OBJECTIVE

To examine the suitability of using pulse flours in spaghetti and extruded snacks and to determine if the products exhibited improved nutritional properties and maintained acceptable quality characteristics.

MATERIALS AND METHODS

Pulse Flours, Wheat Flours and Corn Meal

- Dehulled and split yellow peas, Kabuli chickpeas, and green and red lentils were processed into flour using a Jacobson hammer mill.
- Whole wheat flour and whole grain (WG) durum semolina were produced using a Buhler pilot-scale flour mill.
- Durum semolina and corn meal were acquired from commercial suppliers.
- Protein (Williams et al. 1999), starch (AACC 76-13), total dietary fibre (AOAC 991.43), and colour (Minolta CR-310, wet slurry AACC 14-30) were determined on the flours.

Spaghetti

- Pulse flours were incorporated into spaghetti at levels ranging from 10-30%.
- Spaghetti was extruded using a Namad laboratory pasta extruder and dried at 85°C using a commercial drying cycle.
- Dried spaghetti colour was determined using a Minolta CR-310 colorimeter.
- Cooking time was defined as the time required for the centre core in the strands to disappear.
- Firmness of the cooked spaghetti was determined using a TA-HD Plus texture analyzer equipped with a pasta blade and plate.

Extruded Snacks

- Extruded snacks were prepared using 100% pulse flours on a Clextral EV-25 pilot-scale twin screw extruder.
- Bulk density and expansion ratio of the extrudates were measured.

Sensory Analysis

- A trained sensory panel rated the spaghetti and extruded snacks for their quality characteristics using unstructured line scales. Data was analyzed using ANOVA and Tukey's test.

RESULTS AND DISCUSSION

Pulse Flours

- The highest protein levels were found in the pulse flours (Table 1).
- Yellow pea flour had the highest total starch and dietary fibre among the pulse flours (Table 1).
- Green lentil flour had the highest a* value and red lentil flour had the highest a* value (Table 1, Figure 1).

Spaghetti

- As the level of pulse flour increased in the spaghetti, there was an increase in protein, fibre and a* values (Table 2, Figure 2).
- Similar cooking times were found among all the treatments (Table 2).
- Spaghetti made with pulse flours was firmer than both wheat flour reference samples (Table 2).
- Panels did not find differences in spaghetti firmness among the three levels of pulse flour with the exception of red lentil flour (Table 3).
- No differences in flavor intensity were found among any of the pulse flour treatments (Table 3).
- No differences were found in overall quality between the spaghetti made with pulse flours or WG durum semolina (Table 3).

Extruded Snacks

- Protein and fibre content increased on all pulse flour extrudates.
- Extruded products made from yellow pea flour had the highest expansion ratio and bulk density to the 100% corn meal sample (Table 4, Figure 3).
- Panels found significant differences in hardness and crunchiness among the various samples (Table 5).
- No differences were found in flavour acceptability between extruded snacks made with pulse flour or whole wheat flour. (Table 5).

CONCLUSIONS

- The partial substitution of durum semolina with pulse flours improved the nutritional properties of the spaghetti and extruded snacks by increasing the protein content. Similar dietary fibre levels were found among the whole, wheat and whole grain wheat products.
- Overall, the quality of the spaghetti and extruded snacks made with pulse flours was comparable to whole wheat and whole grain wheats.
- Fibre levels could be further improved in the pulse flour products if the flour fractions were included in the blends.
- Pulse flours can be successfully used in extruded product formulations such as spaghetti and extruded snacks to develop healthier products with acceptable quality characteristics.

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