EFFECT OF PRETREATMENTS AND DRYING ON BETA CAROTENE CONTENT OF ORANGE FLESHED SWEET POTATO TUBERS AND COWPEA LEAVES USED IN MASWA DISTRICT, TANZANIA.

Christerbel Nicanuru
M Sc. Food Science and Technology.

Supervisors:
Dr. D. N Sila (JKUAT)
Prof H. S Laswai (SUA)
Content

- Introduction
- Problem statement
- Justification
- Objective
- Hypothesis
- Methodology
- Results
- Conclusion and commendation.
Introduction

- Food preservation can reduce wastage of a harvest surplus.
- Food preservation include: canning, freezing, pickling, curing and drying.
- Drying is the commonly method used for food preservation.
- Sweet potato (*Ipomea batatas* (L.) Lam.) is a very important crop in the developing world.
- Sweet potato is among seven crops in the world, produce over 105 hundred million metric tonnes of edible food products annually (FAO 2011).
Introduction …

- In Tanzania average yield of sweet potatoes is approximately 5-6 metric tons per hectare on dry weight basis.
- It is mainly produced in Shinyanga, Mara, Mwanza, Kagera, Kigoma, Tabora, Morogoro, Mbeya and Geita.
- They are rich in starch, sugars, minerals and vitamins.
- The flesh can be white, cream, yellow, orange, or purple.
- In Tanzania roots are sliced fresh (*michembe*) or after boiling (*matobolwa*) before drying.
Introduction …

- OFSP is among food-based approaches to tackle vitamin A deficiency.
- Small quantity of OFSP contain 300 to over 3,000 μg retinol equivalent per 100g fresh weight which can provide the recommended daily allowances (RDA).
Cowpea (*Vigna unguiculata* L. Walp), are widely grown and consumed as a basic diet in African region.

Worldwide, area of production of cowpeas is approximately 10.1 million hectares and grain production is approximately 4.99 million tonnes.

Area of production of cowpeas in Tanzania is approximately 1.11 million ha and grain yield is approximately 0.67 tonnes per ha.

Both leaves and grains are the final important products.

Leaves of cowpea are the source of carbohydrates, proteins, fats, minerals, ß-carotene, and vitamins B and C, which are necessary for maintaining good health.

Cowpea leaves are among food based approach to tackle vitamin A deficiency.
Problem statement

- Vitamin A deficiency (children under five (33%), pregnant women and lactating women (37%).
- Postharvest loses caused by perishability (50%) and
- lack of processing technology.
Justification

- The three most common strategies for addressing VAD in Tanzania are:
  - Large scale vitamin A supplementation programmes,
  - Food fortification with vitamin A, and
  - Food-based approaches that encourage diet diversification and promote consumption of vitamin A rich foods.
- Orange fleshe sweet potato and cowpea leaves are important sources of beta carotene can be used to address VAD under a food-based intervention.
- This study will serve as guide for promoting the consumption and market opportunities for dried OFSP and cowpea leaves and in turn will enhance food security in the country.
Objectives

Main objective

• To assess the nutrient content of sun-dried orange fleshy sweet potato tubers and cow pea leaves used in Maswa District, Tanzania.
Specific objectives

- To determine beta carotene content of fresh and dried orange fleshed sweet potato tubers and cowpea leaves.

- To determine the effect of storage on beta carotene of dried orange fleshed sweet potato tubers and cowpea leaves (6 months).
Hypothesis

- Baseline information on orange fleshed sweet potato and cowpea production, processing and utilization varies regionally in Tanzania.
- The β-carotene content content of fresh and dried orange fleshed sweet potato chips and cowpea leaves is not similar.
- The beta carotene content of dried orange fleshed sweet potato chips and cowpea leaves after six months storage is not similar.
Methodology

- Baseline survey was done using questionnaire.
- N=100
- Information collected were on:
  - production,
  - processing and
  - storage of sweet potato and cowpea leaves
Methodology...

