Nutritional and Sensory Evaluation of EPITI (IKWOKE) Prepared from Maize/Soybean Flour Blends

Akusu, M. O. & Wordu G.O*.

Department of Food Science and Technology
Rivers State University of Science and Technology,
Port Harcourt, Nigeria

*Email: wordugab@yahoo.com

Abstract - Proximate composition, acceptability and nutritional evaluation of epiti prepared from blends of maize/soybean flour in the ratio 100:0 (sample A, control), 80:15 (sample B), 75:25 (sample C), 65:35 (sample D), 50:50 (sample E), 40:60 (sample F) and 30:70 (sample G) respectively were investigated. Protein quality was evaluated by feeding 28 days old weaning albino rats with 10% protein diets formulated with sample A to F, with casein as control diets (sample H). Crude protein, fat and ash content of all maize epiti (sample A) were 7.90%, 14.65% and 1.42% respectively as the level of soybean flour in the blend increased to 70%. Up to 35% of soybean flour in the blend produced acceptable epiti with sensory properties similar to the traditionally prepared epiti. There were no significant (P > 0.05) difference between the values obtained for protein efficiency ratio, net protein ratio and apparent and true digestibility of epiti diet (G) and casein (H) when fed to rats suggesting an improvement in protein quality of epiti prepared from maize/soybean (30:70 w/w) flour blend but epiti was unacceptable.

Key words: Epiti, maize/soybean flour, protein quality, sensory evaluation.

1. Introduction

Maize is the basic staple cereal grain for large groups of people in Latin America, Africa and Asia. Cereal such as maize are known to be deficient in some essential amino acids such as lysine and tryptophane. The maize diet can provide sufficient calories; they themselves cannot provide adequate source of protein for infants (Bressani 1991). The poor consume cereals without any form of supplementation.

The complementary effect of soybean protein to cereal protein is especially significant mainly because of the high lysine content in soybean protein.

Epiti (Ikwoka) is a maize based gel produced by heating slurries containing maize flour, overripe plantain and other minor ingredients, soybean flour is added as a supplement to complement the maize protein epiti is mostly eaten by the middle and lower class in southern Nigeria.

Although the traditional Nigerian epiti which is an all maize base has received less research attention but it is widely consumed. The commercial availability of easily rehydratable maize/soybean flour blends to which water can be added to form a slurry and gel with good performance compared to traditionally processed epiti preparation would greatly reduce preparation time.

However, these flour blends are still not available commercially. The beneficial effects of adding soybean flour to maize flour in epiti preparation cannot be at the expense of sensory quality if the epiri is to be acceptable to the Nigerian consumers.

The aim of this study is to develop maize/soybean flour blends for epiti preparation that will be nutritionally adequate and be acceptable to the Nigerian consumers compared to the traditional epiti prepared from all maize flour.

2. Materials and Methods

2.1. Materials

White maize (Zea mays), soybean (Glycine Max), fresh onion, dried red pepper, salt and red palm oil were purchased from a local market in Port-Harcourt, Nigeria. Weaning albino rats, vitamin and mineral premixes were obtained from the University of Port Harcourt, Nigeria. All reagents used were of analytical grade and were obtained from BDH chemical (Poole, U. K.).

2.2. Methods

a. Preparation of flour samples

Whole-seed samples (21kg each) maize and soybean were separately soaked at room temperature (28 ± 1°C) in tap water at a bean or grain to water ratio of 1:5 for 12h.

The presoaked soybean was then parboiled (100°C/30 mins) and then manually dehaulled.
Maize grain were separately autoclaved (121°C, 1.05 kg cm², 15 min), oven dried (60°C, 24hr) in a hot air fan oven (model QUB 30510G, Gallenkamp, U.K.), ground using a laboratory mill (Numex pep Grinding mill, India) and screened through a 0.25mm British standard sieve (model Bs 410, Endecotts Ltd, U.K. to obtain flour samples.

b. Preparation of EPITI

The preparation of Epiti involved the replacement of part of the maize flour (MF) with 0% (blend A, control), 15% (blend B), 25% (blend C), 36% (blend D), 50% (blend E) 60% (blend F) and 70% (blend G) soybean flour (SF) by gradual mixing of SF into MF in a mixing bowl using a wooden spatula. The recipe (Table 1) was used for the Epiti preparation.

