Technological studies for production of easy cook parboiled cargo rice

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The present investigation was carried out by usmg the long gram I variety Giza 181. This study aimed to produce parboiled cargo rice easilycooked with improved physical and technological properties and havehigh nutrition value, as well as acceptable panel taste. To achieve thesegoals, two parboiling methods for paddy rice, i.e. (A) parboiling in freshwater, (B) parboiling in 0.5 %1 NaHCOJ solution, were adopted withseven drying temperature rates to 14 % MC., i.e. 0) : drying the boiledpaddy at 80°C, O2 : drying at 70°C, 03 : drying at 65°C, 04 : drying at60°C, Os : drying at 55°C, D6 : drying at 80°C to 16 % MC., then at40°C to 14 % MC. and 07 : drying at 70°C, to 16 % MC., then at 40°C to14 % MC. The physical, technological, chemical composition,microstructure, cooking quality and organoleptic scores of cargo riceresulted from parboiling were compared with raw white rice of Giza 181variety, in order to evaluate the effect of parboiling and drying treatments.Data obtained were statistically analyzed by complete randomizedanalysis to figure out the best and suitable parboiling treatment and dryingtemperature rate for reaching the objectives of this investigation.The results of this study explored the following points :I . Physical and technologicallJlroperties :1. Parboiling the paddy rice in NaHCOJ solution (0.5 % cone.) anddrying at 55°C to 14 % moisture content (MC.) significantly increasedthe length, width and thickness of cargo rice grains to the highervalues.2. The highest gram index (1000 - gram weight) of cargo rice (22.17gm), obtained from parboiling paddy rice in fresh water and drying athigh temperature rate 80°C.3, There was a significant decrease in bulk density of cargo rice due toparboiling and drying treatments. Raw white rice had the highest bulkdensity.4. Parboiling treatments significantly decreased the husk percentage. Thelowest husk percentage (19.57 %) was obtained from parboilingpaddy rice in fresh water with drying at 55°C to 14 % Me, ascompared with raw white rice (21.52 0/0).5. The highest (cargo rice 0/0), resulted from parboiling paddy rice infresh water and drying the boiled paddy at 55°C to 14 % MC.6. A considerable increase in head rice yield percentage was obtainedwith parboiling treatments. The highest head rice yield percentage ofcargo rice (74.6 0/0)resulted from parboiling in fresh water and dryingat 55°C to 14 % MC.7. Generally, broken grains percentage were significantly affected hyparboiling the paddy rice treatments. The lowest percentage (5.83 %)was obtained by parboiling the paddy rice in fresh water and drying at55°C as compared with raw white rice (9.57 %). Each 5°C increase indrying temperature than 55°C gave gradual increase in brokenpercentage.8. Cracks percentage of cargo rice significantly decreased from 16.000/0to 6.33 % as drying temperature of boiled rice in fresh waterdecreased from 80°C to 55°C to 14 % MC.drying treatments. Raw white rice had the highest carbohydrateparboiled nee than 55°C, increased gradually the carbohydratecontent of cargo rice.4. Parboiling treatments and drying rates significantly affected on thetotal lipids of cargo rice. Cargo rice resulted from parboiling paddy in0.5 % NaHC03 solution and dried at 55°C to 14 (Yo MC., containedthe highest total lipids percentage (2.93 0/0). Increasing dryingtemperature of boiled paddy reduced gradually the lipids percent ofcargo nee.5. Generally, ash content of the cargo rice showed pronounced increasesdue to parboiling treatments. The highest ash content of cargo rice(1.67 0/0), obtained from parboiling the paddy in 0.5 % NaHCO~solution and drying the boiled rice at 80°C to 160/0 MC., then at 40°Cto 14 % MC., treatment.6. Parboiling treatments gave a marked increases in the crude fibercontent of cargo rice. Parboiling in 0.5 % NaHC03

