VALUE-ADDED PROCESSING OF FRUIT-BASED EXTRUDED PORRIDGE AND SNACKS

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INTRODUCTION

Michigan is one of the major dry beans and fruit producing states in the U.S. Beans and fruits, in addition to being low in fat and high in fiber, are also rich in many antioxidants. Because of their nutritional and health-promoting properties, the development of value-added bean-based products for new market opportunities is being promoted on an increased level (Singh, 1999). A review of approximately 200 studies on the relationship between fruit and vegetable intake and various cancers concluded, "major public health benefits could be achieved by substantially increasing consumption of these foods" (Block et. al., 1992). Diet is believed to play an important role in the four major health threats faced by our society—cardiovascular (heart and artery) diseases, cancer, hypertension, and obesity (Goldberg, 1999). The USDA food intake guidelines recommend 2-4 servings of fruits daily. To increase the current consumption level of fruits, there is a need to develop new, tasty, fruit-based products that are convenient to consume.

Our main objectives were: (1) to develop fruit-based products that are tasty, shelf-stable, nutrient-rich, virtually fat-free, and convenient to consume, and (2) evaluate these products different quality characteristics.

MATERIALS AND METHODS

Dry cranberry beans (*Phaseolus vulgaris* L.) were purchased from Bayside Best Beans, LLC (Sebewiang, MI) and ground in a hammer mill (WJ Fitzpatrick Company, Chicago, IL). Following fruits in diced/dried form were used for co-extrusion with bean flour: (i) Golden Delicious and (ii) Red Delicious apples, (iii) blueberries, (iv) cherries, (v) cranberries, and (vi) d'Anjou pears, using a low-cost twin-screw extruder (model JS30A, Qitong Chemical Industry Equipment Co, Ltd, China); shown in Fig. 1. Extruder screws are 30 mm in diameter and the barrel has a L/D (length/diameter) ratio of 16. Extrudates were dried overnight at 60 C and stored in sealed polyethylene bags until need for physico-chemical or sensory quality evaluation using standard lab procedures and equipment.

Figure 1. Twin-Screw Extruder

RESULTS

Sample fruit-based extrudates (snacks) made with a pilot-scale extruder are shown in Fig. 2. Addition of fruits, when compared to control, had minimal effect on extrudates density (data not shown). However, as shown in Table 1, hydration rate of the control extrudates was higher than those with added fruits except for one containing cranberries. Presence of pectin and sugars in the fruit tissue can affect the density of the extruded products thus resulting in lower hydration capacity. The hydration property of snacks plays a role in satiety by giving a feeling of 'fullness.'

Table 1. Hydration capacity of fruit-based extruded bean snacks

	Hydration Time (minutes)					
Bean Snacks with:	**15**	**30**	**45**	**60**	**75**	**90**
Control (no fruit)	33.3	39.3	41.8	45.1	47.3	48.9
Golden Delicious Apples	28.6	33.6	35.4	37	38.2	39.7
Red Delicious Apples	29.6	34.7	36.5	38.3	40.1	41.1
Blueberries	26.6	30.7	32	33.9	34.9	35.7
Cherries	34	40.1	42.6	44.5	46	47.5
Cranberries	30.9	35.7	37.5	38.3	39.8	40.8
D'Anjou Pears	30.6	36.1	38.2	39.7	41.1	42.6

As expected, the Hunter color "L", "a", and "b" values of fruit snacks differed significantly from the control (data not shown), as addition of pigment-rich fruits resulted in improved color of the final product. Data on fruit snack/strands texture (breaking force, Fig. 3); as compared to controls, except for the fruit snacks made with blueberries or cranberries, no significant differences were found among other fruit-added extrudates. Our results showed fruit-based bean snacks with acceptable quality can be prepared successfully using extrusion technology.

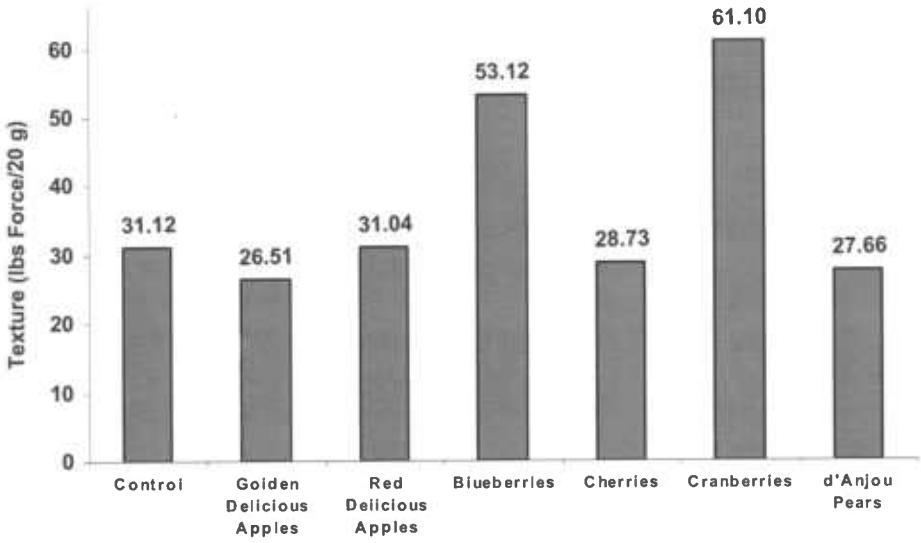

Figure 3. Instrumental texture values of fruit-based extruded bean snacks

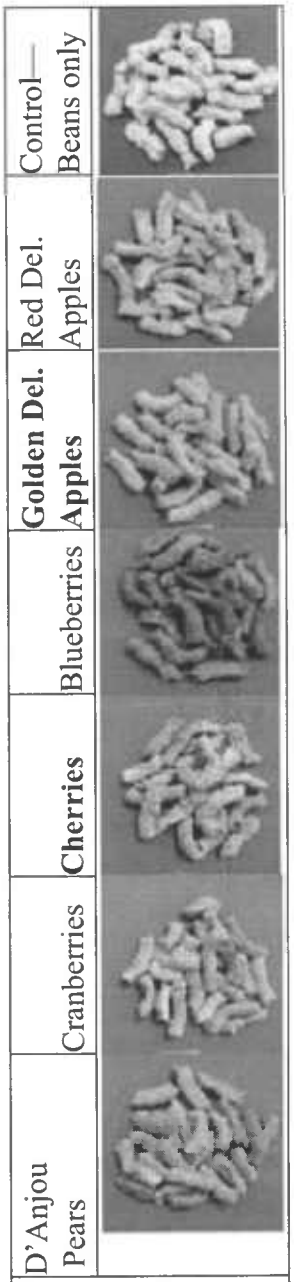

Figure 2. Fruit-based Bean Snacks.

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