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Short Communication

Effect of prolonged parboiling duration on proximate composition of rice

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Effect of prolonged parboiling duration on proximate composition of rice was determined. Result indicated that there was a decrease in vital constituents such as proteins, and mineral elements as a result of prolonged parboiling duration. The longer the duration of parboiling periods the greater the losses in nutritive value. Comparing these effects at 30, 45, 60 and 90 min, greater loss was recorded at 90 min with a loss of 32.5% in crude protein, calcium 13.3%, iron 16.66%, sodium 5.76% and potassium 2.31%. The longer the parboiling duration the higher the percentage of breakages of paddy rice during milling. Variations observed in the result of proximate analysis carried out on parboiled rice obtained from different rice farmers indicated that there is no unique method of processing in operational, which can regulate the quality of rice in this locality. Rice parboiled at not more than 30 - 40 min will still produce the best quality product.

Key word: Prolonged, duration, parboiling, quality, rice.

INTRODUCTION

Parboiling of paddy rice is one of the post harvests processing of rice which is commonly employed for quality maintenance. More than 75% of rice farmers in Nigeria are low scale farmers and they still employ the traditionnally method of parboiling of rice. Prolonged par-boiling duration is a major problem to the quality of rice produced and processed locally. About four decades ago, the main staple food stuffs in Nigeria were cassava, sorghum and yam tubers of different varieties. The cultivation of rice in an appreciable scale commenced in Nigeria only during world war II. When there was a break in the importation from the far east (Oyenuga, 1968), production rose sharply and reached an estimated amount 300,000 tons form 509,000 acres in 1963 (Rome, 1996), Anambra and Bendel states constitute the main producing areas in Nigeria. Today the story is different; Ondo state has joined the leading Rice producers. The position occupied by rice in the Nigerian diet changed about two and a half decades ago with rice now assuming a stable status. Unfortunately, the increase in demand for rice in recent times is not accompanied with a corresponding increase in production and quality assurance; rather there had been an astronomical increase in its importation with its attendant effect on nations' foreign reserve.

Parboiling is an age-old process in part of Asia, Africa, and to a limited extent in some European countries and USA. This process improves the milling recovery of paddy rice, salvages poor quality or spoiled paddy rice, and meets the demand of certain consumers. Parboiling is the hydrothermal treatment of paddy before milling. A number of traditional and modern processes have been used to parboil paddy rice in different countries. Other methods are being developed or studied but have not yet reached a level of economic success. Each method is an attempt to improve grains, the technology or equipment used to soak, steam, and re-dry paddy.

A range of factors (genetic make-up and environmental factors) combines to affect the quality of rice from the paddy storage through to the quality of the finished product (Honjyo, 1971), (Virmain et al., 1978). However, less emphasis has all along been placed on particularly the effect of prolonged parboiling duration on the quality of rice.

Recently, the effect of parboiling on physico-chemical qualities of two local rice varieties in Nigeria was carried out (Otegbayo et al., 2001). Their results indicated that parboiling reduced the breakage, fat, protein and amylose content of the rice while the cooking time, water uptake and thiamine contents were increased. This paper is particularly aimed at presenting the effect of prolonged

Table 1. Proximate composition (%) of paddy rice at different parboiling periods.

Period (min)	Moisture	Crude fibre	Crude protein	Fat	Ash	CHO
30	13.58	1.28	8.86	1.47	1.19	73.63
45	13.11	1.02	8.60	1.53	1.15	76.74
60	13.62	1.35	6.66	1.69	2.04	74.64
90	13.65	1.76	5.98	1.84	2.77	74.00

Values represent means of duplicate analysis.

Table 2. Mineral composition (mg/5 g) at different parboiling periods.

Period (min)	Ca	P	Fe	Na	K
30	1.80	10.50	0.090	0.52	10.80
45	1.66	10.38	0.079	0.50	10.76
60	1.56	10.32	0.076	0.48	10.66
90	1.56	10.32	0.075	0.49	10.55

Values represent means of duplicate analysis.

Table 3. Percentage of breakages after milling at different parboiling duration.

Parameter	30	45	60	90
Moisture (%)	13.65	13.58	13.11	13.62
Breakages (%)	55.6	19.5	30.8	40.3

Values represent mean of triplicate calculations.

parboiling duration on the quality of rice and to encourage the local rice farmers that their rice if better parboiled, better quality is assured and there will be less dependence on imported rice.

MATERIALS AND METHODS

Chemicals

The chemicals are products of Eagle Scientific and BDH Chemicals, these include petroleum ether, sulphuric acid, sodium, hydroxide, hydrochloric acid, methylated spirit, boric acid, mix indicator, distilled water and Kjedhal catalyst tablet.

