Effect of drying methods on the nutrients and anti-nutrients composition of African nightshade

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ABSTRACT

African nightshade is a luminary food plant considered as cheap and potential dietary source for micronutrients and bioactive compounds. Small-scale farmers face losses both quantitatively and qualitatively in the field, especially postharvest handling and storage. The effect of various drying techniques on some nutritional (minerals & vitamin C) and anti-nutritional (oxalates & phytate) contents of *Solanum scabrum (SS)*, and *Solanum villosum (SV)* were evaluated. Three drying techniques, mixed solar drying, indirect solar drying, and open sun drying, were employed in drying ANS. Pre-treatment of ANS by either blanching at 85°C, 2 min, or blanching at 85°C, 2 min with an additional of 3% NaCl was done. Results showed significant differences ($p<0.05$) in nutritional and anti-nutritional contents for dried ANS using different methods. The nutrients retention trend as follows; ascorbic acids (5.47% to 19.22%), Ca (70.59% to 96.58%), Fe (34.96% to 77.88), Mg (51.74% to 80.86%), and Zn (34.96% to 86.94%) for *S. scabrum* and *S. villosum*. The percentage reduction in anti-nutritional factors was as follows; oxalate (4.66% to 35.24%) and phytate (51.72% to 85.42%), respectively. Indirect solar drying was shown to be the best method for retaining vitamin C, minerals, and reduction of anti-nutrients compared to other drying methods. The present study shows the significance of different drying methods on the retention of nutrients and reduction of anti-nutrients in SS and SV

Key words: African nightshade, *Solanum* spp., drying methods, nutrient retention, antinutrients

INTRODUCTION

Vegetables are edible parts of the plant, consumed wholly or in parts as raw or cooked to accompany the main dish or used as a salad. They play an essential part between the food crops as they provide adequate amounts of many vitamins and minerals for humans (Mohammed *et al.*, 2011). Africa nightshade (ANS) is among African indigenous leafy vegetables, contributing substantially to food, nutritional, and medicinal benefits(Kamga *et al.*, 2013; Traoré *et al.*, 2017). The commonly consumed ANS species in East Africa are *Solanum scabrum, Solanum villosum,* and *Solanum nigrum.* They grow naturally and are also cultivated in gardens/farms. The parts of ANs mainly eaten are leaves and young shoots. They are eaten in the form of cooked foods and most of the cooking methods employed are frying, steaming, or boiling methods to improve the organoleptic properties and remove anti-nutritive compounds (Ochieng *et al.*, 2018; Oluoch *et al.*, 2012). The high moisture content pose the vegetables at great risk of continual changes which shortens their shelf life by supporting the enzymatic browning, microbial spoilage and senescence thus cause post-harvest losses (James and Matemu, 2016). The post-harvest losses of leafy vegetables ranges up to 30–50% in sub-Saharan Africa (SSA) as per crop, markets and region (Gustavsson *et al.*, 2011; Sagar *et al.*, 2010; Tumwet *et al.*, 2014). Nevertheless, small-scale farmers are facing losses both quantitatively and qualitatively especially during postharvest handling and storage. Due to the high perishability of ANS, proper postharvest handling is highly needed for improving shelf life. The study aimed at improving diversification, livelihood, break seasonality, increase utilization, improve food and nutritional security, and reduce postharvest losses.

MATERIALS AND METHODS

The two species of ANS were used, which are *Solanum scabrum* and *Solanum villosum*. The pre-treatments were done to the sample involving water blanching at 85˚C for 2 minutes and water blanching with an additional of 3% NaCl. The samples were then dried by the open sun, mixed solar dryer, and indirect solar dryer as per illustration 1.

