Effect of heat moist treatment on functional properties of rice flour of selected traditional rice varieties in Sri Lanka

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Introduction

Rice flour is good food crop which has been found to be an important calories source. Gluten-free nature can play important role in preventing celiac problem. The substitution of selected traditional rice flour to the wheat flour can provides beneficial nutraceutical properties than the commercial hybrid rice flour. The traditional rice varieties contain higher amounts of Glutamic acid, higher concentrations of vitamins, richer in fiber and a lower Glycemic index (Oyarekua and Adeyeye, 2008). Heat moisture treatment (HMT) is used to modify the rice flour which can change the functional properties of rice flour. The functional properties of flours play important role in the manufacturing of bakery products. These hydrothermal treatments could suppress granule swelling, retard gelatinization and increase starch paste stability. HMT of rice flour could enhance the cooking and textural qualities of rice flour (Sandoval *et al*., 2008).

Methodology

Four different traditional rice varieties (Madathuwalu, Kaluhenati, Pachaperumal and Rathadal) were obtained depending on their availability and the nutritional status, from Rural Network Farmers organization and certified the varieties from the rice research institute, Bathalegoda, Sri Lanka. Subsequently, eight percent of bran was removed from all the brown rice grains. White rice flour were obtained from the rice grains by dry grinding process of Pin Mill machine sieving the 160 μm mesh (IPHT, Anuradhapura). The moisture content of selected rice flour was adjusted to one percent, followed by heating at 100 °C for one hour (HMT 01) and two hours (HMT 02) and soaking slightly at 80 °C for five hours by adding 65% (w/w) of excess water.

Native and modified rice flour (Madathuwalu F1, Kaluhenati F2, Pachaperumal F3 and Rathadal F4) obtained from the rice grains before and after different flour modification methods were analyzed separately for different functional properties such as water solubility (WS), swelling power (SP), water absorption index (WAI) and bulk density. Native rice flour obtained from traditional rice varieties were maintained as a control for each treatment. Experiments were conducted in triplicates and data obtained were analyzed using ANOVA in model Minitab 16.0 software.

Result and Discussion

The functional properties of rice flours play important role in the manufacturing of bakery products. The bulk density obtained for both HMT 1 and HMT 2 were lower than that of the native flour in F1 and F2 flour types (Fig.1 A). Further, the bulk density for treatments HM1 and HM2 were approximately similar in F2 and F3 flour types. The lowest significant bulk density was recorded for the treatment HMT2 in F4 flour type compared to all other treatments ($p < 0.05$).

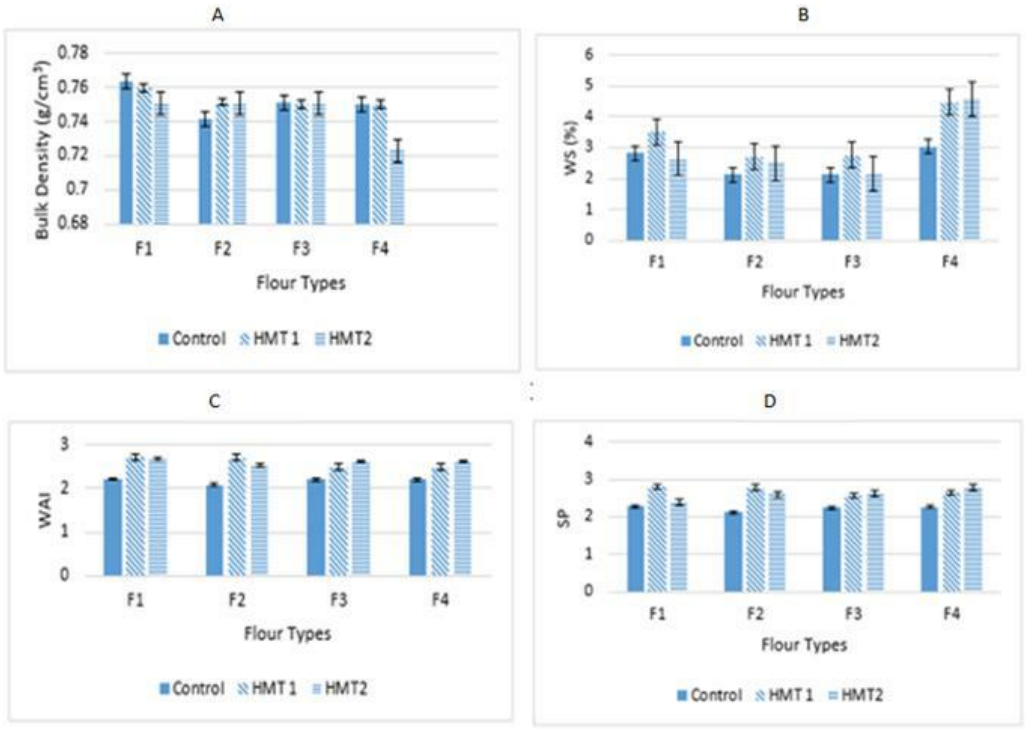

Figure 01: Functional properties of rice flour modified after different treatments. Figure 1A- Bulk Density of modified rice flour for different treatments; Figure 1B- Water solubility (WS) of modified rice flour for different treatments; Figure 1C- Water Absorption Index (WAI) of modified rice flour for different treatments; Swelling Power (SP) of modified rice flour for different treatments. Treatments: HMT 1- Heating 100 C 1 hour followed by soaking water at 80 C 5 hours , HMT 2 - Heating 100 C 2 hours followed by soaking water at 80 C 5 hours Flour types: F1- Madatuwalu, F2- Kaluhenati , F3- Pachaperumal , F4- Rathadal

It has been reported that the low bulk density enhances the digestibility and provides well-organized bread crumb to the bread and bakery products (Sandoval *et al*., 2008). The highest significant WS was recorded for both treatments HMT1 ($p < 0.05$) and HMT2 ($p<0.05$) in flour type F4 compared to the native flour type (Fig.1B). It has been well documented that the flour with very high solubility resulted in soggy and less cohesive dough which provides favorable characteristics for bakery products when applied in baking (Eriksson, 2013). All four flour types were showed higher WAI and SP properties for HMT 01 and HMT 02 compare to the native rice flour (Fig.1C and Fig.1D). However, the highest WAI and SP properties were recorded from flour type F1 and F2 for the treatment HMT1 compared to the other flour types. A previous study has proven that the high WAI and SP enhance the product cohesiveness and that can be used to diversify rice flour into different categories of food. Further, baking performance of the dough can be improved by the presence of high WAI and SP properties due to the enhancement of organoleptic characteristics (Naivikul and Lorlowhakarn, 2006).

Conclusions

Treatment HMT2 for the flour type F4 can be considered as the best treatment in terms of the bulk density and WS whereas treatment HMT1 for the flour type F1can be considered as the best treatment

in terms of WAI and SP functional properties. Heat moist modification method (HMT 1 and HMT 2) enhances the functional properties of all selected rice flour types compared to the un-modified flour and can be used to develop bakery products.

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