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Nutritional characterization of traditional preserved cowpea leaves consumed in coastal drylands of Kenya

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Abstract

Consumption of African leafy vegetables such as cowpea leaves is high among communities in the arid and semi-arid lands in sub-Saharan Africa. However, seasonal availability of these vegetables has often limited their utilization. The utilization of the preserved forms of the leaves seeks to enhance their availability among households. This study sought to characterize the nutritional quality of the traditional preserved forms of cowpea leaves consumed and utilized in the arid and semi-arid lands of the coastal region of Kenya. Twenty samples of the preserved forms of cowpea leaves were obtained from farmer groups in Taita Taveta County. Similar forms of preserved leaves from the same group were mixed and homogenized; twelve samples were then subjected to nutritional analysis. Drying induced significant ($p<0.05$) in moisture and beta-carotene contents whereas blanching resulted into significantly ($p<0.05$) lower protein contents. Zinc, iron and calcium contents of preserved leaves had no significant ($p>0.05$) difference compared to that in fresh forms. Maximum variability (100%) in the data was explained by nine principal components with ash, protein and fibre on one having a similar trend of deterioration on one hand and moisture and beta carotene showing a similar trend too. As much as the preservation techniques induced nutrient deterioration in the vegetables, the techniques still helped avail the key nutrients in cowpea leaves: protein, zinc, iron and beta carotene. Promotion of traditional dehydration technique for alleviation of seasonal availability of the vegetables can therefore not be ruled out as cost-effective strategies of addressing food and nutrition security in the arid and semi-arid lands.

Introduction

The vast utilization of cowpea leaves in sub-Saharan Africa (SSA) for food and nutrition security has been adduced to its rich nutritional composition and its thriving in a variety of agro-ecological zones. In Kenya, the coastal areas are among the regions with the highest production and consumption of the vegetable (Owade et al., 2019). However, seasonal availability of the crop often constrain its extended utilization in households. Communities in the coastal arid and semi-arid areas of Kenya of the country often incorporate traditional preservation techniques in order to enhance their utilization of the vegetable (Owade et al., 2020). Traditional preservation of the vegetables range from sun-drying techniques, hurdle technology of blanching or cooking and drying and fermentation (Muchoki, 2007). Therefore, it is not sufficient enough to be dismissive of these technologies as less efficient ways of availing the vegetables for consumption despite the limited practice among communities. Moreover, every potential avenue is explored to enhance the availability of the vegetables in food and nutrition initiative in SSA, thus it is important to evaluate the traditional preserved cowpea leaves as source of nutrition for these communities. For these practices to be promoted in other communities of similar socio-economic settings, it would be important to evaluate the products for their adequacy in ensuring food and nutrition security and promote adequacy. The current study sought to characterize the nutritional quality of traditional preserved cowpea leaves that are consumed in the arid and semi-arid lands of the coastal region of Kenya.

Materials and methods

The study was conducted in the coastal drylands of Mwatate and Wundanyi Sub-Counties in Taita Taveta County, Kenya (Figure 1). A total of 20 samples of preserved forms of cowpea leaves were collected from four farmer groups that were exhaustively sampled across the study area. Samples that were preserved using similar techniques and were from the same farmer groups, were homogenized resulting in 12 samples. The samples were then analyzed for proximate composition and beta-carotene content as per the AOAC procedures (AOAC, 2005). Statistical techniques used were analysis of variance (ANOVA) and Tukey's Honest Significant Difference (HSD) in analysis of the nutrition composition of the samples. Data exploration was effected using the principal component analysis (PCA) to establish similarity in trends in the nutritional composition.

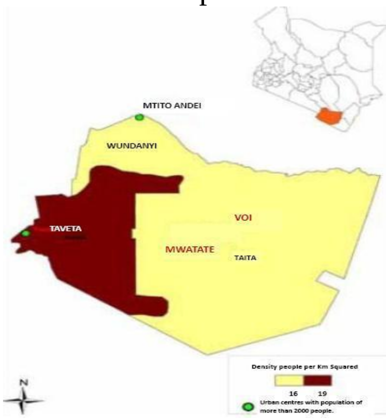

Figure 1: Study Area, Taita Taveta County, Kenya

Results and Discussion

Drying significantly ($p<0.05$) affected the moisture content whereas the fibre and carbohydrate contents had no significant ($p>0.05$) change (Table 1). Moisture content of the vegetables significantly ($p<001$) reduced with drying. Blanching on the other hand, significantly ($p<0.05$) reduced the protein content of the vegetables. In his study, Kirakou et al. (2017) found similar results whereby blanching induced further deterioration in the protein content. Thermal denaturation of the protein during the blanching process explains the resulting lower contents in blanched cowpea leaves (Xiao et al., 2017). Additional deterioration was noted in the bet-carotene content (Table 2). Sundrying without blanching had the highest effect in diminishing the beta-carotene content of the preserved products. This is as a result of both photo-oxidation and thermal degradation that converts the all Trans form of beta-carotene into Cis form with lower vitamin A activity (Ndawula et al., 2004).