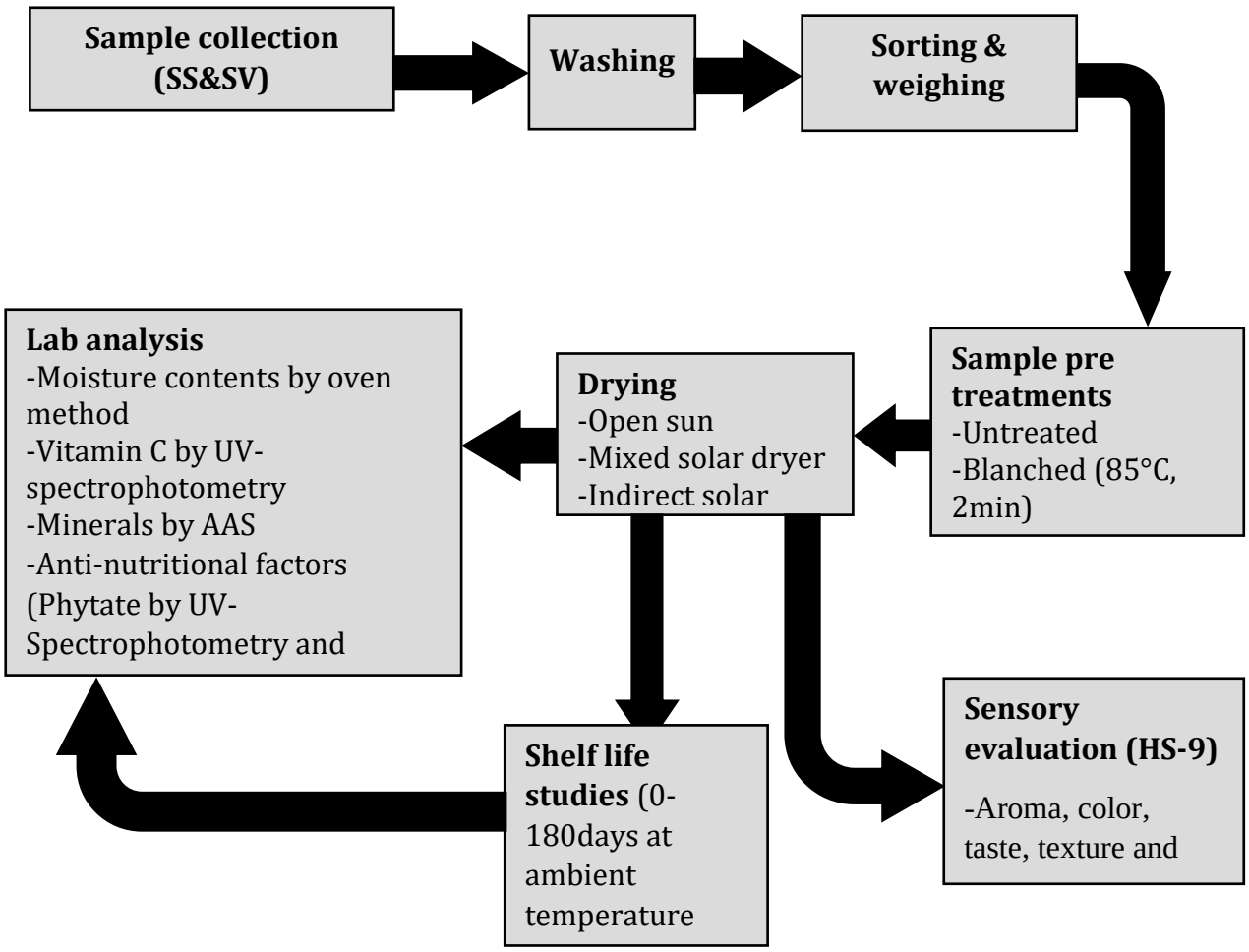

Illustration 1: Processing procedures and analysis methods employed in development of the dried product

