%), protein (3.97%), carbohydrate (68.40%), energy (384.29kcal). On the basis of sensory evaluation, treatment T₇ (Avocado pulp 75% + DCP 20% + Dry Figs 5%) was found most acceptable in terms of organoleptic properties viz., colour (9.00), taste (8.67), flavour (8.67), texture (8.33), overall acceptability (8.67).

Keywords: Avocado, bar, desiccated coconut powder, dry fruits, organoleptic properties, physico-chemical properties

Introduction

Fruit bars can be simply defined as dried sheets of fruit pulp that have a soft, rubbery texture and a sweet taste (Ihekoronye and Uzomah, 2011) [6]. Fruit leathers/bars are restructured fruit made from fresh fruit pulp or a mixture of fruit juice concentrates and other ingredients after a complex operation that involves a dehydration step (Haung and Hsieh, 2005; Maskan *et al.*, 2002) [4, 8]. Fruit bar is a dehydrated fruit-based confectionery dietary product which is often eaten as snack or dessert (Raab and Oehler, 1976) [14]. Fruit bar is a confectionery product, prepared by drying fruit pulp after mixing with appropriate quantities of sugar, pectin, acid and colour (Narayana *et al.* 2007) [11]. It can be prepared from a wide variety of fruits including guava, banana, papaya, mango, sapota, apple, jackfruit etc. (Mathur *et al.*, 1972) [9]. Fruit bars are both delicious and nutritionally rich, making it a good alternative to snack foods. Fruit bars are produced by freezing various dried fruits (apricots, figs, grapes, apples, etc.) with various nuts (nuts, peanuts, sunflower seeds, etc.) in honey or sugar syrup. Fruit bar is a practical solution of fruit consumption out of season, and it contains concentrated nutritional content since it is produced from dried fruits. The production of fruit bar varies in different producers according to formulations and processes. Fruit pulp, fresh or dried fruits, sugars (sucrose, maltodextrin, glucose syrup and fruit juice concentrates), binders (pectin, glycerol, various carbohydrates) and various minor components (colourants, flavours and acids) can be used in fruit bar production (Munir *et al.*, 2016) [10].

Avocado (*Persea americana* L.), also called alligator pear, belongs to the family Lauraceae. Tree is native to the Western Hemisphere from Mexico south to the Andean regions. Avocado fruits have greenish or yellowish flesh with a buttery consistency and a rich, nutty flavour. They are often eaten in salads, with seafood or an acid fruit such as citrus, in sandwiches, soups, ice creams and milk shakes and in many parts of the world they are eaten as a dessert. The demand for this fruit has been increasing over the past few years in many countries. Avocados provide thiamin, riboflavin, and vitamin A, and in some varieties the flesh contains as much as 25% unsaturated oil.

An unripe avocado needs about 2 to 5 days to be ready to eat. Once it has matured, it can last another 3 to 5 days at peak quality in the fridge. After that, the fruit will become overripe, and there will be brown spots that grow over time. Avocados can be the healthiest food in nutritional diet. It has become an important fruit in the international trade (Kumar and Singh, 2000) [7].

Persea americana, commonly known as avocado fruit, has recently achieved significant popularity and is often marketed as a “superfood” because of its unique nutritional composition, phytochemical content, and health benefits (Segovia *et al.*, 2018) [15]. Apart from its use as food, the avocado is traditionally used for several medicinal purposes including hypotensive, hypoglycemic, anti-viral and anti-diarrheal and cardiovascular diseases (Cortés- Rojo *et al.*, 2019; Nayak *et al.*, 2013) [3, 12]. Avocado is the most nutritive among fruits and is regarded as the most important contribution of the New World to human diet. It is recommended as high energy food for diabetics. Its energy value is twice as much as banana fruit. The pulp is rich in proteins (up to 4%) and fat (up to 30%), but low in carbohydrates. The fat is similar to olive oil in composition and is widely used in the preparation of cosmetics. The fruit is a powerhouse of heart-healthy fats and brain-boosting Omega fatty acids (Van Vuuren *et al.*, 1997) [18].

