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Effect of Infrared Radiation Drying on Sensory Characteristics of Rice

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Abstract

Infrared (IR) heating has a promising potential to be used as an efficient drying method for rice. The aim of this study was to study the impact of IR drying (IRD) on the sensory quality of rough and brown rice. Samples of freshly harvested medium grain rice variety were used. They were dried using IRD, hot air (HAD) and ambient air (AAD) for comparison. The dried samples were divided into two portions which were respectively used as rough and brown rice for storage. Fourteen descriptive texture attributes at different phases of sensory evaluation were determined by a trained panel. The IR dried rice showed higher springy and hardness intensities than the springy and hardness of rice dried with ambient air. The intensity of initial starchy coating intensity, slickness, stickiness to lips and intensity of cohesiveness of the cooked rice kept decreasing during storage. However, these attributes of IR dried rice showed less decrement after 7 months of storage. IR drying could be used as a feasible efficient drying technique for rice with better maintained sensory quality.

Background

Our previous research has shown that IRD has high moisture diffusivity corresponding to high drying rate. It simultaneously achieved effective disinfestation, disinfection, and stabilization without compromising milling quality. In addition, the drying method also extended shelf life with maintained physicochemical properties for rough and brown rice. However, the effect of IR drying on sensory properties for rough and brown rice need to be further investigated.

Objectives

1. To study the impact of IR drying on the sensory quality of rough rice and brown rice.
2. To investigate the changes in sensory attributes of rough and brown rice during storage period.

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Materials and Methods

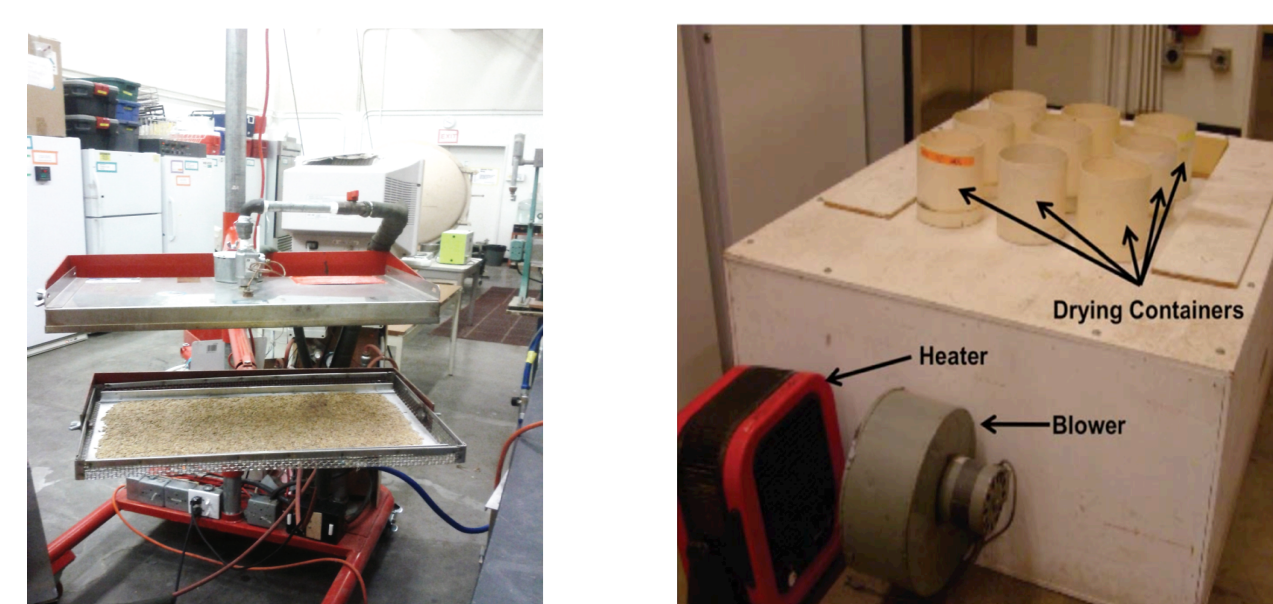
Rice drying

Sample: freshly harvested medium grain rice, variety M206, moisture content $25.03 \pm 0.01\%$ (d. b.).