- Sweet potatoes were randomly collected from Ukiliguru Research Centre (Mwanza).
- The sample size was 25 kg per variety of sweet potato.
- Fresh roots were arranged in a line and after five roots the root was picked.
- The picked roots were peeled, quartered and two opposite sections were combined and blended to a fine pulp.
- Fresh cowpea leaves were purchased at Mawenzi market,
- Cowpea leaves were picked randomly to obtain the sample for analysis of beta carotene, proximate and mineral content.
- The remaining cowpea leaves were divided into two portion, one portion was blanched and another portion was boiled.
Cowpea leaves
(sorted and washed)

Blanched sun dried
Blanched solar dried
Boiled sun dried
Boiled solar dried
Fresh samples

Laboratory analysis

Beta carotene
• Zero month storage
• 3 month storage
• 6 month storage
Sweet potato

- Sliced sun dried
- Sliced blanched solar dried
- Boiled, sliced sun dried
- Boiled, sliced solar dried
- Fresh samples

Laboratory analysis

Beta carotene
- Zero month storage
- 3 month storage
- 6 month storage
Results
OFSP: Baseline survey

- Both white and orange fleshed sweet potatoes are cultivated and dried.
- 47% of the respondents dried *michembe* and 46% both *michembe* and *matobolwa*.
- Respondents use different drying material: 49% bare ground, 30% materials like iron sheet and roof tops, 17% mat and 4% synthetic sacks.
Baseline survey cont...

- only 5% used sweet potato chips to make baked products.
- Insecticides used to preserve other crops like maize are also used in michembe to prolong shelf life.
- 64% of the respondents stored the dried products in hessian bags, 32% in sacks and 4% on the floor (bare soil).
Beta carotene content

- There was a significant difference between fresh and dried samples.
- Fresh samples ranged between 24.2 and 73.9mg/100g and dried samples ranged from 8.2 to 59.8mg/100g on DMB.
- Pretreatment conditions resulted in reduction in beta carotene content in all cases.
- Considering the fresh samples, Jewel had the highest β-carotene content, 2-3 fold higher than any of the other varieties.
- Of all the samples, michembe showed the lowest β-carotene content.
Beta carotene content...

- Blanching resulted retention of β-carotene in Kabode (92%), Jewel (71%), Ejumula (67%) and Karoti dar (62).
- Retention of β-carotene in *michembe* was different in OFSP variety; Ejumula (58%), Jewel (54%), Karoti dar (46) and Kabode (34%)
- Solar dried *matobolwa* were observed to retain more beta carotene compared to sun dried *matobolwa* in all varieties studied.
Beta carotene content of orange fleshed sweet potato varieties in mg/100g in fwb

<table>
<thead>
<tr>
<th>Variety/Treatment</th>
<th>Jewel</th>
<th>Karoti Dar</th>
<th>Kabode</th>
<th>Ejumula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>73.92±5.84&lt;sup&gt;d&lt;/sup&gt; (100)</td>
<td>32.11±0.52&lt;sup&gt;c&lt;/sup&gt; (100)</td>
<td>24.21±1.52&lt;sup&gt;b&lt;/sup&gt; (100)</td>
<td>31.35±0.07&lt;sup&gt;d&lt;/sup&gt; (100)</td>
</tr>
<tr>
<td>Blanched solar dried</td>
<td>52.38±0.51&lt;sup&gt;b&lt;/sup&gt; (71)</td>
<td>19.77±0.06&lt;sup&gt;b&lt;/sup&gt; (62)</td>
<td>22.37±0.01&lt;sup&gt;b&lt;/sup&gt; (92)</td>
<td>21.02±0.08&lt;sup&gt;b&lt;/sup&gt; (67)</td>
</tr>
<tr>
<td>Matobolwa solar dried</td>
<td>59.77±0.04&lt;sup&gt;c&lt;/sup&gt; (81)</td>
<td>19.20±0.04&lt;sup&gt;b&lt;/sup&gt; (60)</td>
<td>28.03±0.68&lt;sup&gt;c&lt;/sup&gt; (116)</td>
<td>31.51±0.47&lt;sup&gt;d&lt;/sup&gt; (101)</td>
</tr>
<tr>
<td>Matobolwa sun dried</td>
<td>59.60±0.05&lt;sup&gt;c&lt;/sup&gt; (81)</td>
<td>18.42±0.55&lt;sup&gt;b&lt;/sup&gt; (57)</td>
<td>23.09±0.64&lt;sup&gt;b&lt;/sup&gt; (95)</td>
<td>28.69±0.69&lt;sup&gt;c&lt;/sup&gt; (92)</td>
</tr>
<tr>
<td>Michembe</td>
<td>39.88±0.99&lt;sup&gt;a&lt;/sup&gt; (54)</td>
<td>14.78±1.58&lt;sup&gt;a&lt;/sup&gt; (46)</td>
<td>8.21±0.52&lt;sup&gt;a&lt;/sup&gt; (34)</td>
<td>18.07±0.75&lt;sup&gt;a&lt;/sup&gt; (58)</td>
</tr>
</tbody>
</table>

Values are means ± SD. Means in the same column bearing different superscripts are significantly different (p<0.05). Values in brackets are percentage retentions.
Effect of storage on beta carotene

