Developing and Testing Guava- and Jackfruit-nut-bars to Bridge Seasonal Food Gaps in East Africa

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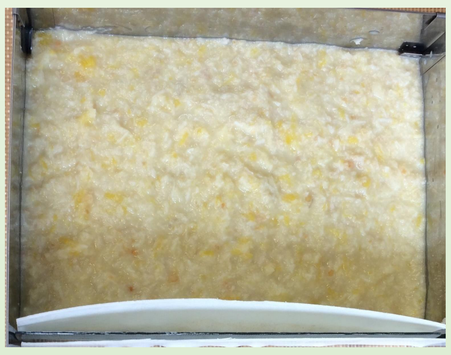

Guava-based fruit-nut-powder
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Guava-based fruit-nut-bars after 6-hour-drying
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Guava-based fruit-nut-bars after 19-hour drying
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Jackfruit-based fruit-nut-bars after 6-hour-drying
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Jackfruit-based fruit-nut-bars after 19-hour-drying
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Introduction

Guava (*Psidium guajava*) and jackfruit (*Artocarpus heterophyllus*) are naturalized fruits in East Africa with high contents of nutrients essential for human bodies. However, through improper post-harvest treatments and only seasonal availability many nutrients or even whole surplus fruits are lost while at the same time fruit consumption in East Africa is far below the recommended amounts.

In the framework of a joint project on "Fruits and vegetables for all seasons" with partners in East Africa and Germany, this study aimed to explore the development of nutritional fruit-nut-bars with a long shelf-life. The effects of common processing methods (cooking and oven drying) and varying ingredients (mango, lemon juice, desiccated coconut, peanut and cashew nut) on nutrient composition in fruit-nut-bars were measured.

Methodology

- Ascorbic acid: titration by using 2,6-Dichlorophenolindophenol (DIP) dye (Puwastien et al., 2011).
- Total phenolic content: by using Folin & Ciocalteu's phenol reagent (Folin-C reagent) and photometrical determination (Singleton et al., 1965).
- Titratable acidity: titration by using 0.1N NaOH solution (LMBG, 1983).
- Water content: by drying for 19 hours at 60 ℃ followed four hours at 105 ℃ (Slatyer et al., 1968).
- Mineral nutrients: sample preparation by microwave extraction with the microwave, measurement of minerals by ICP-OES (Wheal et al., 2011).

Results

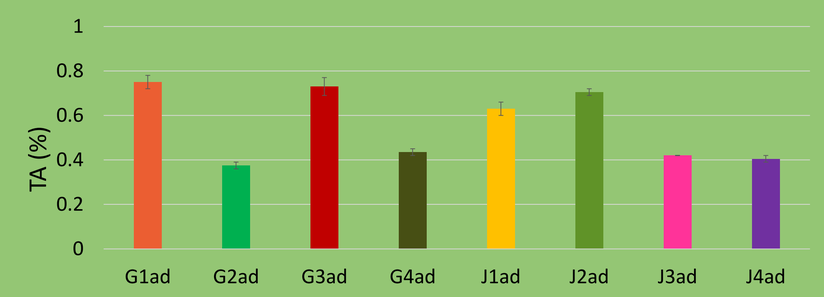
- Bars with guava and lemon juice contained the highest content of ascorbic acid (81.19 ± 0.37 mg/100g FM) (Figure 1).
- Water content of final products was <10 %, which indicated a longer shelf life.

G1=Guava-Cashew-Lemon, G2=Guava-Cashew, bc=before cooking, ac=after cooking

Figure 1: Ascorbic acid content of guava samples (n=3, mean ± SD)

- Based on the results of this study, the ascorbic acid content has decreased by 54% during the production of fruit bars, so that the final guava products still contain about 27 mg ascorbic acid in 100g DM. According to the USA Institute of Medicine (1998), for teenagers at the age of 9-13 years old, the recommended dietary allowances (RDAs) of ascorbic acid is 45 mg per day. This means that the consumption of the fruit bar could still be beneficial to children as well as other population groups in East Africa.

- Fruit bars with lemon juice had higher acidity (Figure 2).
- For phenolic content, most samples of jackfruit contained more than guava products (Figure 3).



G1=Guava-Cashew-Lemon, G2=Guava-Cashew, G3=Guava-Peanut-Lemon, G4=Guava-Peanut,
J1=Jackfruit-Cashew-Lemon, J2=Jackfruit-Cashew, J3=Jackfruit-Peanut-Lemon,
J4= Jackfruit-Peanut, ad=after drying

Figure 2: Titratable acidity of guava and jackfruit samples after drying (n=2, mean ± SD) .

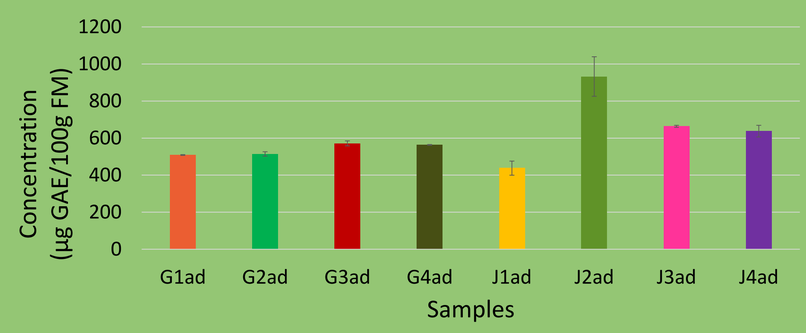


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Figure 3: Total phenolic content of guava and jackfruit samples after drying (n=2, mean ± SD)

Results

According to Institute of Medicine (2011), for teenagers at the age of 9-13 years old, the dietary reference intakes (DRIs) of Fe and Zn is 8 mg per day. In general, bars in this study can provide sufficient essential nutrients for teenagers in East Africa (Table 1).

Table 1: Mineral content of guava and jackfruit samples

Mineral element	Content (mg/g DM)	DRI values are suitable for 9-13 years old teenager (mg/day)
Potassium (K)	11.96±1.30	4500
Phosphorous (P)	4.31±0.16	1250
Magnesium (Mg)	1.76±0.13	1.6-1.9
Copper (Cu)	0.07±0.01	0.7
Iron (Fe)	0.06±0.02	8
Zinc (Zn)	0.05±0.01	8
Manganese (Mn)	0.02±0.00	1.6-1.9

DRI: dietary reference intakes Source: Government of Canada

Conclusions

Cooking and drying procedures decrease, as expected, nutrient contents, yet, to varying extent. While the consumption of fresh fruits is always the better choice, the fruit-nut-bars provide a good option to process surplus fruits and bridge seasonal gaps.

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