IR drying (IRD): 60°C → tempering (4h) → natural cooling

Hot air drying (HAD): 43°C

Ambient air drying (AAD): 25°C

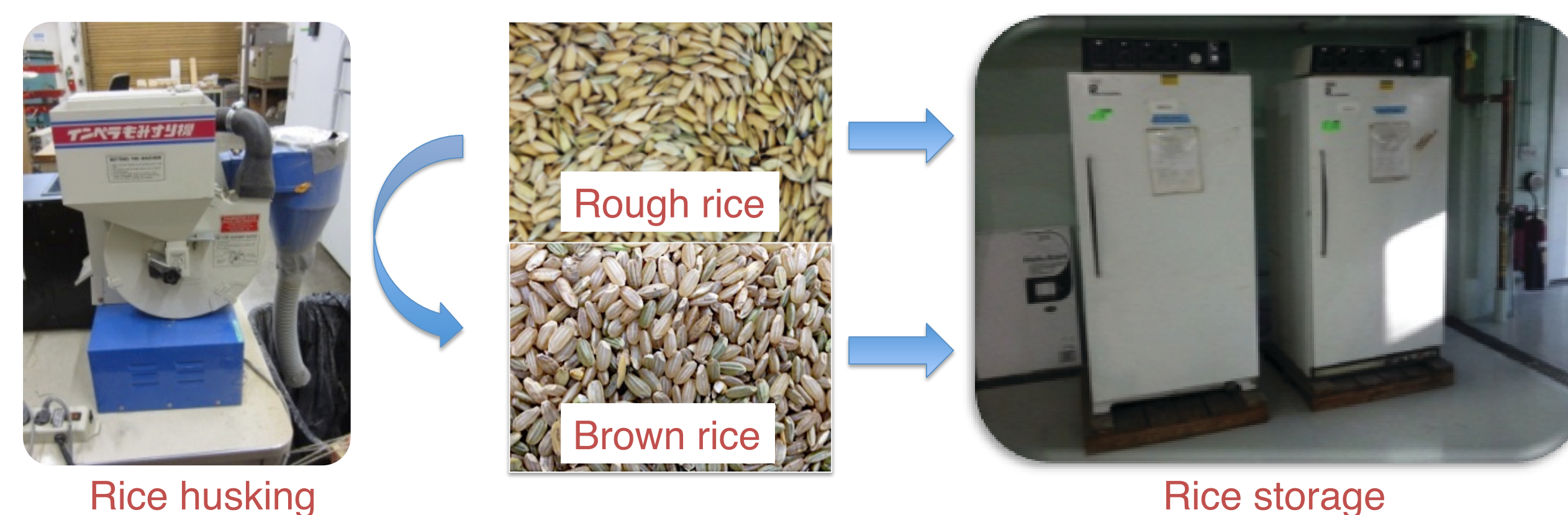


Rice storage

Sample: dried rough rice and brown rice

Storage condition: $35 \pm 1^\circ\text{C}$, RH = $65 \pm 3\%$

Storage time: 0, 4, 7 months

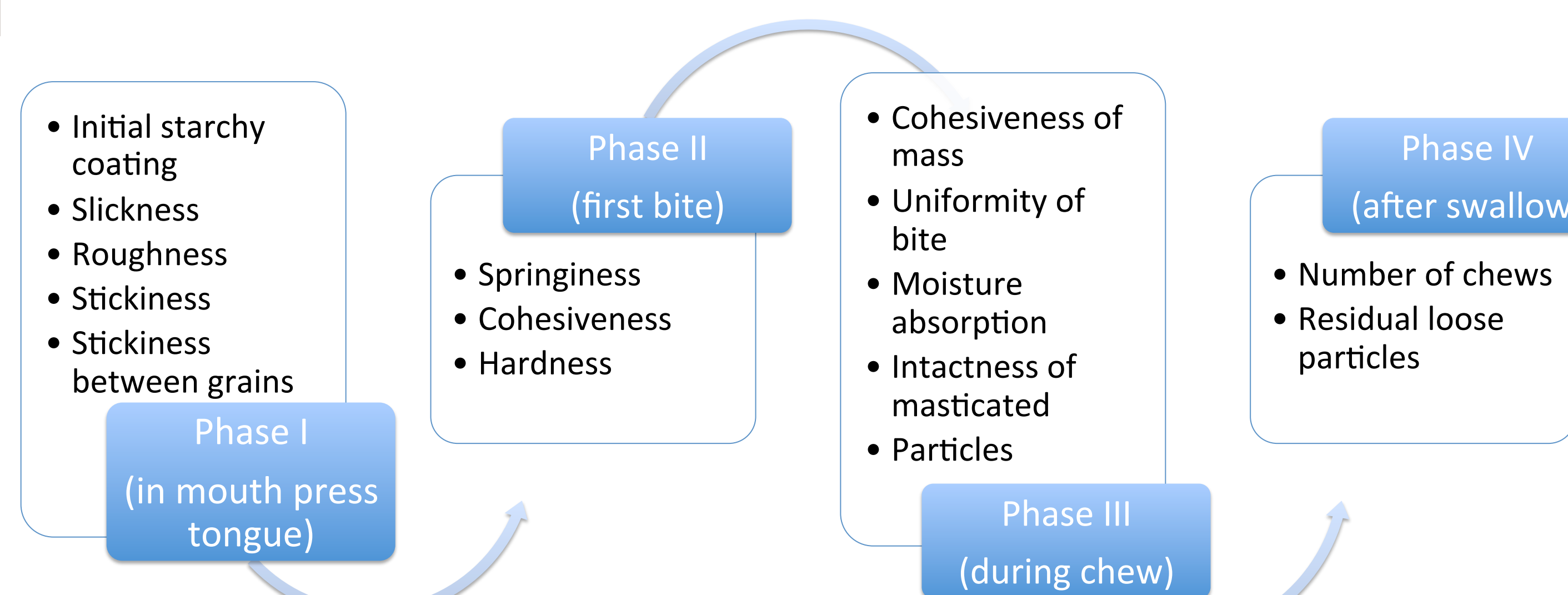


Rice sensory evaluation

Sample: cooked white rice

Sensory evaluation: 9 panelists, with 1-8 years of experience in principles and concepts of descriptive sensory analysis

Survey: Including 14 sensory texture attributes



Descriptive texture attributes at different phases of sensory evaluation

Results

IR dried rough rice showed higher springy than the rice dried using ambient and hot air drying methods (Fig. 1). The stickiness and intactness of masticated particles of rice dried using infrared and hot air were higher than those of rough rice dried using ambient air (Figs. 2 and 3). IR dried rough rice was harder than that dried using ambient and hot air drying methods. IR dried rice was not significantly ($P < 0.05$) different in uniformity of bite than either that dried using ambient or hot air drying. It also showed less decrement in all sensory attributes during storage period compared to the rough rice dried using ambient and hot air.