The post-harvest losses of fruits in India are estimated at 30-40% of total production. Processing of fruit minimizes these losses to some extent and gives better returns to the farmers during glut seasons. Freshly harvested, ripe avocado fruit naturally can remain in good condition only for few days. The fruits shelf life can be increased by changing their form by preparation of value added products. Among different processed products, fruit bar is one of the processed products which are thick, pleasant and dried product made from fruit pulp having high calorie and rich source of the vitamins and minerals. Value added products like avocado bar can command premium prices, further boosting farmer earnings. The establishment of avocado bars also fosters consumer awareness and demand for avocados, creating a more stable and lucrative market for farmers. Overall, the development of avocado bars presents a promising avenue for farmers to enhance their income and sustainability in the avocado industry. By taking into consideration of above facts in view, a fruit bar from avocado value added with desiccated coconut powder and dry fruits was developed with the objective of evaluating its physico-chemical and organoleptic properties.

Materials and Methods

The experiment was conducted in the Post-harvest Technology Laboratory, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, Uttar Pradesh, India during the year 2022-2024. The experiment was laid out in Completely Randomized Design (CRD) having 10 treatments and 03 replications. The treatments were T₀ (Avocado pulp 100%), T₁ (Avocado pulp 75% + DCP 20% + Cashews 5%), T₂ (Avocado pulp 75% + DCP 20% + Almonds 5%), T₃ (Avocado pulp 75% + DCP 20% + Walnuts 5%), T₄ (Avocado pulp 75% + DCP 20% + Peanuts 5%), T₅ (Avocado pulp 75% + DCP 20% + Chironji 5%), T₆ (Avocado pulp 75% + DCP 20% + Pista 5%), T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%), T₈ (Avocado pulp

75% + DCP 20% + Raisins 5%), T₉ (Avocado pulp 75% + DCP 20% + Mix Dry Fruits 5%).

Preparation and Storage of Avocado Bar

Ripe avocados were selected and washed thoroughly. They were peeled, and their pulp was carefully extracted. In a pan, the appropriate quantity of avocado pulp was combined with desiccated coconut powder and heated to a temperature between 70-80°C for 10 minutes, allowing the ingredients to meld together. Following this, sugar was added to the mixture, along with the desired amount of dry fruits, creating a balanced and flavorful blend. Once the mixture reached a homogenous consistency, it was poured and evenly spread into a plastic mold tray lined with butter paper. After allowing it to set, the solidified mixture was skillfully cut into suitable-sized bars. These bars were then left to air dry at ambient room temperature for approximately 60 minutes, allowing them to achieve the desired texture. Finally, the dried bars were carefully packed in plastic containers and stored at ambient room temperature.

Evaluation of Physico-chemical Properties of Avocado Bar

The prepared avocado bars were evaluated for various physico-chemical properties *viz.*, moisture, ash, fat, protein, carbohydrate and energy. The moisture content was analyzed by oven dry method and ash content by muffle furnace method. The fat content was analyzed by soxhlet extraction method and protein content by kjeldahl method. The carbohydrate content was calculated by difference method and energy content was calculated by calorific value determination method. The recorded data of all samples for different parameters were tabulated and statistically analyzed to find out the most suitable treatment combination in terms of physico-chemical properties.

Evaluation of Organoleptic Properties of Avocado Bar

The prepared avocado bars were evaluated for various organoleptic properties *viz.*, colour, taste, flavour, texture and overall acceptability. The samples were analyzed using the 9-point hedonic scale rating method by a panel of five judges. The mean scores of all samples from all five panelists were tabulated and statistically analyzed to find out which treatment combination is the most acceptable in terms of organoleptic properties.

Results and Discussion

Physico-chemical Properties of Avocado Bar

The nutritional value of avocado bars was evaluated by analyzing its physico-chemical properties *viz.*, moisture, ash, fat, protein, carbohydrate and energy. The data recorded on effect of different treatments on physico-chemical properties of avocado bar have been presented in Table 1.

Effect of different treatments on Moisture content of Avocado Bar

Statistical analysis demonstrated that moisture content varied significantly among all treatments. The mean values of moisture content ranged from 15.10 to 16.01%. The minimum moisture content 15.10% was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%), while the maximum moisture content 16.01% was recorded in T₀ (Control). Similar results were reported by, Shanthi *et al.*,

(2020) ^[16] in soy flour incorporated mango bars; Chavan *et al.*, (2016) ^[2] in mixed fruit bars prepared from sapota and mango pulp; Philip and Peter (2018) ^[13] in fruit bars prepared from apple, grape and banana. Lower moisture content in avocado bars inhibits microbial growth, extends shelf life, and preserves nutrients, ensuring product safety and quality while maintaining desirable texture and flavour.

