FORMULATION OF BEAN FLOUR PASTA SUITABLE FOR MICROWAVE COOKING

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Abstract: A comparative study was conducted using pasta made with 100% semolina durum wheat flour and pasta made with 15% substituted navy bean cotyledon flour. Proximate chemical composition (moisture, ash, protein and fat) of the pasta formulations was determined. Results indicated slightly higher protein value for pasta made with bean flour. Physical changes (texture, weight gain and degree of starch gelatinization) during conventional cooking in boiling water were studied. Weight increased and objective firmness decreased as cooking time increased up to 12 minutes. Differences in heating properties and sensory characteristics of pasta formulations were determined when heated in a microwave oven. Fiber optic heat sensing probes were used to monitor temperature profile within the pasta system during microwave cooking. Results of this research indicated that a highly acceptable pre-cooked and dehydrated pasta suitable for microwave heating was obtained using 15% substituted navy bean cotyledon flour.

Methods: Pasta flour, water, eggs, salt and oil were blended, formed and cut as noodles. Two pasta formulations were made: CONTROL pasta using 100% semolina flour and EXPERIMENTAL pasta using 15% navy bean (cultivar Seafarer) flour (NBF) and 85% semolina flour. Triplicate formulations were divided into groups for precooking in boiling water prior to drying: (1) non-precooked (raw), (2) partially precooked (6 min.) and fully precooked (12 min.). The samples were dried in an oven overnight at 40°C. Non-precooked (raw) dehydrated samples were conventionally heated in boiling water, and weight gain(g/35g pasta) and texture (Kramer Shear Press) were evaluated. A microwave oven was used to heat partially precooked and fully precooked dehydrated samples for 2 minutes. A sensory evaluation was conducted on rehydrated microwave samples.

Results and Discussion: Results of the chemical analysis are shown in Tables 1 and 2. Semolina and navy bean flours differ in moisture, protein, ash (minerals) and carbohydrate contents (Table 1). Semolina is significantly higher in moisture and carbohydrates while navy bean flour contains more protein and ash. These differences were attributed to the variations among major ingredients found in the pasta formulations. Pasta formulations made with semolina and navy bean flours varied in chemical compositions (Table 2). Non-precooked (raw) and fully precooked pasta made with 15% navy bean flour were higher in protein, but possessed only about 1% more protein. This slight but significant difference was due to the limited percentage of navy bean flour substituted into the pasta. Partially precooked pasta showed differences in moisture, fat, ash and carbohydrate contents. Higher values for ash can be attributed to the bean flour, while other differences may be due to the precooking treatment. Physical changes that occurred during conventional heating in boiling water of non-precooked samples showed apparent differences between pasta formulations. Changes in texture are shown quantitatively by values of shear force (pounds/ 75 grams) in Figure 1. During all cooking times the shear force is lower for pasta made with substituted bean flour than with semolina flour. Figure 2 shows the weight gain (g/35g pasta) that occurred during cooking, which was higher for bean flour pasta. The softer texture and higher weight gain are attributed to the increase in water absorption and to the intrinsic bean protein characteristics (high in glutelin and albumin). Sensory evaluations of pasta rehydrated in microwave oven showed positive results for pasta substituted with bean flour. In appearance, navy bean flour pasta had a richer yellow color which was favored over the 100% semolina flour pasta. There was no significant flavor difference between pasta formulations. The attributes of increased tenderness and increased weight gain attained for bean flour substituted pasta may be further exploited to optimize a quick cooking microwaveable pasta formulation. This study formulated a nutritionally enhanced bean flour pasta that was suitable for microwave cooking.

Further research is needed to study the limitations of the bean flour substitution and variations in the types of bean flours utilized in pasta formulation.