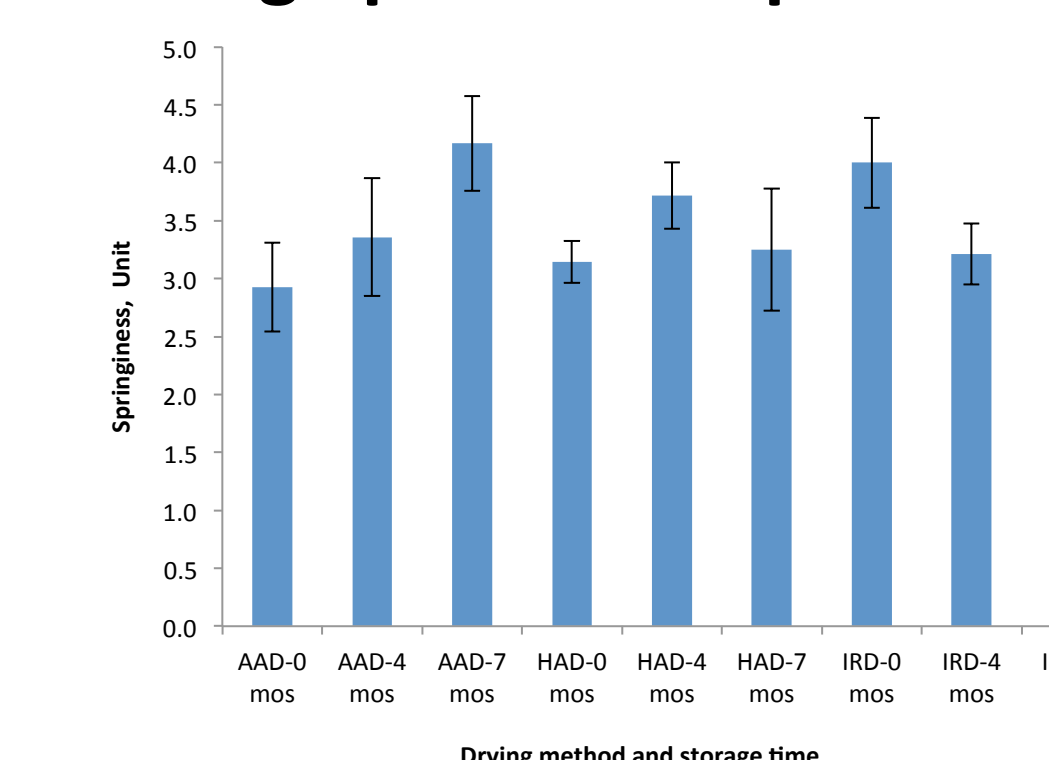


Fig. 1 Springiness of rough rice under AAD, HAD and IRD

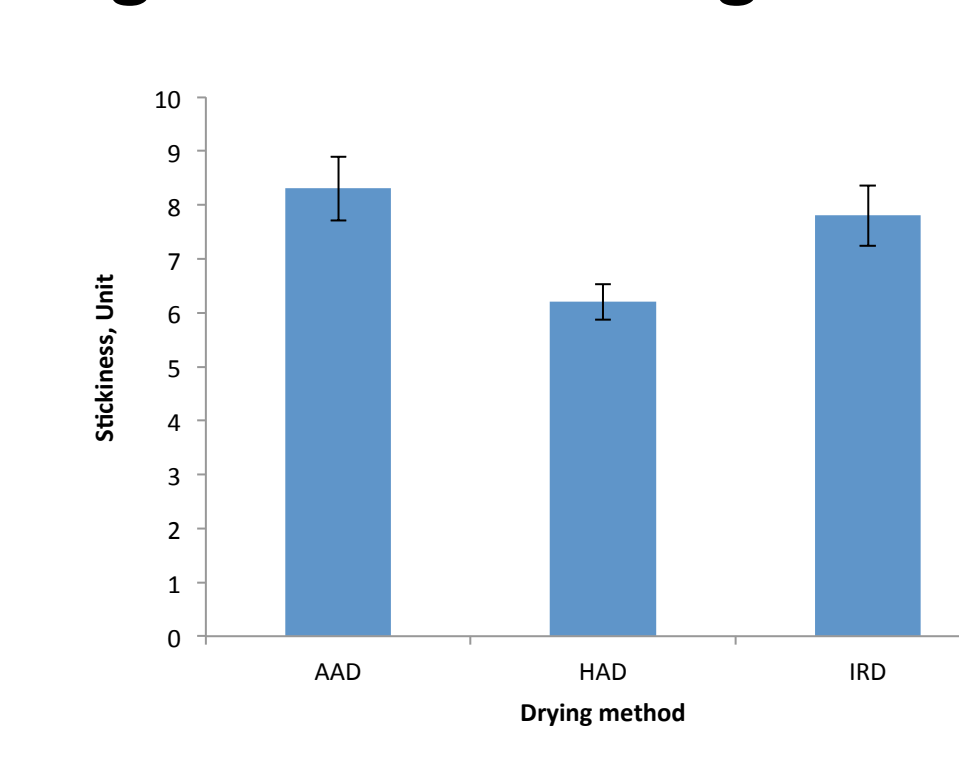


Fig. 2 Stickiness of rough rice after seven month of storage under AAD, HAD and IRD

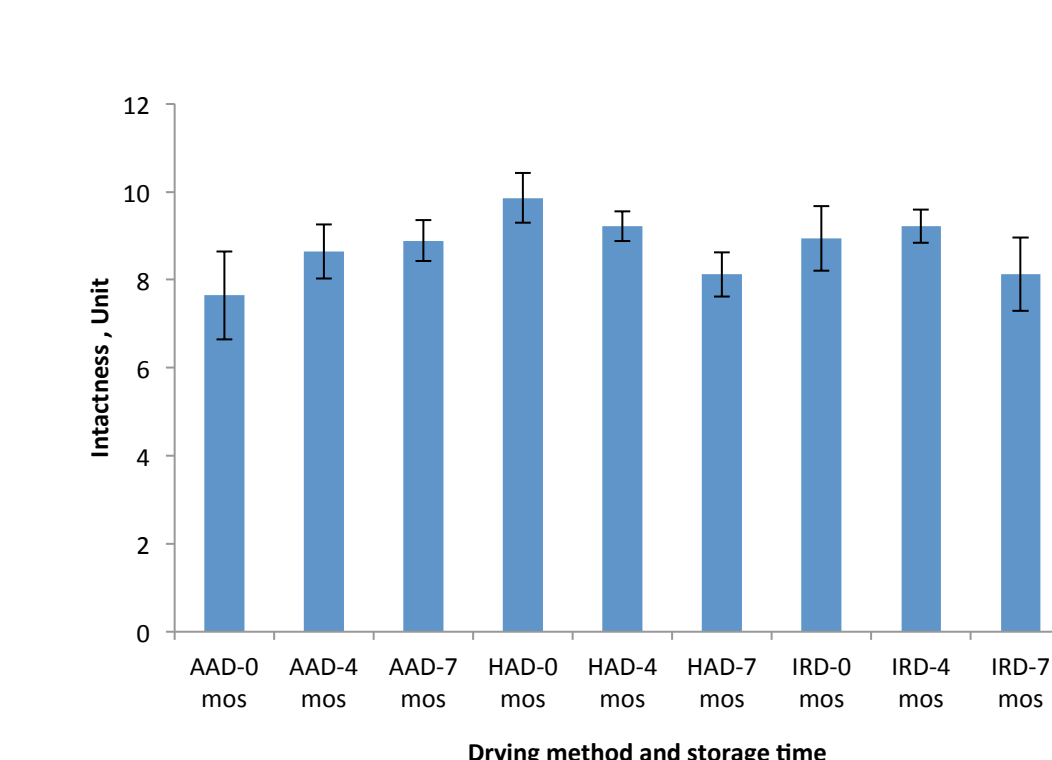


Fig. 3 Intactness of masticated particles of rough rice under AAD, HAD and IRD

When the rice stored as brown rice, drying methods affected springiness, hardness and uniformity of bite. Rice dried using ambient air was less springy than that dried using hot air and IR methods even no significant difference was found (Fig. 4). The ambient air dried rice showed better uniformity during the first bite than hot air and IR dried rice (Fig. 5). IR dried rice was harder than that dried using ambient and hot air drying. There was no significant difference ($P < 0.05$) among cohesiveness of rice dried using IR, hot and ambient air drying methods (Fig 6).

