PJN

ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet

308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Mob: +92 300 3008585, Fax: +92 41 8815544

E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 7 (2): 321-324, 2008
ISSN 1680-5194

Effects of Malt Addition and Fermentation on Sensory Characteristics of Formulated Cereal Based Complementary Food

C.U. Odumodu
Department of Pediatrics, University of Jos, P.M.B. 2084, Jos, Plateau State, Nigeria

Abstract: Sensory evaluation of formulated cereal based complementary food was carried out. Paddy and parboiled rice, soybean and crayfish were obtained from the open market in Jos, Nigeria. The paddy rice malted for 72h and other food stuffs were processed into flours. Parboiled rice and dehulled soybean mix was formulated in a standard ratio 70:30g. A modified standard formulation of parboiled rice, dehulled soybean, malted rice and crayfish in the ratio of 65:25:5:5g was prepared. From the formulation fermentation of different blends at varying periods was carried out for 24, 48, 72, 96 and 120h. The unfermented standard and modified standard ($PR:DSB_0$ and $PR:DSB:MR_{72}:CF_0$ respectively) blends were the controls. Sensory evaluation was carried out on the unfermented and fermented blends by a 10-member untrained but experienced staff. Five texture characteristics were evaluated based on colour, taste, aroma consistency and overall acceptability of the blends. The results showed the two unfermented ($PR:DSB_0$ and $PR:DSB:MR_{72}:CF_0$) blends had the highest values for colours (5.0 and 4.6 respectively), followed by the $PR:DSB:MR_{72}:CF_{24}$ and the $PR:DSB:MR_{72}:CF_{48}$ blends (3.5 and 3.4 respectively). The modified standard and standard blends had the highest values for taste (4.8 and 4.5 respectively) followed by the $PR:DSB:MR_{72}:CF_{24}$ and the $PR:DSB:MR_{72}:CF_{48}$ blends (4.0 and 2.9 respectively). The $PR:DSB:MR_{72}:CF_{24}$ blend had the highest value for aroma (3.2). For consistency the $PR:DSB:MR_{72}:CF_{120}$ and the $PR:DSB:MR_{72}:CF_{96}$ blends had the highest values (3.7 and 3.4 respectively). In overall acceptability the two unfermented blends scored the same (4.2 each) while the $PR:DSB:MR_{72}:CF_{24}$ had the highest value (3.7) among the fermented blends. The results revealed that fermentation of complementary food should not go beyond 24h.

Key words: Sensory, fermentation, complementary, foodstuffs

Introduction

Food processing enhances the quality of foods because in the process foodstuffs are converted to forms which may be more acceptable and completely different from the original food stuffs. The promotion of traditional household processing techniques (germination and fermentation) to produce infant complementary foods have attracted a lot of interest. During germination alpha and beta-amylase are mobilized which hydrolyzed starch molecules into lower molecular weight dextrins and maltose (Nnam, 1999). Michealson and Friis (1999) reported that germination serves to reduce bulk and increase the energy and nutrient density. Golder (2001) stated that high volume and viscose complementary foods referred to as dietary bulk is considered a major factor in the development of malnutrition in areas where cereal and starchy staples are the main foods.

Fermentation process may be a complete oxidation in which sugars are converted to carbon dioxide and water imparting new colour, flavour, taste, odour and texture to a product (Enwere, 1998).

The objective of this project is to determine the best blend based on effects of malt addition and fermentation on sensory characteristics of the formulated cereal based complementary food.

Materials and Methods

Paddy and parboiled rice (*Oryza sativa*), soybean (*Glycine max L.*) and crayfish (*Astacus fluvatilis*) were purchased from Jos Main Market, Nigeria. The grains and crayfish were manually cleansed to remove foreign materials.

Preparation of samples: Production of malted rice flour: Malted rice flour was produced by washing 1kg paddy rice grains in 5% (w/v) sodium chloride to prevent growth of mould. It was soaked in tap water in ratio of 1:3 (w/v), grains to water for 12h. The grains were spread on wet jute bag in a basket covered with a moist-muslin cloth and allowed to germinate for 72h at room temperature (30±3°C). The grains were watered at regular intervals of 12h. The germinated grains were dried at 80°C for 24h, devegetated by rubbing between palms, winnowed and dehulled mechanically. The malt was milled in a laboratory hammer mill to fine flour (300µm mesh screen) and packaged in a low density polyethylene bag and labeled. It was placed in a plastic bucket with a lid and stored in a deep freezer (-18°C) for subsequent use.

