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## Effect of Lesser Yam (*Dioscorea esculenta*) flour Supplementation to Ice Cream quality characteristics

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Lesser yam (*Dioscorea esculenta*) flour has a high content of carbohydrate. Therefore it can be utilized as stabilizer replacement in different foodstuffs. Ice cream is a frozen food prepared from milk, stabilizer and sweetener. Our research was aimed to investigate the effect of lesser yam flour supplementation to the quality characteristics of ice cream. Different lesser yam flour replacements (0, 4, 8, 12, 16%) to milk were examined thoroughly. The quality parameters of ice cream were evaluated on the melting power (minute), volumn overrun (%), total soluble solid (°Brix), overall acceptance (sensory score). Our results revealed that 12% lesser yam flour could be applied to replace milk in ice cream making to achieve the best ice cream quality.

**Keywords:** Lesser yam, ice cream, supplementation, melting power, volumn overrun, total soluble solid, overall acceptance

### INTRODUCTION

Ice cream is a frozen food widely consumed. The main structural constituents of ice cream include fat globules, air, and ice crystals dispersing in a frozen fluid and concentrated with proteins, salts, and polysaccharides (Muse and Hartel, 2004). The sweetener and stabilizer added in formulations play an important role of viscosity and freezing point depression of the mix (Drewett, Hartel, 2007). The development of structure in ice cream is often attributed to the macromolecules present in the ice cream mix – milk fat, protein, and complex carbohydrates. Milk fat interacts with other ingredients to develop the texture, mouthfeel, creaminess, and overall sensations of lubricity (Elieste et al., 2011). The demand for lactose-free ice cream has been driven in front of many cases of food intolerances and allergies.

Lesser yam (*Dioscorea esculenta*) belongs to the family of Dioscoreaceae. Its root system developed fully around 21 weeks after planting. Productivity of lesser yam is influenced by a range of soil fertility, agronomic, physiological and

environmental factors (Marie et al., 2008; Lucien et al., 2009). It is one of the the most important tropical root crops in Vietnam. It is an important kind of food providing carbohydrate, minerals and essential vitamins for the human diet (Fashina et al., 2017). Babaleye (2003) proved that lesser yam supplied over 200 dietary calories per day. It's normally consumed as fresh, boiled, baked or fried produce. Lesser yam is highly valued owing to its essential dietary nutrients superior other tropical root crops (Shajeela et al., 2011). Tubers of lesser yam (*Dioscorea esculenta*) contains 84.86% carbohydrate, 7.19% protein, 1.10% fat, 14.77% inulin 91.7°C gelatinization temperature (Saskiawan et al., 2014; Surekha et al., 2016). Lesser yam (*Dioscorea esculenta*) has potential to be utilized as thickener due to its high starch content. It's possible to convert into flour and utilize in bread making (Ukpabi, 2010). Lesser yam flour contained high inulin possibly applied as a prebiotic and healthy for the digestive tract (Rifqi and Titik, 2019). Therefore its flour could be substituted on boiled tuna nugget-okara. Nondairy

ice cream based on fermented lesser yam was examined (Nádia et al., 2019). Lesser yam (*Dioscoreaesculenta*) has relatively short shelf life after harvesting at ambient condition posing a serious constraint to the crop expansion (Akinoso and Olatoye, 2013). Purpose of our research was to verify the influence of different supplementations of lesser yam flour as stabilizer in ice cream production..

## MATERIALS AND METHODS

### Material

Tubers of lesser yam (*Dioscoreaesculenta*) were collected from HauGiang province, Vietnam. After collecting, they must be kept in dry cool place and quickly conveyed to laboratory for experiments. They were subjected to washing with clean water, peeling with sharp knife, slicing into 2.5 mm thickness, soaking in 0.01% peracetic acid for 15 minutes, draining off peracetic solution, drying at 55°C to brittleness, milling, sieving in 250 micron sieve to collect lesser yam flour. The prepared flour was kept in zipper polyethylene pouch within 2 weeks for ice cream production. Lab equipments and utensils included freezer, blender, ice cream maker, viscometer, refractometer, pH meter, measuring cup, ice cream cup, stopwatch, analytical balance.