RESULTS

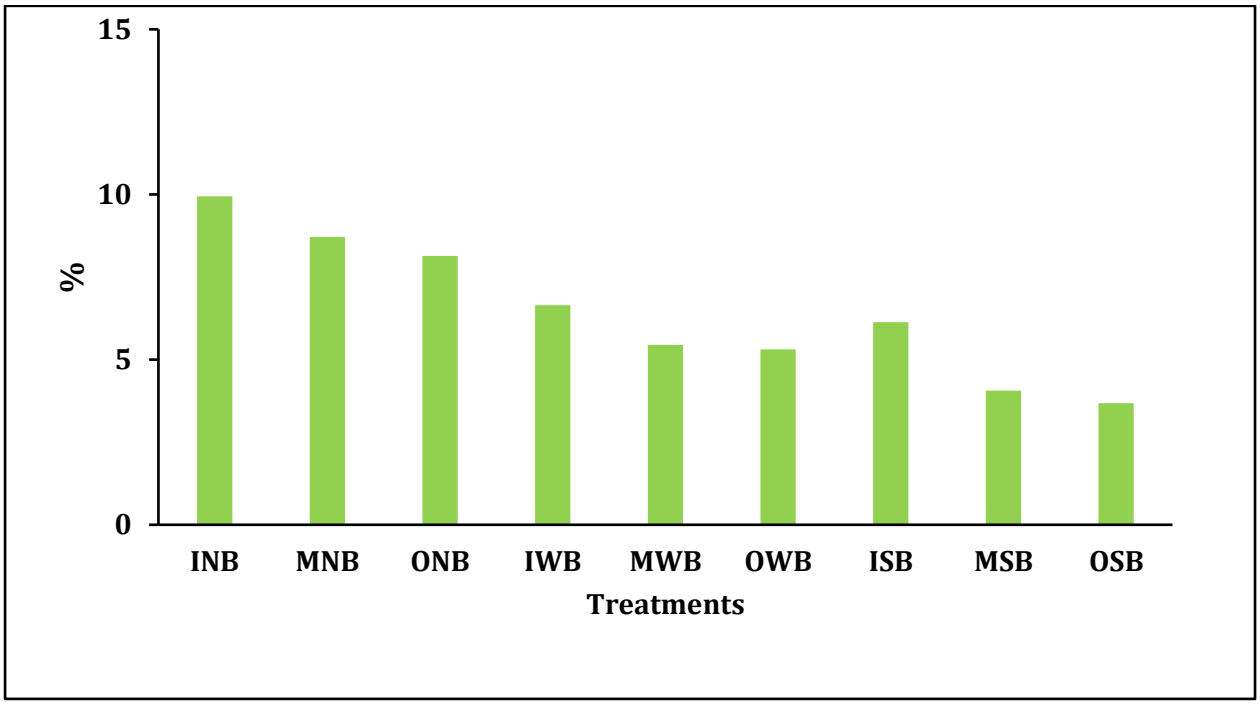

Figure 1: Percentage retention of vitamin C in *S. scabrum*

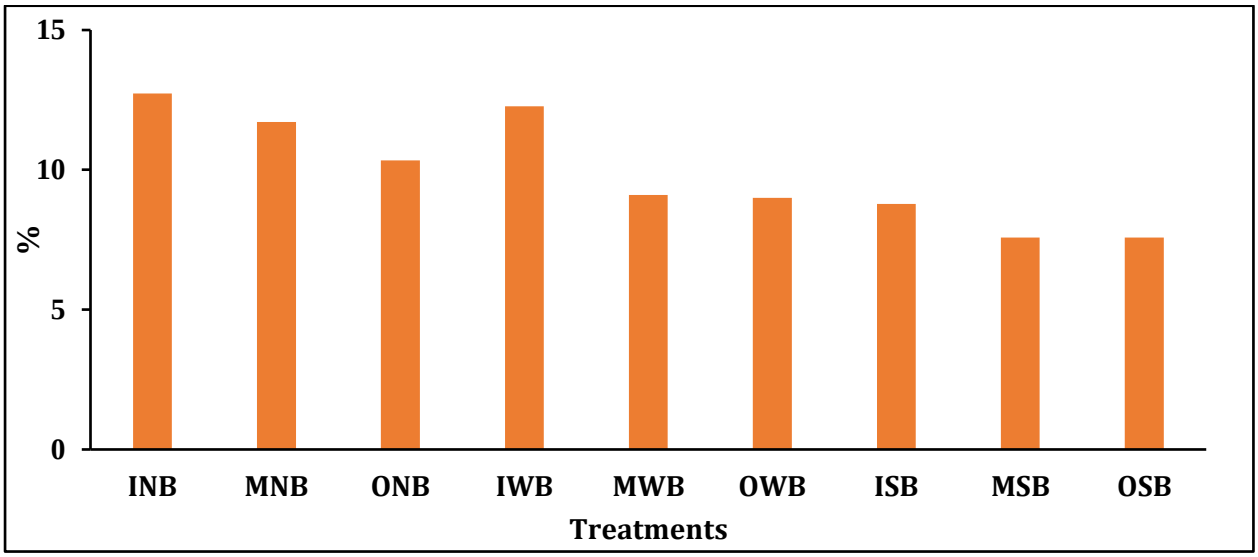

Figure 2: Percentage retention