Table 1. Proximate Chemical Composition of Pasta Flours

Pasta Flour	Moisture %	% Dry Basis			
		Total CHO	Protein	Fat	Ash
Semolina	12.4 + 0.0 b	77.8 + 0.8 b	19.3 + 0.0 a	1.9 + 0.9 a	1.0 + 0.1a
Navy Bean	10.9 + 0.0 a	65.0 + 0.3 a	28.0 + 0.4 b	2.4 + 0.1 a	4.6 + 0.0b

n=3, Means in a column followed by like letters are not significantly different,P < 0.05.

Table 2. Proximate Chemical Composition of Pasta Formulations

Pasta Treatment	Moisture %	% Dry Basis			
		Total CHO	Protein	Fat	Ash
Non-precooked (raw)					
Control	9.4 + 0.7 a	69.3 + 2.3 a	21.8 + 0.1 a	5.9 + 0.0 a	1.6 + 0.1 a
Experimental (15%NBF)	9.9 + 0.2 a	70.0 + 0.2 a	22.9 + 0.3 b	5.5 + 0.1 a	1.7 + 0.2 a
Partially Precooked (6 min)					
Control	8.6 + 0.3 b	69.4 + 0.0 a	23.4 + 0.1 a	6.1 + 0.1 a	1.1 + 0.0 a
Experimental (15%NBF)	7.1 + 0.3 a	70.4 + 0.1 b	23.7 + 0.1 a	4.6 + 0.0 b	1.3 - 0.0 b
Fully Precooked (12 min)					
Control	8.3 + 0.2 a	67.6 + 0.1 a	23.5 + 0.1 a	7.4 + 0.0 b	1.5 + 0.0 a
Experimental (15%NBF)	8.3 + 0.2 a	72.0 + 2.6 a	24.4 + 0.2 b	4.2 - 0.0 a	1.5 + 0.1 a

n = 3, Means in a column (within each treatment) followed by like letters are not significantly different,P < 0.05.

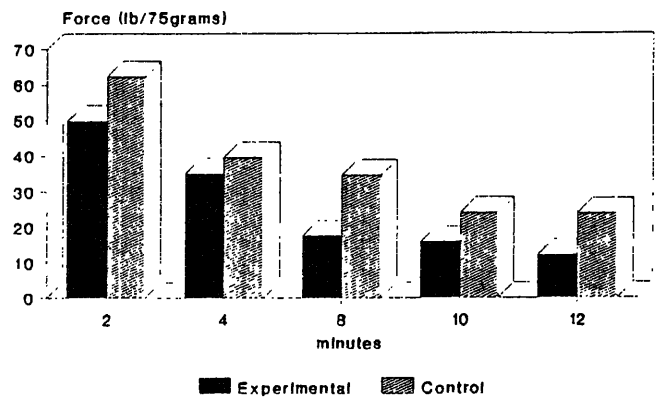

Fig. 1: Textural changes during conventional heating in boiling water of non-precooked pasta (Kramer Shear Texture lb/75g cooked pasta)

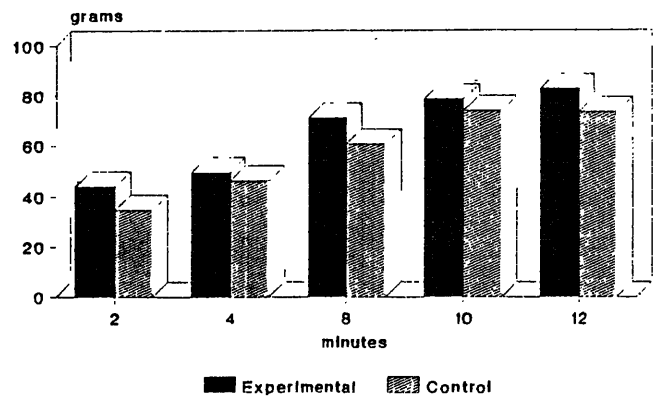

Fig. 2: Weight gain during conventional heating in boiling water of non-precooked pasta (g weigh gain/35g dry pasta)