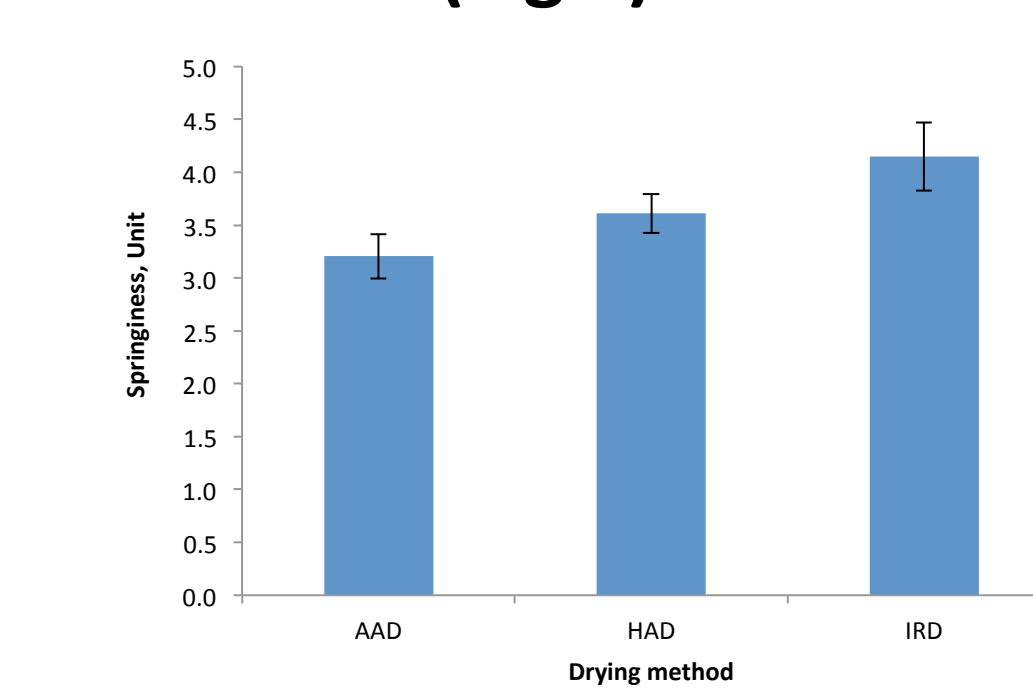


Fig. 4 Springiness of brown rice after seven months of storage under AAD, HAD and IRD