of vitamin C in *S. villosum*

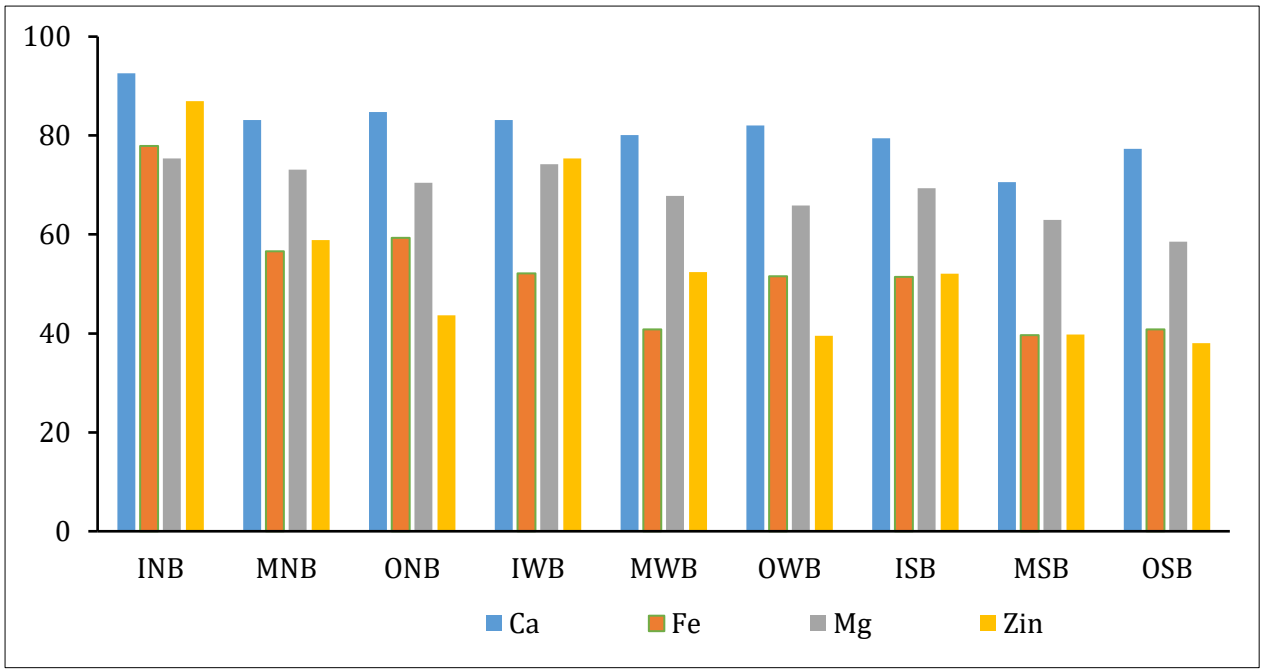

Figure 3: Percentage retention of minerals in *S. scabrum*

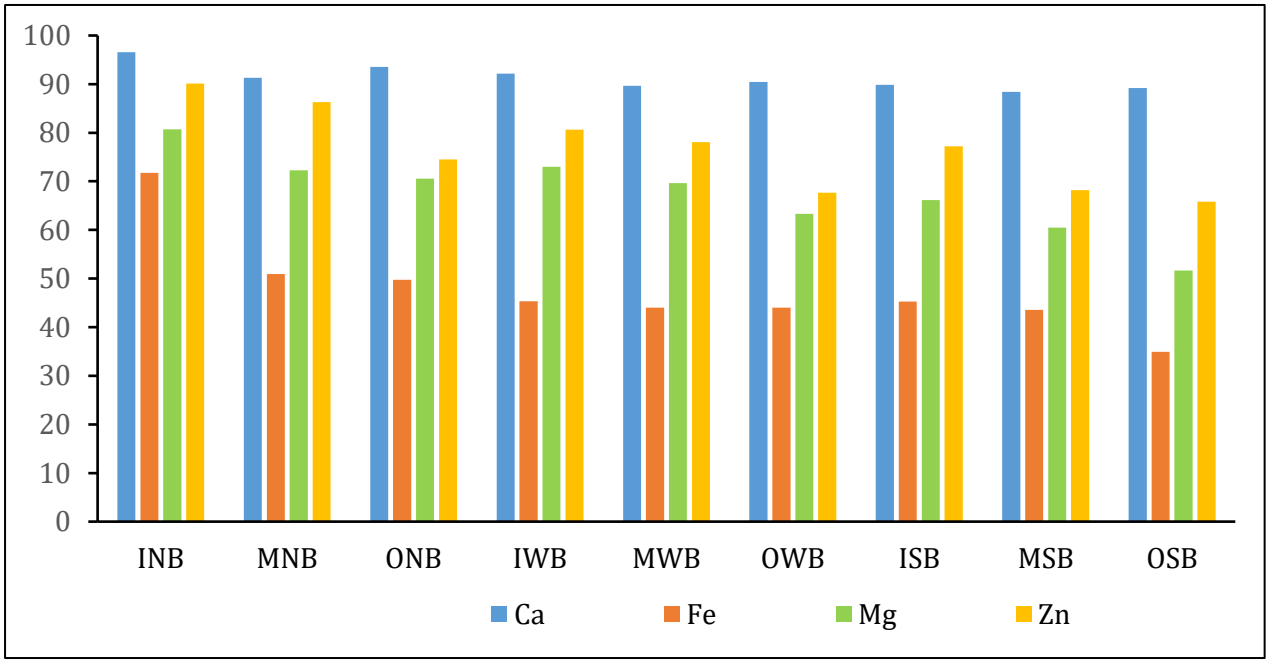

