CHARACTERISATION OF WHOLE AND EXTRACTED AMARANTH FLOURS AND WHEAT-AMARANTH COMPOSITE FLOURS FOR BREAD MAKING

BY

MUGAMBI PATRICK MAINA, B.Sc. (HONS), NAIROBI

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT

FOR

THE DEGREE OF

MASTER OF SCIENCE

IN THE UNIVERSITY OF NAIROBI

DEPARTMENT OF FOOD TECHNOLOGY

AND

NUTRITION

1988

ABSTRACT

Whole and extracted amaranth flours obtained from Kenyan bred *Amaranthus hypochondriacus* grain, cultivar 1023, were **examined for their suitability in composite flour technology in bread making.** The amaranth flours were combined with Kenyan bred and grown, strong and distensible bread quality wheat, locally known as Kenya Fahari, at **Substitution rates of 5,10,15,20 and 25% of extracted wheat flour.**

Proximate chemical composition analyses showed that the amaranth flours (extracted; whole) contained higher contents of crude protein (14.9±0.1; 16.3±0.1); crude fibre (2.8±0.0; 4.8±0.0); crude fat (5.7±0.0; 5.7±0.2); and ash (1.5±0.0; 4.0±0.0) as compared to 12.6±0.1; 0.1±0.1; 0.9±0.1; and 0.15±0.0% respectively in extracted wheat flour. In each case whole amaranth flour contained higher levels than extracted amaranth flour showing that extraction of the outer parts of the amaranth grain during milling resulted in loss of nutrients. The amaranth lipids were found to be 76% unsaturated with linoleic acid being responsible for 46% of the unsaturation. This finding indicated that oxidative rancidity would be a possible problem during the storage of amaranth flour.

Brabender gelatinization viscosity, Hagberg falling number, starch swelling power and solubility determinations showed that the amaranth flour contained starch possessing a more crystalline structure which resisted swelling much more than the starch in the extracted wheat flour.

Amylographic, farinographic, extensigraphic and instron machine studies showed that partial substitution of the wheat flour with amaranth flours resulted in more bulky and denser flour slurries, doughs and bread crumbs. Wheat gluten visco-elastic properties and dough gas retention ability deteriorated in presence of the amaranth flour, the effects being greater in intensity when whole amaranth flour was used. Loaf specific volumes decreased as the amaranth flours contents in the composite flour increased while loaf specific weights and crumb compressibility increased. Loaf crust and crumb colour also became increasingly darker with increased amaranth flour. Clear crumb vesiculation was also observed to decrease as the level of amaranth flour in the composite flour was increased, the reduction being greater where whole amaranth flour was used. This was attributed to reduction in gluten strength and gas holding capacity by the presence of amaranth flour.

All the loaves scored above 50% in acceptability organoleptic evaluation. The acceptability was, however, observed to decrease as the level of amaranth flours increased in the formula. Composite breads with whole amaranth flour in them were the least acceptable. An after-taste bitterness was reported in all cases containing amaranth flour. The bitterness was reported to be more intense in presence of whole amaranth and to increase with increasing level of amaranth flour in the recipe. It was finally concluded that inspite of some undesirable properties imparted to bread, amaranth flour has a good opportunity of being accepted in blends with wheat flour for composite bread making.