solutionsignificantly increased the crude fiber than parboiling paddy in freshwater. While increasing drying temperature of boiled paddy from550C to 80°C increased the crude fiber content of the cargo rice to thehigh level.7. Potassium, Phosphorus and Sodium elements content of cargo ricewere significantly affected by parboiling and drying treatments.Parboiling the paddy rice in fresh water and drying the boiled paddyat 55°C to 14 % MC., gave the highest values of Potassium andPhosphorus content for cargo rice, however the highest Sodiumcontent of cargo rice was obtained from parhoiling in NaHCO:l anddrying at low temperature (55°C) under both methods of parboiling,increasing drying temperature significantly decreased the Potassium,Phosphorus and Sodium percentage of cargo rice.8. Parboiling and drying treatments had a significant effect on the microelement(Ferrous, Manganese. Copper and Zinc) contents of cargorice. Raw white rice (control) gave the lowest values of Ferrous,Manganese, Copper and Zinc elements. The highest Ferrous,Manganese, Copper and Zinc contents were 13.0,7.30,5.0 and 7.80ppm respectively, obtained from parboiling the paddy in fresh waterand using the low temperature rate (55°C to 14 % MC.). Increasingdrying temperature of the boiled paddy over 55°C gradually decreasedthe Fe, Mn, Cu and Zn contents in cargo rice, under both methods ofparboiling.9. Thiamine content of cargo rice significantly increased by parboilingthe paddy rice. It can be concluded that parboiling paddy rice inchemical solution of 0.5 o NaHC03 and drying at high temperaturerate 80°C to 14 % MC., gave the maximum value of thiamine in cargonee.II . Scanning electron microscopy of parboiled cargo and raw white-rice:The microstructure of cargo rice resulted from parboiling paddy infresh water or in 0.5 % NaHC03 solution and drying at 55°C to 140/0MC., or drying at 70°C to reach primarily 16 % Me., then followeddrying at 40°C up to final 14 % MC., was studied. After parboiling,pronounced differences III the appearance of starch granules in theendosperm was noticed. The granules were compact in the polygonalstructure in surface was disappeared. Several homogenous degrees orstarch granules gelatinization shown as partially gelatinization and itsdegradation are the main reason of this appeat'ance beside, widenssbetween protein intermolecules due to water absorption and partialswelling. Alteration due to alkalinity and absorption played a role in thisI appearance. Also, the heat effect and the oil content or cargo rice thatmay interfere with starch and protein to form a state emulsion to form allthe previous appearances.IV . Cooking quality :1. Parboiling treatments and drying rates significantly affected thevolume increase of cooked cargo rice. The maximum increases involume for cooked cargo rice was obtained from parboiling paddy infresh water and drying at 80°C to 16 % MC., then at 40°C to 140/0MC. Cooked raw white rice gave the minimum increase in volume.2. Cooked cargo rice resulted from parboiling in fresh water and dried atlow temperature rate of 55°C to 14 % MC., gave the highest increasein weight (142.0 gm) after cooking. Increasing drying rate than 55°Cafter parboiling caused decrease in weight for cooked cargo rice.3. significant difTerences in cooking time were obtained due toparboiling and drying treatments. Raw white rice had the shortest timefor cooking (20.83 min.). Parboiling paddy rice in chemical solutionof (0.5 0/0)NaHC03 reduced the cooking time of cargo rice to (22.60min.), when compared with cargo rice, obtained from parboiling infresh water method (28.67 min.). Drying the boiled rice at hightemperature rate of 80°C to 14 % MC., reduced the cooking time ofcargo rice to minimum values (21.00 and 26.17 min.) for parboilingmethod (B) and (A), respectively.v . Panel taste (organoleptic evaluation) : 1. Generally, parboiling the paddy rice decreased the colour score degrees for cooked cargo rice. Raw white rice was more whitenessthan parboiled cargo rice after cooking. Cooked cargo rice resultedfrom parboiling in fresh water had a higher colour scores than thatparboiled in 0.5 % NaHC03 solution. Increasing temperature ofdrying decreased the colour score of cooking cargo rice.2. Flavour scores of cooking cargo rice, obtained from parboiling thepaddy in fresh water was as that of raw white rice alter cooking (8.0score degree) without any effect to drying levels under this parboilingmethod. Parboiling paddy in chemical solution of 0.5 % NaHCO~decreased the flavour scores of cooked cargo rice.3. Parboiling paddy rice in fresh water and drying the paddy at the twodrying treatments (at 55°C or 80°C to 14 % Me., or at 70°C to 16 %MC., then at 40°C to 14 0;.) Me.) improved the texture of cookedcargo rice resulted. These results may attributed to the effect ofparboiling on grain hardness and the unifonnity of grains. Raw whiterice gave the lowest scores of texture when it cooked.4. parboiling paddy rice in fresh water and drying at low temperature(550C to 14 % MC.) gave cargo rice had excellent overallacceptability

after cooking (8.0 scores). Raw white cooked rice hadthe same scores (8.0), whereas increasing drying temperature than550C under both methods of parboiling decreased the overallacceptability of cooked cargo rice.