Effect of different treatments on Ash content of Avocado Bar

Statistical analysis demonstrated that ash content varied significantly among all treatments. The mean values of ash content ranged from 1.21 to 1.44%. The minimum ash content 1.21% was recorded in T₀ (Control), while the maximum ash content 1.44% was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%). Similar results were reported by, Shanthy *et al.*, (2020) ^[16] in soy flour incorporated mango bars; Chavan *et al.*, (2016) ^[2] in mixed fruit bars prepared from sapota and mango pulp; Srivastava *et al.*, (2019) ^[17] in guava orange fruit bar. Ash content in avocado bars reflects mineral content, indicating nutritional density and aiding in dietary balance, thus contributing to overall health and well-being when consumed.

Effect of different treatments on Fat content of Avocado Bar

Statistical analysis demonstrated that fat content varied significantly among all treatments. The mean values of fat content ranged from 3.05 to 3.50%. The mean values of fat content ranged from 10.09 to 10.75%. The minimum fat content 10.09% was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%), while the maximum fat content 10.75% was recorded in T₀ (Control). Similar results were reported by, Ibrahim *et al.*, (2021) ^[5] in fruit bar prepared from date. Low fat content in avocado bars reduces calorie intake, promotes heart health by lowering cholesterol levels, making it a healthier option for consumers.

Effect of different treatments on Protein content of Avocado Bar

Statistical analysis demonstrated that protein content varied significantly among all treatments. The mean values of protein content ranged from 3.30 to 3.97%. The minimum protein content 3.30% was recorded in T₀ (Control), while the maximum protein content 3.97% was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%). Similar results were reported by, Srivastava *et al.*, (2019) ^[17] in guava orange fruit bar; Arinzechukwu and Nkama (2019) in fruit bar prepared from banana, cashew and apple. Avocado bars with good protein offer a satisfying and nutritious snack, combining healthy fats from avocados with protein for sustained energy and muscle support, ideal for a convenient and wholesome option.

Effect of different treatments on Carbohydrate content of Avocado Bar

Statistical analysis demonstrated that carbohydrate content varied significantly among all treatments. The mean values of carbohydrate content ranged from 67.72 to 68.40%. The minimum carbohydrate content 67.72% was recorded in T₀ (Control), while the maximum carbohydrate content 68.40% was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%). Similar results were reported by, Arinzechukwu and Nkama (2019) ^[1] in fruit bar prepared from banana,

cashew and apple; Ibrahim *et al.*, (2021) ^[5] in fruit bar prepared from date. Avocado bars with optimum carbohydrates from avocado fruits and dry fruits, offer a balanced energy boost, promote satiety, and provide a delicious and wholesome snack option.

Effect of different treatments on Energy content of Avocado Bar

Statistical analysis demonstrated that energy content varied significantly among all treatments. The mean values of energy content ranged from 384.29 to 385.18kcal. The minimum energy content 384.29kcal was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%), while the maximum energy content 385.18kcal was recorded in T₃ (Avocado pulp 75% + DCP 20% + Walnuts 5%). Similar results were reported by, Ibrahim *et al.*, (2021) ^[5] in fruit bar prepared from date. Avocado bars, featuring a blend of healthy fats, complex carbohydrates, and protein, offer an excellent snack choice, providing sustained energy release, satiety promotion, and overall well-being support, ideal for fueling your day with satisfaction and nutrition.

Organoleptic Properties of Avocado Bar

The sensory acceptability of avocado bar was evaluated by analyzing its organoleptic properties *viz.*, colour, taste, flavour, texture and overall acceptability. The data recorded on effect of different treatments on organoleptic properties of avocado bar have been presented in Table 2.

Effect of different treatments on Colour of Avocado Bar

Statistical analysis indicated significant variations in organoleptic score for colour across all treatments. The mean values of organoleptic score for colour ranged from 7.0 to 9.0. The minimum organoleptic score 7.0 for colour was recorded in T₀ (Control), while the maximum organoleptic score 9.0 for colour was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%).

Effect of different treatments on Taste of Avocado Bar

Statistical analysis indicated significant variations in organoleptic score for taste across all treatments. The mean values of organoleptic score for taste ranged from 6.7 to 8.7. The minimum organoleptic score 6.7 for taste was recorded in T₀ (Control), while the maximum organoleptic score 8.7 for taste was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%).