Figure 4: Percentage retention of minerals in *S. villosum*

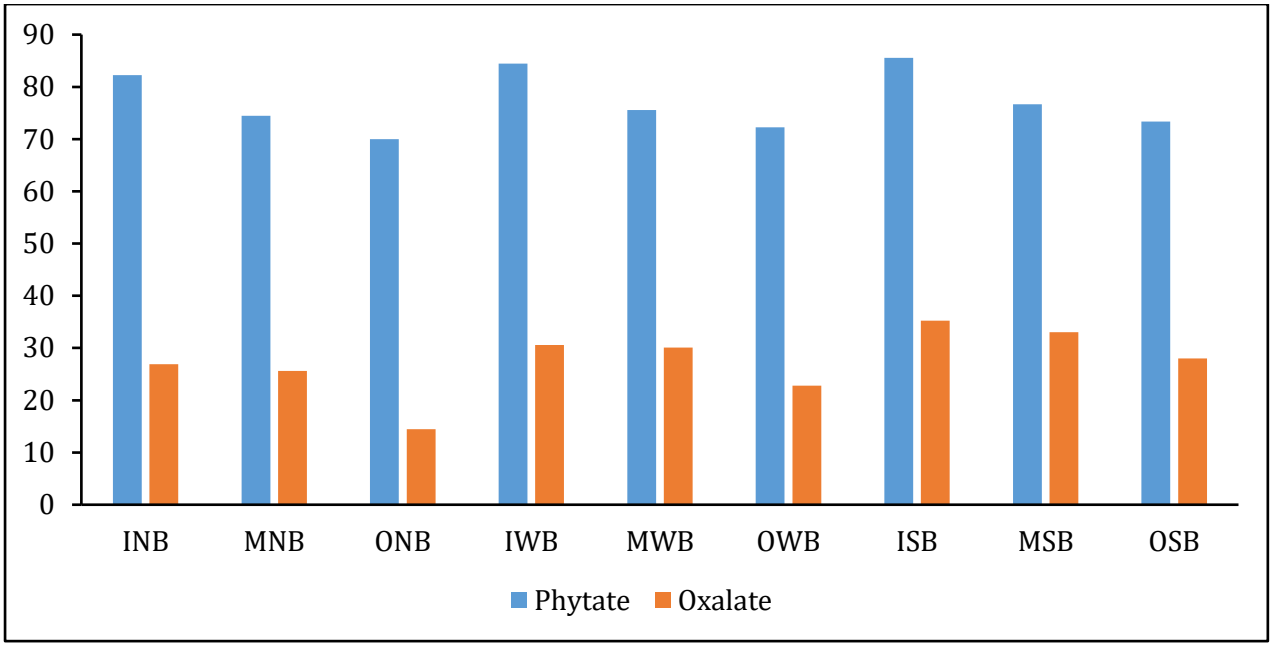

Figure 5: **Percentage retention of anti-nutrients (Oxalate and Phytate) in *S. scabrum***

