Development of Maize Based Orange – Fleshed Sweet Potato Flat Bread for Lactating Mothers at Hawassa Zuria Woreda, SNNPRS, Ethiopia

Conference place Desalegn Hotel
By: MENEN ZEGEYE
Content

- Introduction
- Objectives
- Materials and Methods
- Result and Discussions
- Conclusion and Recommendations
- Acknowledgement
Introduction

• Vitamin A deficiency (VAD) remains an important public health problem in Ethiopia just as in other developing countries (Assefa et al., 2007)

• In Ethiopia a study had indicated that national prevalence rate for night blindness among mothers were 1.8 % (Tsegaye et al., 2010)

• In SNNPR 2.6 % of mothers were suffered from night blindness (CSA, 2006)

  – The sub clinical VAD was 27.9 % (Jemal et al., 2008)
Introduction Cont’d…

• The main strategies which have been adopted globally to control and eliminate vitamin A deficiency (MOH, 2004)
  – Dietary diversification
  – Food fortification and,
  – Supplementation
Laboratory studies have proved that the daily addition of 100 g of OFSP to the diet can prevent vitamin A deficiency in children and reduce maternal mortality (CIP, 2007)
Objectives

• General Objective
  – To assess consumption of vitamin A rich foods, develop maize based OFSP incorporated flat bread and its acceptability for lactating mothers.
• Specific Objectives
  – To assess the consumption of vitamin A rich foods by lactating mothers in the study area.
  – To develop maize based OFSP incorporated flat breads for lactating mothers in the study area.
– To assess the sensory acceptability of OFSP incorporated maize based flat breads.

– To assess the nutritive quality of OFSP incorporated maize based flat breads.
Materials and Methods

Part I: Cross-sectional study

• Study area
  – Hawassa Zuria Woreda 21.6 km far from Hawassa

• Study period
  – March 7 - 28, 2011

• Study design
  – Community based cross-sectional survey
Materials and Methods Cont’d...

• Sample size
  It is determined to be 565 by the following formula;
  $$n = \frac{(Z_{1-\alpha/2})^2 \cdot P \cdot (1-P)}{d^2}$$

where;
  n= sample size,
  Z= confidence interval (1.96)
  P= prevalence = 0.5 and
  d= margin of error
  D=DE=1.5
  Contingency=5 %
Materials and Methods Cont’d...

- **Sampling technique**
  - A two stage cluster sampling technique was used

- **Data Collection instrument**
  - Pre tested questionnaire was used

- **Data collectors**
  - Six data collectors were selected and trained to collect data
Materials and Methods Cont’d…

• Quality Control for questionnaire
  – Training was given for 4 consecutive days
  – Data collection was supervised
  – Data were checked for completeness

• Data Analysis
  – SPSS version 16 software was used
Materials and Methods Cont’d…

Part II: Experimental study

• Study period
  – Laboratory and community level sensory evaluations were done from May 10-12, 2011 and from June 29-July 1, 2011, respectively. Nutrient analysis was from November 21-25, 2011

• Study design
  – Experimental study design was used

• Sample selection
  – *Tula* variety of OFSP (*Ipomoea batatas* L.) and maize grain (*Zea mays* L.) was used
Preparation of OFSP flour

Fresh sweet potato roots → Trimming → Washing → Pre-drying

Drying ← Soaking ← Slicing ← Peeling

Sorting → Milling → Sweet potato flour → Packing and Storing

Figure 1. Flow chart of flour preparation from orange fleshed sweet potato (Oworri and Hagenimana, 2004)
Preparation of Maize flour

1. Maize grains
2. Sorting/grading
3. Milling
4. Maize flour
5. Packing and Storing

Figure 2. Flow chart of flour preparation from maize grains
Materials and Methods Cont’d…

Table 1. Proportion of maize-OFSP composite flour

<table>
<thead>
<tr>
<th>Samples code</th>
<th>Maize Flour</th>
<th>OFSP Flour</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 120 (Control)</td>
<td>100 %</td>
<td>0 %</td>
</tr>
<tr>
<td>S 168</td>
<td>75 %</td>
<td>25 %</td>
</tr>
<tr>
<td>S 175</td>
<td>70 %</td>
<td>30 %</td>
</tr>
<tr>
<td>S 254</td>
<td>65 %</td>
<td>35 %</td>
</tr>
</tbody>
</table>
Materials and Methods Cont’d…

- Pictures of four flat bread samples
Materials and Methods Cont’d…

Sensory evaluation

Laboratory level
• 15 panelists were involved
• 9-point hedonic scale was used (Amerine et al., 1996)

Community level
• 50 lactating mothers were involved
• 5-point hedonic scale was used (Stone and Sidel, 1993)

Figure 3. Summery on the sensory evaluation process
Materials and Methods Cont’d…

• Nutrient analysis
  – Proximate composition and β- carotene were analyzed for all samples in duplicate.