Maximal variability (100%) in the nutrition composition of the preserved cowpea leaves was explained by nine principal components. The deterioration of ash, protein and fibre contents was similar whereas on the other hand, beta carotene and moisture deterioration was also similar. With decreasing moisture, drying kinetics have established that beta carotene available for degradation is increases thus this explains the similarity in the trend of the decline (Timoumi et al., 2019).

Table 1: Proximate composition of traditional preserved forms of cowpea leaves consumed in coastal drylands

Processing technique	Moisture (%) **	Protein (%)*	Fat (%)*	Fibre (%)*	Carbohydrates (%)*	Ash (%)*	Energy values (Kcal)**
S1	87.3±3.4^{a}	32.4±3.4^{ab}	1.7±0.1^{a}	19.1±1.1^{a}	35.3±2.1^{a}	11.5±0.7^{a}	286.2±4.0^{b}
S2	15.1±0.0^{b}	28.3±1.3^{c}	4.8±0.3^{a}	19.1±1.1^{a}	36.1±0.1^{a}	10.7±0.8^{b}	301.7±3.1^{ab}
S3	14.5±0.0^{b}	37.8±1.8^{a}	0.2±0.0^{b}	19.5±1.1^{a}	29.5±0.6^{a}	12.9±0.7^{a}	271.2±4.6^{b}
S4	12.6±1.2^{c}	30.8±5.1^{b}	1.9±0.4^{a}	16.1±3.1^{a}	40.4±8.4^{a}	11.5±0.7^{a}	302.1±12.3^{a}
%CV	109.1	15.3	104.6	15.5	19.3	8.0	5.1

*significant at p<0.05. **significant at p<0.01. The values are mean ± sd of duplicates. Values with different letters in the superscript are statistically different. S1-Fresh leaves, S2 Blanched sundried, S3- Unblanched shadow drying and S4-Unblanched sundried.

Table 2: Micronutrient composition preserved forms of cowpea leaves consumed in coastal drylands

Processing technique	Iron (mg)*	Zinc (mg)*	Calcium (mg)*	Beta carotene (mg)**
Fresh leaves	0.32±0.03^{a}	0.12±0.06^{a}	1.57±0.10^{a}	22.62±14.63^{a}
Blanched sundried	0.33±0.13^{a}	0.09±0.04^{a}	1.59±0.10^{a}	0.54±0.03^{c}
Unblanched shadow drying	0.38±0.03^{a}	0.08±0.03^{a}	1.37±0.35^{a}	2.60±0.21^{b}
Unblanched sundried	0.33±0.07^{a}	0.10±0.04^{a}	1.44±0.24^{a}	0.40±0.10^{c}
%CV	21,5	43.6	15.5	219.4

*significant at p<0.05. **significant at p<0.01. The values are mean ± sd of duplicates. Values with different letters in the superscript are statistically different.

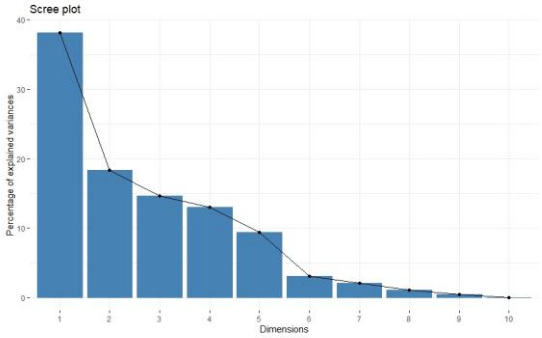

Figure 2: Principal components explaining variability in nutrient composition of traditional preserved cowpea leaves

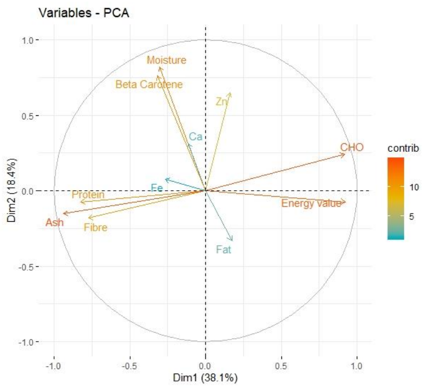

Figure 3: Principal component analysis of deterioration in nutrients in traditional preserved cowpea leaves

Conclusion

As much as the preservation techniques induced nutrient deterioration in the vegetables, the techniques still helped avail the key nutrients in cowpea leaves: protein, zinc, iron and beta carotene. In promoting food and nutrition security in the malnutrition hotspots the preserved forms of the vegetables can thus be used as alternative to the fresh in order to overcome the challenges of seasonality in availability.

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