Production of soybean, parboiled rice and crayfish flours: One kilogram of raw soybean was placed in ten litres of boiling water containing 5.0g sodium bicarbonate. The soybean was boiled for 10mins and the water drained off. It was dried in the oven at 80°C for 24h and dehulled mechanically using laboratory hammer mill. One kilogram of parboiled rice was washed in tap water and allowed to drain water. It was dried in the oven at 80°C for 24h. One kilogram of crayfish was measured. Each of the foodstuffs was separately milled in a laboratory hammer mill into a fine flour (300µm mesh screen) and packaged separately in a low density labeled polyethylene bag. The bags were placed in plastic buckets with covers and stored in a deep freezer (-18°C) for analysis.

Formulation of rice-soybean mix 70:30g by FAO/WHO/UNU (1985): Parboiled rice-dehulled soybean mix (70:30g) was formulated as a standard blend and thoroughly mixed using a laboratory hammer mill to ensure evenness. It was packaged in a low density labeled polyethylene bag and stored in a deep freezer (-18°C) for analysis.

Dough preparation using parboiled rice, dehulled soybean, malted rice and crayfish flours in the ratio 65:25:5:5, fermented at varying periods. A blend of parboiled rice (65g),dehulled soybean (25g), malted rice (5g) and crayfish (5g) was prepared and divided into six equal parts. Five parts were fermented for 24, 48, 72, 96 and 120h respectively, after mixing with tap water to form a dough by brining the moisture content to 50%. The other part was used as a control. At the end of each fermentation period, the blend was taken out, dried at 80°C in the oven for 24h. The dried blend was remilled in a laboratory mill to fine flour and packaged in low density laballed polyethylene bag. The bags were placed in plastic buckets with covers and stored in a deep freezer (-18°C) for analysis.

Preparation of porridges: One hundred grams of each blend was weighed into a plastic bowl. One hundred and twenty millitres (120ml) of cold water was added to form a slurry. Two leveled table spoons of sugar were added to the slurry. Two hundred and fifty millitres (250ml) of boiling water was added to the slurry, stirred and boiled for 2 minutes. The porridges were allowed to cool at room temperature (28±2°C) to 40°C (serving temperature). The porridges were kept separately in thermos flasks to maintain the serving temperature of 40°C.

Sensory evaluation of porridges: Sensory evaluation of the unfermented and fermented blends was carried out using hedonic scale in accordance with the method described by Larmond (1977). A 10-member untrained but experienced staff was used. Five texture characteristics were evaluated based on colour, taste, aroma, consistency and overall acceptability of the blends. An orientation program was organized for the panelists to brief them on the objective of the project. The porridges were brought to the sensory analysis laboratory after cooling to 40°C. The panelists were instructed to evaluate each porridge independently.

All the porridges were coded with 3 digits random numbers and presented simultaneously. The panelists were each provided with water at room temperature to rinse their mouths after each sample. Each porridge was evaluated in triplicate. The panelists were provided with prescribed questionnaire to record there sensory observation. The information contained in the sensory forma was indicated as 5 = Like extremely; 4 = Like moderately; 3 = Dislike slightly; 2; = Dislike moderately; 1 = Dislike extremely.

Statistical analysis: All data collected were statistically analyzed using analysis of variance and Duncan's New Multiple Test as described by Steel and Torrie (1960). Significance was accepted at $P<0.05$.

Results and Discussion

Sensory scores for all the unfermented and fermented blends were summarized in Table 1.

Colour: The colour of the seven blends varied. The values ranged from 1.3 to 5.0. The standard and the modified standard ($PR:DSB_0$ and $PR:DSB:MR_{72}:CF_0$ respectively) blends had the values 5.0 and 4.6 respectively. There was a significant difference ($P<0.05$) in colour values between the two standard blends. In the same vein, there was a significant difference ($P<0.05$) between the modified standard ($PR:DSB:MR_{72}:CF_0$) and all the fermented blends. On the other hand the $PR:DSB:MR_{72}:CF_{96}$ and the $PR:DSB:MR_{72}:CF_{120}$ blends had similar values (3.4 and 3.5 respectively). The higher colour acceptability for the standard ($PR:DSB_0$) blend as against that for the modified standard ($PR:DSB:MR_{72}:CF_0$) blend could be due to the effects of crayfish and malted rice supplements. These supplements were omitted in the standard ($PR:DSB_0$) blend. Crayfish and malted rice imparted their colours to the original creamy white colour of the standard ($PR:DSB_0$) blend to produce the colour of the modified standard ($PR:DSB:MR_{72}:CF_0$) blend. The higher colour acceptability for the modified standard ($PR:DSB:MR_{72}:CF_0$) blend against the fermented blends was due to the graded fermentation periods. The graded periods changed the colour to various shades of dark brown.