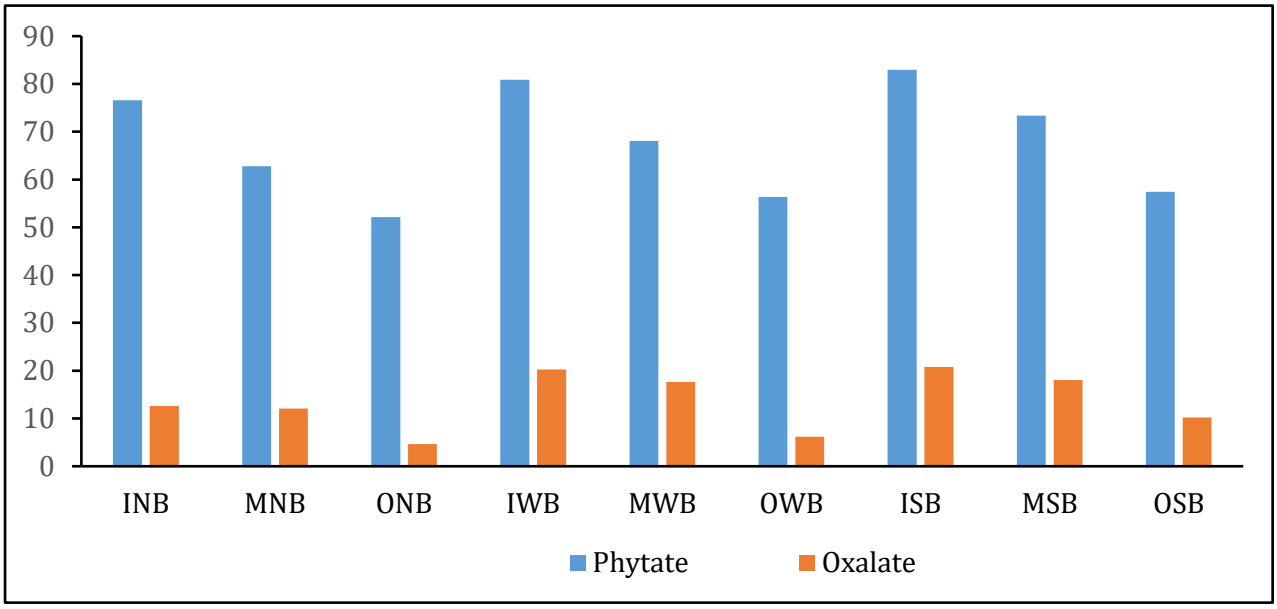

Figure 6: Percentage retention of anti-nutrients (Oxalate and Phytate) in *S. villosum*

Key:

- ❑ Indirect solar drying technique (INB-Non blanched; IWB-Water blanched; ISB-Salt blanched)
- ❑ Mixed solar drying technique (MNB-Non blanched; MWB- Water blanched; MSB- Salt blanched)
- ❑ Open sun drying techniques (ONB-Non blanched; OWB-Water blanched; OSB- Salt blanched)

Discussion

- Two ANS species, *Solanum scabrum*, and *Solanum villosum* were dried using open sun, mixed solar dryer, and indirect solar dryer.
- The study found higher mineral content, especially calcium, iron, magnesium, and zinc, in raw and dried ANS.
- Indirect solar drying technique (ISDT) retained higher content of minerals compared to other techniques.
- Drying techniques significantly reduce vitamin C, although higher vitamin C retention was observed using the indirect solar drying technique.
- Higher retention of Vitamin C in ISDT is attributed to low drying temperature and less penetration of sunlight.
- Blanching was observed to have a significant reduction of vitamin C and minerals
- ISDT reduced significantly amount of anti-nutritional factors such as oxalate and Phytate.
- Together with this, blanching without or with NaCl followed by indirect solar drying have resulted into best effective method of reduction of oxalate and Phytate in SS and SV species. This agreed to other studies which reported that blanching have an effect on reduction of anti-nutritional factors in vegetables (Elisha *et al.*, 2016; Ilelaboye *et al.*, 2013; Natesh *et al.*, 2017).

CONCLUSION AND FUTURE PLAN

Comparing to other drying methods used, indirect solar drying method was observed to the best drying technique for preserving ANS. The finding in this study will be disseminated to households, women groups and small-scale farmers. Consequently, the study is anticipated to improve food and nutrition security.

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