Effect of different treatments on Flavour of Avocado Bar

Statistical analysis indicated significant variations in organoleptic score for flavour across all treatments. The mean values of organoleptic score for flavour ranged from 7.0 to 8.7. The minimum organoleptic score 7.0 for flavour was recorded in T₀ (Control), while the maximum organoleptic score 8.7 for flavour was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%).

Effect of different treatments on Texture of Avocado Bar

Statistical analysis indicated significant variations in organoleptic score for texture across all treatments. The mean values of organoleptic score for texture ranged from 6.7 to 8.3. The minimum organoleptic score 6.7 for texture was recorded in T₀ (Control), while the maximum organoleptic score 8.3 for texture was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%).

Effect of different treatments on Overall acceptability of Avocado Bar

Statistical analysis indicated significant variations in organoleptic score for overall acceptability across all treatments. The mean values of organoleptic score for

overall acceptability ranged from 7.0 to 8.7. The minimum organoleptic score 7.0 for overall acceptability was recorded in T₀ (Control), while the maximum organoleptic score 8.7 for overall acceptability was recorded in T₇ (Avocado pulp 75% + DCP 20% + Dry figs 5%).

Table 1: Physico-chemical Properties of Avocado Bar

Treatment	Moisture	Ash	Fat	Protein	Carbohydrate	Energy
	(%)	(%)	(%)	(%)	(%)	(keal)
T ₀	16.01	1.21	10.75	3.30	67.72	384.86
T ₁	15.18	1.38	10.14	3.92	68.38	384.42
T _h	15.29	1.37	10.29	3.84	68.21	384.78
T _s	15.71	1.24	10.59	3.56	67.90	385.18
T _s	15.55	1.28	10.45	3.67	68.05	384.92
T _s	15.42	1.30	10.38	3.72	68.18	384.99
T _s	15.35	1.34	10.32	3.78	68.21	384.86
T	15.10	1.44	10.09	3.97	68.40	384.29
T _s	15.83	1.23	10.65	3.47	67.82	385.01
T _s	15.23	1.41	10.20	3.88	68.28	384.44
F-test	S	S	S	Ss	Ss	Ss
SE)	0.03	0.02	0.03	0.03	0.07	0.17
CV	0.225	1.800	0.331	1.107	0.125	0.054
CD at 5%	0.059	0.041	0.059	0.070	0.147	0.355

Table 2: Effect of different treatments on Organoleptic properties of Avocado Bar

Treatment	Colour	Taste	Flavour	Texture	Overall acceptability
T ₀	7.0	6.7	7.0	6.7	7.0
T ₁	8.7	8.3	8.3	8.0	8.3
T ₂	8.3	8.0	8.3	7.7	8.0
T ₃	7.7	7.7	7.7	7.7	7.7
T ₄	7.3	7.3	7.3	7.0	7.3
T ₅	7.7	7.7	7.7	7.3	7.7
T ₆	8.0	8.0	8.0	7.3	8.0
T ₇	9.0	8.7	8.7	8.3	8.7
T ₈	7.3	7.7	7.7	7.0	7.3
T ₉	8.7	8.3	8.3	8.0	8.3
F-test	S	S	S	S	S
S.Ed	0.39	0.42	0.42	0.37	0.39
CV	6.063	6.592	6.537	5.963	6.167
CD at 5%	0.823	0.880	0.880	0.762	0.823

Conclusion

Based on the results of assessment, it is concluded that treatment T₇ (Avocado pulp 75% + DCP 20% + Dry Figs 5%) performed best in terms of physico-chemical properties viz., moisture (15.10%), ash (1.44%), fat (10.09%), protein (3.97%), carbohydrate (68.40%), energy (384.29kcal). On the basis of sensory evaluation, treatment T₇ (Avocado pulp 75% + DCP 20% + Dry Figs 5%) was found most acceptable in terms of organoleptic properties viz., colour (9.00), taste (8.67), flavour (8.67), texture (8.33), overall acceptability (8.67). The development of a nutritive and healthy fruit bar from avocado, combined with desiccated coconut powder and dry fruits, offers a promising solution to address post-harvest losses and enhance farmer profitability in the avocado industry. The avocado fruit bar, with its creamy texture, rich flavor and nutritional benefits, emerges as a promising snack option, offering a delightful blend of taste and health in a convenient package.

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