Taste: The modified standard ($PR:DSB:MR_{72}:CF_0$) blend had the highest value for taste (4.8) which is significantly different ($P<0.05$) from the taste value for the standard ($PR:DSB_0$) blend (4.5). The $PR:DSB:MR_{72}$: CF_{48} and the $PR:DSB:MR_{72}:CF_{96}$ blends had the same value (2.9 each). The $PR:DSB:MR_{72}:CF_{120}$ had the least value for taste (1.8). The sweet taste of the blends was due partly

Table 1: Sensory evaluation of all blends

Blend	Colour	Taste	Aroma	Consistency	Overall acceptability
$PR:DSB_0$ 70:30	$5.0^a \pm 0.0$	$4.5^b \pm 0.53$	$2.0^d \pm 0.33$	$2.1^c \pm 0.57$	$4.2^a \pm 0.42$
$PR:DSB:MR_{72}CF_0$ 65:25:5:5	$4.6^b \pm 0.84$	$4.8^a \pm 0.42$	$2.8^a \pm 0.48$	$1.1^d \pm 0.32$	$4.2^a \pm 0.42$
$PR:DSB:MR_{72}CF_{24}$ 65:25:5:5	$3.5^c \pm -0.67$	$4.0^c \pm 0.48$	$3.2^a \pm 0.40$	$2.5^b \pm 0.85$	$3.7^b \pm 0.82$
$PR:DSB:MR_{72}CF_{48}$ 65:25:5:5	$3.4^c \pm 0.67$	$2.9^d \pm 0.74$	$2.9^b \pm 0.10$	$2.9^b \pm 0.88$	$3.0^c \pm 0.67$
$PR:DSB:MR_{72}CF_{72}$ 65:25:5:5	$3.0^d \pm 1.0$	$2.4^e \pm 0.26$	$25^c \pm 0.08$	$3.6^a \pm 0.84$	$2.8^c \pm 0.03$
$PR:DSB:MR_{72}CF_{96}$ 65:25:5:5	$2.6^e \pm 0.52$	$2.9^d \pm 0.99$	$2.2^c \pm 0.40$	$3.4^a \pm 0.07$	$3.0^c \pm 0.67$
$PR:DSB:MR_{72}CF_{120}$ 65:25:5:5	$1.3^f \pm 0.53$	$1.8^f \pm 0.14$	$2.4^c \pm 0.43$	$3.7^a \pm 0.16$	$2.4^d \pm 0.17$
LSD	0.38	0.19	0.31	0.40	0.28

Values with different superscript in the same column are significantly different ($P<0.05$)

Values are means ± standard deviations of triplicate determinations. LSD = Least significant difference

Key

$PR:DSB_0$ 70:30	=	Parboiled rice 70% and 30% dehulled soybean (unfermented)
$PR:DSB:MR_{72}:CF_0$	=	Parboiled rice 65%, dehulled soybean 25%, malted rice (72h) 5% and crayfish 5%,(unfermented)
$PR:DSB:MR_{72}:CF_{24}$	=	Parboiled rice 65%, dehulled soybean 25%, malted rice (72h) 5% and crayfish 5%, all fermented for 24h
$PR:DSB:MR_{72}:CF_{48}$	=	Parboiled rice 65%, dehulled soybean 25%, malted rice (72h) 5% and crayfish 5%, all fermented for 48h
$PR:DSB:MR_{72}:CF_{72}$	=	Parboiled rice 65%, dehulled soybean 25%, malted rice (72h) 5% ,crayfish 5%, all fermented for 72h
$PR:DSB:MR_{72}:CF_{96}$	=	Parboiled rice 65%, dehulled soybean 25%, malted rice (72h) 5% and crayfish 5%, all fermented for 96h.
$PR:DSB:MR_{72}:CF_{120}$	=	Parboiled rice 65%, dehulled soybean 25%, malted rice (72h) 5% and crayfish 5%, all fermented for 120h

to equal amount of table sugar added to each of the blends as well as effects of fermentation. The prolonged fermentation period reduced the sweetness of the blends to sourness. The $PR:DSB:MR_{72}:CF_{24}$ blend was the sweetest of all the fermented blends. This confirmed the observation made by Mensah *et al.* (2004) that during early hours of fermentation considerable amount of sugar is produced to impart sweet taste and most mothers preferred to feed their infants porridges that were fermented for 24h.