Equipments

The equipments used include moisture Can, oven, desiccators, silica disk, muttle furnace, steam bath, 500 ml round bottom flask, soxhlet extractor, reflux condenser, conical flask, filter paper, 500 ml Kjedhal flask, Markham distiller, pestle and mortar, milling machine and atomic absorption spectrophotometer.

Sample collection

Raw paddy rice samples were collected from rice farms located at Ita Ogbolu, Akure in Ondo State of Nigeria.

Treatment

The treatment given was adopted from the methods of treatment used by the rice farmers in Ita Ogbolu locality. Raw paddy rice samples were soaked in water for 48 h after which they were steamed or parboiled for a short period of 30 min for normal duration which also serve as the control. Prolonged parboiling duration was set at successive periods of 45, 60 and 90 min.

The samples were sun dried at a temperature not more than 38^{o}C (Chancellor, 1965), dehusked using pestle and mortar, Retschemule blending machine was used to grind this into powder form suitable for analysis. Another set of already parboiled paddy rice samples were obtained at the point of milling from different rice farmers in this locality and milled using a milling machine. As they were collected right away from the milling industry, samples were grinded into powdered form using Retshmule blending machine.

Analytical methods

Proximate compositions of paddy rice were evaluated using standard AOAC (1984) methods. The nitrogen content was evaluated using the micro-Kjeldahl method and crude protein was determined as N x 6.25 as reported by Pearson (1976). Fat was determined gravimetrically after soxhlet extraction with petroleum ether (40 - 60 grades) and subsequently evaporated to dryness on the steam bath (AOAC, 1990). The minerals were determined by the method of AOAC (1990).

Percentage of breakages was determined after milling by sorting out the breakages in 5 g of sample by simple calculation in triplicates and calculating the mean values.

RESULTS AND DISCUSSION

The severity of steaming during prolonged parboiling duration has in a way greatly influenced the distribution of nutrients in the parboiled rice (Tables 1 and 2). Parboiling under normal condition of time (30 min) has no effect on the minerals and trace element composition of rice (Tables 1 and 2). The parboiling toughens the grain and reduces the amount of breakage in milling, (Bhattacharya, 1980), but prolonged parboiled rice tends to absorb more water and if not properly sun dried retains shell during milling, reducing its quality and if highly dried, high breakages are often recorded. The result in Table 3 shows that the percentage of breakages was highest at 90 min of parboiled duration and was lowest at 30 min of parboiled duration even when the moisture content has not changed much. The longer the parboiled duration the lower the protein content and this might be due to the leaching out of non protein nitrogen (Adeyemi, 1979; Omobuwajo, 1982).

The magnitude of losses of nutrient is higher as a result of prolonged parboiling duration, protein content being

Table 4. Proximate and mineral composition of parboiled paddy rice obtained from rice farmers.

Samples	Moisture (%)	Crude Fibre (%)	Crude protein (%)	Fat (%)	Ash (%)	CHO (%)	Ca (mg/100g)	P (mg/100g)	Fe (mg/100g)	Na (mg/100g)	K (mg/100g)
R1	12.01	1.13	6.70	0.8	1.41	77.95	1.44	10.31	0.42	5.52	7.24
R2	11.83	1.12	8.40	1.22	1.21	76.22	1.56	10. 25	0.55	5.10	7.20
R3	12.45	0.55	7.98	0.75	0.18	78.09	1.66	10.52	0.47	5.32	7.22
R4	12 .00	0.90	7.12	0.83	1.77	77.38	1.40	10.66	0.47	5.31	7.20
R5	11.52	0.99	6.55	1.20	1.55	78.20	1.66	10.65	0.48	5.22	7.31

Values represent means of duplicate analysis.

affected most where 2.93% loss was recorded at 45 min, 24.83% loss was recorded at 60 min, and 32.5% loss was recorded at 90 min. This indicated that the longer the duration of parboiling the less nutritive the rice becomes and the higher the grain breakages after milling. There were reductions in mineral constituents with parboiling durations (Table 2). Variations were observed in the result of proximate analysis carried out on the parboiled samples collected from different rice farmers at the milling industry (Table 4). This has indicated that no unique methodology in post harvest processing of rice exist for these rice farmers. Unknowingly some of them leave their paddy rice on fire without timing and went about other business activities and allowed to parboil for an unavoidable longer period. If better quality parboiled rice has to be produced, farmers' attitude towards post harvest processing has to change for the better. Farmers have to be encouraged by the government by providing an affordable automated rice processing equipments. The parboiling duration of 30 - 40 min is however recommended so that high quality parboiled rice is assured and sustained. This will among others, improve rice cultivation and production techniques and attempt to reduce the dependence of local consumers on imported rice.

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