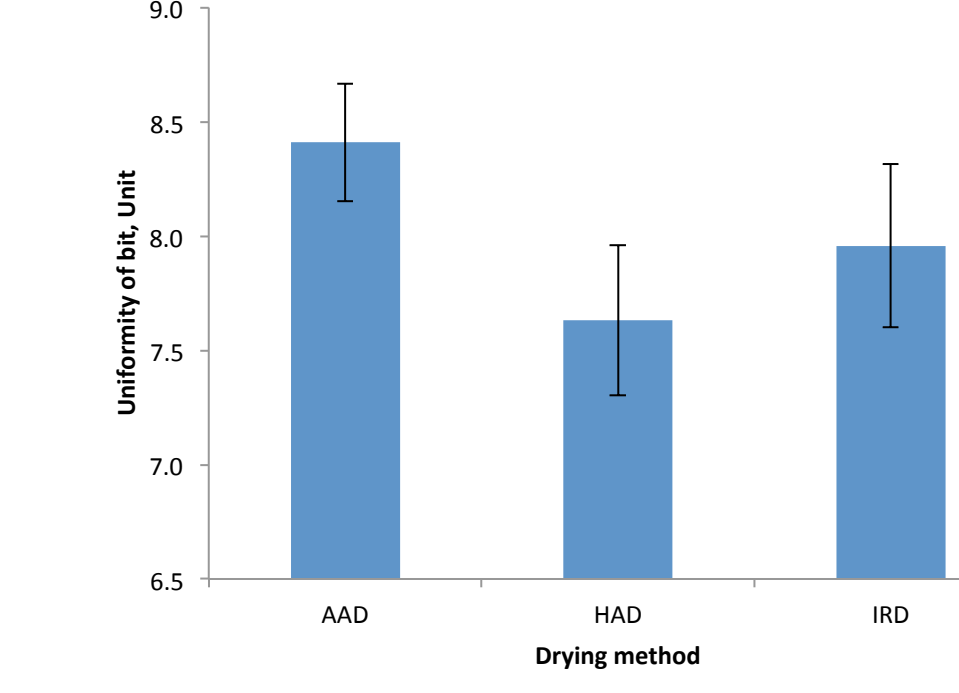


Fig. 5 Uniformity of bit of brown rice after seven month of storage under AAD, HAD and IRD

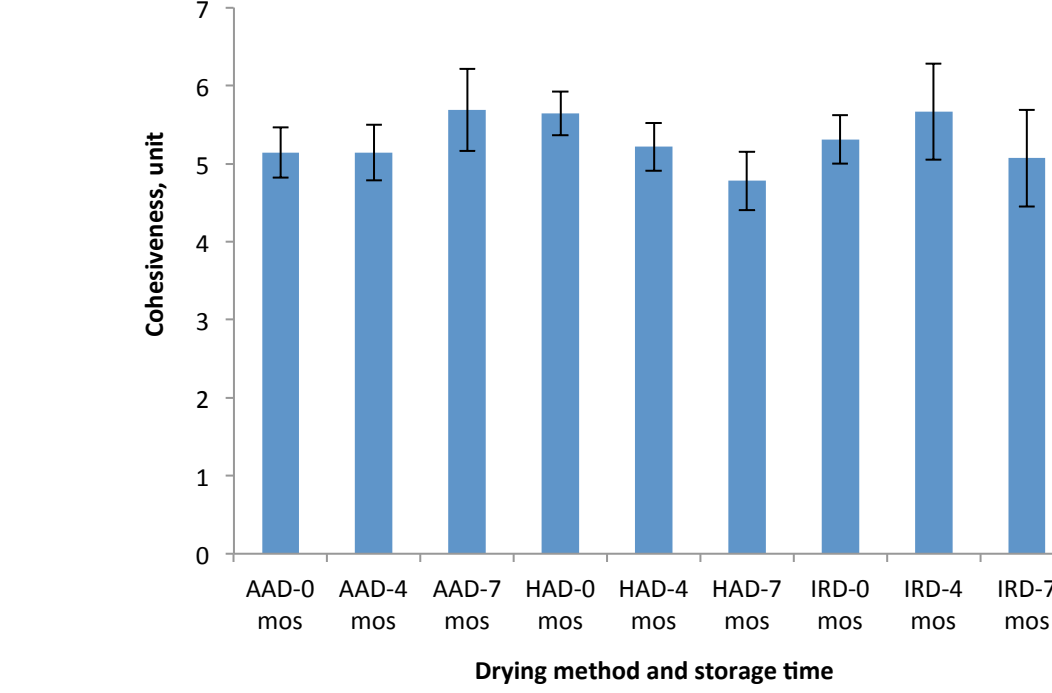


Fig. 6 Cohesiveness of brown rice under AAD, HAD and IRD

Conclusions

The IR dried rice showed higher springy and hardness intensities than the rice dried with ambient air. Initial starchy coating intensity, slickness, stickiness to lips and intensity of cohesiveness were well maintained for the rice dried using IR. There was no significant difference among sensory attributes of rice dried with infrared, hot and ambient drying methods. IR drying could be used as a feasible efficient drying technique for rice with better maintained sensory quality.

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