  – Moisture, crude protein, crude fat, crude fiber and total ash content were determined by using AOAC (2000) method.

  – The β- carotene content was determined by open column chromatography method (Rodriguez et al., 1988)
Materials and Methods Cont’d…

• Statistical analysis
  – Descriptive data was compiled using SPSS software program version 16
  – A one-way analysis of variance (ANOVA) was used
  – p values less than 0.05 were reported as statistically significant
  – Results were calculated as mean and standard deviations of scores
Result and Discussions

Part I: Cross-sectional study

• The common food types reported to have been consumed by the lactating mothers comprised:
  – maize-based flat bread (77.5%)
  – enset-based foods (51.3%)
Result and Discussions Cont’d…

Table 2. Consumption of vitamin A rich foods by lactating mothers in the past 24 hrs preceding the survey in the study area, 2011 ( N= 565)

<table>
<thead>
<tr>
<th>Vitamin A rich food sources</th>
<th>Frequency ( N= 565)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>528</td>
<td>93.5</td>
</tr>
<tr>
<td>No</td>
<td>37</td>
<td>6.5</td>
</tr>
<tr>
<td>Animal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>275</td>
<td>48.7</td>
</tr>
<tr>
<td>No</td>
<td>290</td>
<td>51.3</td>
</tr>
<tr>
<td>Animal or plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>533</td>
<td>94.3</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>5.7</td>
</tr>
</tbody>
</table>
- 70 – 80% of the entire dietary vitamin A intake in developing countries is from vegetables and fruits (McLaren and Frigg, 2001)

- The consumption of vitamin A rich foods in SNNPR was found to be 61.2 % (CSA, 2006)
Figure 4. Proportion of lactating mothers who consumed vitamin A rich foods in the past 7 days preceding the survey in the study area, 2011 (N=565)
Result and Discussions Cont’d…
Part II: Experimental study

Table 3. Sensory score of OFSP incorporated and traditional maize-based flat breads by panelists at laboratory level (Mean ± SD)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Color</th>
<th>Flavor</th>
<th>Appearance</th>
<th>Texture</th>
<th>Taste</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>7.04 ±1.55&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.71 ± 1.71&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.56 ± 1.58&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.71 ± 1.42&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.42 ± 1.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.96 ± 1.19&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>168</td>
<td>7.09 ± 1.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.27 ± 1.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.64 ± 1.61&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>6.58 ± 1.98&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.07 ± 1.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.31 ± 1.31&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>175</td>
<td>7.24 ± 1.46&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13 ± 1.46&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.51 ± 1.36&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.58 ± 1.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.24 ± 1.55&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.18 ± 1.60&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>254</td>
<td>6.40 ± 1.99&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.73 ± 1.70&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.02 ± 2.16&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.76 ± 1.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.84 ± 1.82&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.36 ± 2.08&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Control (120) = Maize: OFSP (100%:0%)
Sample 168 = Maize: OFSP (75%:25%)
Sample 175 = Maize: OFSP (70%:30%)
Sample 254 = Maize: OFSP (65%:35%)

Values with different superscripts in the same column are significantly different at p< 0.05
**Table 4. Score of acceptability trial of OFSP incorporated and traditional maize-based flat breads by lactating mothers (Mean ± SD)**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Color</th>
<th>Appearance</th>
<th>Flavor</th>
<th>Taste</th>
<th>Texture</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>4.36 ± 0.53&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.20 ± 0.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.12 ± 0.48&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.40 ± 0.70&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.78 ± 0.68&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.26 ± 0.49&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>168</td>
<td>4.06 ± 0.55&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.08 ± 0.53&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.12 ± 0.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.50 ± 0.61&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.82 ± 0.63&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.38 ± 0.49&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>175</td>
<td>4.04 ± 0.49&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.94 ± 0.51&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.16 ± 0.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.44 ± 0.54&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.74 ± 0.57&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.28 ± 0.54&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>254</td>
<td>3.78 ± 0.62&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.92 ± 0.53&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.04 ± 0.57&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.50 ± 0.51&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.74 ± 0.66&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.22 ± 0.65&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Control (120) = Maize: OFSP (100%:0%)
Sample 168 = Maize: OFSP (75%:25%)
Sample 175 = Maize: OFSP (70%:30%)
Sample 254 = Maize: OFSP (65%:35%)

