A Sensory Comparison of Fruits and Vegetables Dried using Solar and Electric Forced-Air Dehydrators

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Introduction:

Dehydration of foods using direct sunlight has been used for thousands of years. However, because of largely uncontrollable conditions, direct exposure to free-radicals, and exposure to pests, this method is largely inferior to a commercial electric forced-air dehydrator. Solar dehydrators, which use the sun as an energy source to heat air before it passes through the drying chamber, aim to solve many of these problems while still providing a method of food preservation feasible for developing countries. Past research has focused on optimizing the solar dryers for use in the south Pacific islands and Africa, but no comparisons between the solar dryer and traditional methods have been performed.

Experimental Design

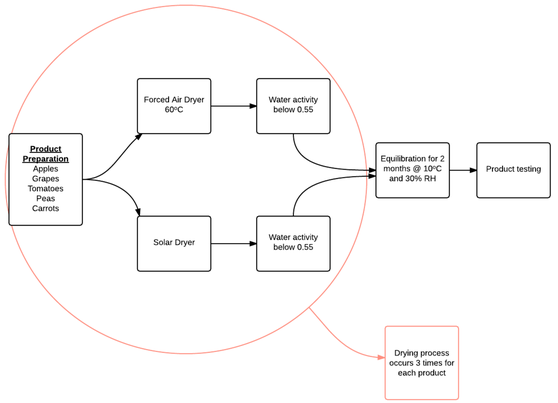
Each fruit and vegetable was divided into three runs, in order to account for variance in the weather from day to day. Each individual fruit was divided in half, with one half going to each treatment. Products were dried either in the solar dehydrator or forced air dehydrator at 60°C until they reached an ending water activity below 0.55. Every hour water activity, outdoor temperature, and dryer temperature were recorded.

After drying, fruits and vegetables were held in an environmental chamber at 10 degrees C and 30% RH to allow the moisture content to equilibrate. After two months of being held, product was separated into 10 gram portions, labeled, and used for testing.

Research Aims

1. To determine if there is a difference in the quality of fruits and vegetables dried using a solar dryer versus fruits and vegetables dried using a traditional forced air dryer;
2. To determine using consumer sensory data whether the consumer perceives any quality differences between the two methods.

Process Design



Results

Sensory: Each product was presented side by side, and panelists (n=100) were asked 9-point hedonic questions about quality attributes. No differences were found for the overall acceptability of each treatment, while slight preferences were found for the texture of forced-air fruits, and a slight preference for the aroma of solar-dried vegetables.

Sensory Results - Overall Acceptability

Product	Mean Score	Significance	P-Value
FA Apple	7.07	NSD	.76
Solar Apple	7.03		
FA Grape	6.69	NSD	.09
Solar Grape	6.36		
FA Carrot	5.40	NSD	.21
Solar Carrot	5.16		
FA Pea	5.50	NSD	.22
Solar Pea	5.65		
FA Tomato	6.15	NSD	.69
Solar Tomato	6.10		

Texture: Texture was analyzed using a TA.XT2 texture analyzer and the force required to pierce the product using a 2mm cylinder probe was measured. It was found that the solar dried fruits required significantly less force than the forced air fruits while only the tomato had significant differences among the vegetables between treatments.

Texture Results

Product	Mean Score (g)	Significance	P-Value
FA Apple	1326.8	A	.003
Solar Apple	1182.4	A*	
FA Grape	1106.2	B	.003
Solar Grape	823.3	B*	
FA Carrot	7694.5	NSD	.413
Solar Carrot	8315.2		
FA Pea	1398.3	NSD	.188
Solar Pea	1726.3		
FA Tomato	4258.6	E	<.001
Solar Tomato	3146.8	E*	

Conclusions

It was found that consumers had no significant preference for the overall acceptability of fruits or vegetables dried using either a solar or forced-air dehydrator. Consumers had a significant preference for the texture of fruits dried using a forced air dehydrator, and a significant preference for the aroma of solar-dried vegetables. Analytical testing shows a significant difference between both treatments in the texture of dried apples, raisins and tomatoes, while there is no significant difference in the texture of dried carrots and peas. Further research aims to look for significant differences between treatments in the color, nutrient loss, and total phenolic content of each sample.