- All varieties studied indicated that there was a significant difference (P<0.05) between zero, three and six month’s storage..
- The highest retention was observed in *matobolwa* while the lowest was observed in *michembe*.
- After four months of storage through physical assessment; *michembe* were infested by pest (whereby small holes were observed on the chips and powdery).
- Beta carotene levels ranged between 1.02 and 7.59mg/100g on DMB after six months storage.
Percentage retention of beta carotene after six months storage

- **Average of % retention** (0)
- **Average of % retention** (3)
- **Average of % retention** (6)
Baseline survey: cowpea leaves

- Local varieties are cultivated
- Large percent (41%) consumed both leaves and dried grains.
- All respondent dried the cowpea leaves and 83% did not wash these leaves before drying.
- Rocks (matale) are mainly used for drying.
- Leaves are picked, dried for a short time to wilt, moulded into small balls and boiled with salt or sodium bicarbonate.
# Beta carotene content of cowpea leaves

<table>
<thead>
<tr>
<th>Treatment</th>
<th>0 month</th>
<th>3 months</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>147.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CWBSO</td>
<td>139.98±7.90&lt;sup&gt;b&lt;/sup&gt;</td>
<td>116.19±9.71&lt;sup&gt;a&lt;/sup&gt;</td>
<td>99.04±1.05&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>CWBSU</td>
<td>129.30±4.72&lt;sup&gt;b&lt;/sup&gt;</td>
<td>118.81±6.44&lt;sup&gt;b&lt;/sup&gt;</td>
<td>76.61±3.05&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>CWCSO</td>
<td>117.75±0.03&lt;sup&gt;b&lt;/sup&gt;</td>
<td>108.81±6.19&lt;sup&gt;b&lt;/sup&gt;</td>
<td>78.40±1.48&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>CWCSU</td>
<td>94.04±1.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>93.12±2.091&lt;sup&gt;b&lt;/sup&gt;</td>
<td>80.16±3.76&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Beta carotene retention of cowpea leaves after six month retention

<table>
<thead>
<tr>
<th>Treatments subjected</th>
<th>0months storage</th>
<th>3months storage</th>
<th>6months storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blanched solardried</td>
<td>100</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>Blanched sundried</td>
<td>100</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>Cooked solardried</td>
<td>100</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>Cooked sundried</td>
<td>100</td>
<td>80</td>
<td>60</td>
</tr>
</tbody>
</table>
Importance of consuming both orange fleshe sweet potato tubers and cowpea leaves

- From baseline results sweet potato tubers and cowpea leaves are consumed in a combined form.
- Orange fleshe sweet potatoes are low in protein and mineral (calcium and iron) contents while cowpea leaves have high content.
- Therefore, when these two food products are consumed together they provide the body with important required nutrients.
- These emphasizes the role of diet diversification in combating Vitamin A deficiency (VAD), Iron Deficiency Anemia (IDA) and protein energy malnutrition (PEM).
Conclusion: Baseline survey

- Both fresh and dried sweet potato tubers and cowpea leaves are consumed in Maswa district.
- Cowpea leaves are cooked first then sundried to make *shiiri* and blanching was not known to many respondents.
- The health benefits and multipurpose use of orange fleshed sweet potato were not known.
- Both white and orange flesh sweet potato are cultivated together.
Conclusion: Chemical analysis

- Dried sweet potato and cowpea leaves can help fight and prevent Vitamin A deficiency due to its high beta carotene content.
- Among three products studied, *matobolwa* and blanched solar dried chips retained more β-carotene after drying.
- *Michembe* start infested after four months of storage and its percentage loss of beta carotene on storage was high.
- Blanched solar dried chips, *matobolwa* and dried cowpea leaves can stay longer than six months at room temperature.
Recommendation

- Blanched solar dried should be adopted in the place of *michembe* because blanched solar dried chips retain more beta carotene, have longer shelf life and the technology is simple to be implemented by farmers.

- More studies should be conducted to determine optimum blanching time and temperature for more vitamin retention and optimum microbial level of the dried chips and cowpea leaves.
Recommendation …

- Education should be provided to farmers on nutritional benefits of orange fleshy sweet potato and cowpea leaves.
- Multipurpose use of dried chips should be introduced to farmers, including baked products and porridge.
ACKNOWLEDGEMENT

- iAGRI (Through USAID) for funding my studies
- My supervisors:
  - Dr. D. N Sila (JKUAT)
  - Prof H. S Laswai (SUA)
- Dean office (JKUAT)
- Food science department (SUA)
Thank you for listening