Values with different superscripts in the same column are significantly different at p< 0.05
– A study done in Central Mozambique found Golden bread superior to that of the white bread (Low and Van Jaarsveld, 2008)

- Another study done in Uganda, showed that bread, chapattis and mandazis prepared from sweet potato were preferred by consumer (Hagenimana and Owori,1996)
### Table 5. Proximate composition of OFSP incorporated and traditional maize–based flat breads on dry weight basis (Mean ± SD)

<table>
<thead>
<tr>
<th>Composition (%)</th>
<th>Control (120)</th>
<th>168</th>
<th>175</th>
<th>254</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>7.50 ± 0.02^a</td>
<td>5.80 ± 0.28^b</td>
<td>5.28 ± 0.02^c</td>
<td>5.71 ± 0.01^b</td>
</tr>
<tr>
<td>Crude protein</td>
<td>3.53 ± 0.15^b</td>
<td>5.42 ± 0.05^a</td>
<td>5.53 ± 0.03^a</td>
<td>4.99 ± 0.46^a</td>
</tr>
<tr>
<td>Crude fat</td>
<td>6.92 ± 0.03^a</td>
<td>5.12 ± 0.02^c</td>
<td>4.80 ± 0.03^d</td>
<td>5.76 ± 0.03^b</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>1.91 ± 0.19^b</td>
<td>2.90 ± 0.13^a</td>
<td>3.18 ± 0.04^a</td>
<td>3.12 ± 0.33^a</td>
</tr>
<tr>
<td>Crude Ash</td>
<td>1.77 ± 0.01^d</td>
<td>3.21 ± 0.02^c</td>
<td>3.40 ± 0.02^b</td>
<td>3.72 ± 0.00^a</td>
</tr>
<tr>
<td>Total carbohydrate</td>
<td>80.29 ± 0.09^b</td>
<td>80.46 ± 0.19^ab</td>
<td>81.00 ± 0.05^a</td>
<td>79.82 ± 0.41^b</td>
</tr>
<tr>
<td>Total energy Kcal</td>
<td>397.54 ± 0.00^a</td>
<td>389.52 ± 1.16^bc</td>
<td>389.32 ± 0.03^c</td>
<td>391.07 ± 0.05^b</td>
</tr>
</tbody>
</table>

Values with different superscripts in the same row are significantly different at p < 0.05
Result and Discussions Cont’d...

Figure 5. Mean value of vitamin A (µg RAE per 100 gm) of OFSP incorporated and traditional maize based flat breads

RAE *- Retinol Activity Equivalent
Result and Discussions Cont’d…

- **Table 6. Amount of flat bread samples (as served) needed to meet the RDA (1300 µg RAE )**

<table>
<thead>
<tr>
<th>Sample code</th>
<th>Vitamin A (µg RAE per 100gm)</th>
<th>% contributed by 100 gm of flat bread for RDA</th>
<th>Total number of flat breads (per 100 gm) required to meet the RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>0</td>
<td>0 %</td>
<td>-</td>
</tr>
<tr>
<td>168</td>
<td>175.8</td>
<td>13.5 %</td>
<td>7.39</td>
</tr>
<tr>
<td>175</td>
<td>197.22</td>
<td>15.2 %</td>
<td>6.59</td>
</tr>
<tr>
<td>254</td>
<td>269.63</td>
<td>20.7 %</td>
<td>4.82</td>
</tr>
</tbody>
</table>
Conclusion and Recommendation

• Consumption of foods rich in vitamin A among lactating mothers was found to be high.

• Maize-based flat breads in which OFSP flour was incorporated at the proportions of 25%, 30% and 35% were acceptable at the laboratory and community level.
Conclusion and Recommendation Cont’d…

• The addition of OFSP improved the vitamin A content (µg RAE) of traditional maize based flat bread.

—Therefore, the formulated flat breads can be used as potential food sources of vitamin A for lactating mothers living in the study area.
Conclusion and Recommendation Cont’d…

• Consumption of OFSP incorporated maize-based flat breads should be promoted in the study area.

• Further studies should be undertaken to assess the possibilities of incorporating OFSP in the staple foods of the communities other than flat bread.

• Availability and consumption of OFSP should be promoted in the study area.
Acknowledgement

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