Aroma: The $PR:DSB:MR_{72}:CF_{24}$ blend had the highest value for aroma (3.2). The modified standard ($PR:DSB:MR_{72}:CF_0$) and the $PR:DSB:MR_{72}:CF_{48}$ blends had similar values (2.8 and 2.9 respectively). On the other hand the $PR:DSB:MR_{72}:CF_{72}$, the $PR:DSB:MR_{72}:CF_{96}$ and the $PR:DSB:MR_{72}:CF_{120}$ blends had comparable values (2.5 vs 2.2 vs 2.4). The improved aroma of the modified standard ($PR:DSB:MR_{72}:CF_o$) blend could be due to supplementation effects of crayfish and malted rice. The improved aroma of all the fermented blends could be as a result of fermentation and supplementation of crayfish and malted rice. Earlier workers showed that fermentation improved flavour, aroma and palatability (Nnam, 1999); malting enhanced aroma and/or flavour (Obizoba and Nnam, 1992).

Consistency: The $PR:DSB:MR_{72}:CF_{120}$ blend had the highest value for consistency (3.7) followed by the $PR:DSB:MR_{72}:CF_{72}$ blend (3.6). The values for consistency for the $PR:DSB:MR_{72}:CF_{24}$ and the $PR:DSB:MR_{72}:CF_{48}$ blends (2.5 and 2.9 respectively) were not significantly different ($P>0.05$). It is not surprising that the $PR:DSB:MR_{72}:CF_{120}$ blend had the highest watery consistency. This could be due to effects of malt supplementation and graded fermentation period that hydrolyzed the complex starch to simpler sugars and reduced the water blending capacity of the blend. The two unfermented ($PR:DSB_0$ and $PR:DSB:MR_{72}:CF_0$) blends that had the thickest consistency could be attributed to the facts that they were unfermented while the $PR:DSB:MR_{72}:CF_0$ was supplemented with malt.

Overall acceptability: In overall acceptability values the two standard ($PR:DSB_0$ and $PR:DSB:MR_{72}:CF_0$) blends had the same value (4.2 each). In the same vein the $PR:DSB:MR_{72}:CF_{48}$ and the $PR:DSB:MR_{72}:CF_{96}$ blends also had the same value (3.0 each). The $PR:DSB:MR_{72}:CF_{120}$ blend had the least value (2.4). The two unfermented blends were preferred equally to all the fermented blends. On the other hand the $PR:DSB:MR_{72}:CF_{24}$ blend was preferred more than all the fermented blends.

In conclusion, ranking of the sensory scores of the fermented blends showed that the $PR:DSB:MR_{72}:CF_{24}$ had the highest scores of 3.5, 4.0, 3.2, 2.5 and 3.7 in colour, taste, aroma, consistency and overall acceptability respectively. Therefore $PR:DSB:MR_{72}:CF_{24}$ blend fermented for 24h was more preferred to other fermented blends.

References

Enwere, N.J., 1998. Foods of Plant Origin. Processing and Utilization with Recipes and Technology Profiles. Afro-Orbis Publication Ltd. Nsukka Nigeria pp: 194-196.

FAO/WHO/UNU, 1985. Energy and Protein Requirements. Reports of a Joint FAO/WHO/UNU. Experts consultation WHO Tech. Report Series. No. 742. WHO Geneva.

Golder, A., 2001. Health and nutritional status of mothers and children below 5yrs in the Biovillage Project Area. Wolkite, Ethiopia, 69-96.

Larmond, E., 1977. Methods for sensory evaluation of food. Food Research Institute, Central Experimental Farm, Ottawa, Canada. Publication No., pp:1637.

Mensah, P., B.S. Drasan, T.J. Harison and A.M. Tomkins, 2004. Fermented Cereal Gruels. Toward a solution of the weanling's dilemma. J. Appl. Bact. 7:203-210.

Michealson, K.F. and H. Friis, 1999. Complementary feedings; a global perspective. Nurtr., 14: 763-766.

Nnam, N.M., 1999. Nitrogen and mineral utilization of young children fed blends of fermented or unfermented corn *Zea mays L.* African yambean *Phenostylis stenocarpa* and Cowpea *Vigna unguiculanta*. Ecol. Food Nutr., 38: 21-34.

Obizoba, I.C. and N.M. Nnam, 1992. The effects of sprouting times on nutritive value of two varieties of African yam bean (*Sphenostylis sterocarpa*). Plant foods Human Nutr., 42: 319-327.

Steel, R.G. and J.H. Torrie, 1960. Principles and procedures of statistics with special reference to the biological sciences. McGraw-Hill Book Co. Inc, New York, Toronto and London.