### Researching method

1000 mL of milk was added with 0%, 4%, 8%, 12%, 16% lesser yam flour + 150 ml of corn syrup + 0.1% lecithin. This mixture was blended thoroughly by blender for 20 minutes and then frozen by freezer at -18°C to form ice cream. Quality parameters such as melting power (minutes), volumn overrun (%), total soluble solid (°Brix), overall acceptance (sensory score) were carefully evaluated.

### Determination of ice cream quality characteristics

Melting power (minutes) was based on the time required to melt the ice cream fully at room temperature. One scoop of ice cream -20°C was sampled and set on dish. The time for ice cream thawing completely at ambient temperature was counted by a stopwatch. Volumn overrun (%) was calculated based on the difference in volume dough ice cream at beginning with the end. Total soluble solid (°Brix) was measured by refractometer. Overall acceptance (sensory score) was evaluated by a group of panelist including 11 members using 9 point-Hedonic scale.

### Statistical analysis

The experiments were run in triplicate with three different lots of samples. The data were presented as mean±standard deviation. Statistical analysis was performed by the Statgraphics Centurion version XVI.

## RESULTS

The structural arrangement of ice cream reflected its thermal properties (Elieste et al., 2011). Running power (minutes), volumn overrun (%), total soluble solid (°Brix) and overall acceptance (sensory score) of ice cream by different replacements of lesser yam flour (0%, 4%, 8%, 12%, 16%) were clearly presented in table 1. It could be noticed that the lowest running power (minutes) achieved by the supplementation of lesser yam flour as much as 16% (w/w). Running power of ice cream was firmly correlated to the thickness and viscosity of ice cream. Increasing lesser yam flour to 12% resulted to the increment of running power of ice cream. However, the supplementation of 16% lesser yam flour caused a reduction of running power for ice cream. The higher the volumn overrun value indicated the better quality of ice cream.

**Table 1: Effect of lesser yam flour supplementations (%) to the running power of ice cream**

Lesser yam flour (%)	0	4	8	12	16
Running power (minute)	10.24±0.02 <sup>bc</sup>	10.95±0.03 <sup>b</sup>	11.64±0.00 <sup>ab</sup>	12.57±0.01 <sup>a</sup>	9.75±0.02 <sup>c</sup>
Volumn overrun (%)	68.45±0.00 <sup>c</sup>	70.16±0.01 <sup>bc</sup>	72.39±0.02 <sup>b</sup>	76.20±0.00 <sup>a</sup>	74.63±0.01 <sup>ab</sup>
Total soluble solid (°Brix)	24.97±0.01 <sup>a</sup>	25.08±0.02 <sup>a</sup>	25.11±0.03 <sup>a</sup>	25.16±0.03 <sup>a</sup>	25.19±0.00 <sup>a</sup>
Overall acceptance (sensory score)	7.12±0.03 <sup>c</sup>	7.79±0.00 <sup>b</sup>	7.96±0.02 <sup>ab</sup>	8.23±0.01 <sup>a</sup>	8.04±0.02 <sup>ab</sup>

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant ( $\alpha = 5\%$ ).

The highest volumn overrun of ice cream was realized at 12% lesser yam flour. The ice cream volumn overrun was mainly depended on the ice cream making process and composition. There was no significant difference of total solid content of ice cream prepared by different lesser yam flour replacement. The highest overall acceptance of ice cream was recored at 12% or 16% lesser yam flour. Our data were similar to findings by Jhauharotu and Tanalya (2019) in investigation of ice cream quality affected by the addition of banana flour. The addition of lesser yam flour increased total soluble solids of frozen wheygurt (Edhi et al., 2017).

### CONCLUSION

Lesser yam is highly appreciated due to its essential dietary nutritional superiority in comparision with other tropical root crops. Its starch has low peak gelatinization viscosity suitable for making ice cream. Lesser yam processing is an alternative to reduce waste and increase the consumption of this tuber by the population. Ice cream composed of a three-component foam including a network of fat globules and ice crystals dispersed in a high viscosity aqueous phase. In this research, we have successfully developed low lactose ice cream by the addition of lesser yam to replace milk proportion in ice cream making..

### CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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### AUTHOR CONTRIBUTIONS

Minh Phuoc Nguyen arranged the experiments and also wrote the manuscript.

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