Table 1: EPITI recipe

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize/soybean flour blend</td>
<td>400g</td>
</tr>
<tr>
<td>Overripe plantain</td>
<td>100g</td>
</tr>
<tr>
<td>Palm oil</td>
<td>100ml</td>
</tr>
<tr>
<td>Water</td>
<td>200ml</td>
</tr>
<tr>
<td>Crayfish</td>
<td>30g</td>
</tr>
<tr>
<td>Pepper</td>
<td>20g</td>
</tr>
<tr>
<td>Maggi</td>
<td>10g</td>
</tr>
<tr>
<td>Salt</td>
<td>20g</td>
</tr>
</tbody>
</table>

Four hundred gram of flour blend and he control (A-G) were each mixed with 100ml of red palm oil in a mixing bowl using a wooden paddle to form a smooth paste. Two hundred milliliter (200ml) of water, 100g of overripe plantain, ground pepper, crayfish, maggi and salt were stirred into and ground using a kenwood electric blender (model A 907D) for 2 min at a speed of 5000rpm. Portions (50 ± 1g) of the slurry were measured and wrapped in plantain leaf and boiled for 50 minutes until the paste thickens and form a gel.

The Epiti was divided into two lots; one lot was used for sensory evaluation and the other lot oven dried (70°C, 24h) in a hot-air fan oven and milled to pass through a 0.25mm save flour sieve. The flour samples (A-6) were defatted by solvent extraction in a soxhlet apparatus (Tecator Inc. Colorado, U.S.A.) for 8 hr using n-hexane. Seven experimental diets were prepared by incorporating the defatted flour from the epiti samples (A-6) into the basal diet at the experience of cassava starch such that they

Table 2: Composition of basal diet

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Amounts (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>10</td>
</tr>
<tr>
<td>Corn oil</td>
<td>1</td>
</tr>
<tr>
<td>Salt mixture</td>
<td>5</td>
</tr>
<tr>
<td>Vitamin mixture</td>
<td>1</td>
</tr>
<tr>
<td>Cellulose</td>
<td>1</td>
</tr>
<tr>
<td>Cassava starch</td>
<td>To make up 100</td>
</tr>
</tbody>
</table>

Source: Achinewhu and Isichei (1990)

i. Salt mixture (composition / 100g)
ii. Calcium (0.69); chloride (0.5g)
iii. Copper (1.0mg); iodine (0.2mg)
iv. Phosphorus (0.5g); potassium (0.5g)
v. Sodium (0.5g); zinc (1.8mg)
vi. Vitamins mixture (composition /100g)
vii. Vitamin A (700 iu); vitamin D (30iu)
viii. Vitamin E (6iu); vitamin K (0.29mg)

c. Analysis of Epiti

The crude protein (N x 6.25), moisture ether extract, total ash and crude fibre content of the epiti samples were determined by the ADAC (17) standard methods 2.057, 14.004, 7.062, 14.006 and 7.070 respectively. Carbohydrates was calculated by difference while energy value was calculated using the Atwater factor.

d. Sensory Evaluation

A thirty-member panel consisting of staff and students of the Rivers state university of science & Technology was selected based on experience and familiarity with epiti for sensory evaluation. At each session, 2 wraps of epiti samples per flour blend of similar size were served on plain white sancers coded with 3-digit numbers; fresh water was provided to rinse the mouth between evaluations.

Epiti prepared from maize/soybean flour blends were compared to those from traditional (100% maize flour) and evaluated for firmness, texture, flavour softness and overall acceptability each attribute was rated on a 9-point hedonic scale of 1 to 9 the sensory scores were subjected to statistical analysis (ANOVA).

3. Nutritional Evaluation

The Nutritional value of Epiti prepared from maize/soybean flour blends as well as the control (100% maize flour) was evaluated using a rat bioassay. A basal diet was prepared based on the formulation of Aclinewhu and Isichei (1990). The composition is shown in Table 2. Epiti were oven dried (70°C, 24h) in a hot-air fan oven and milled to pass through a 0.25mm save flour sieves obtained were defatted by solvent extraction in a soxhlet apparatus (Tecator Inc. Colorado, U.S.A.) for 8 hr using n-hexane. Seven experimental diets were prepared by incorporating the defatted flour from the epiti samples (A-6) into the basal diet at the experience of cassava starch such that they
The digestibility study was stated on the 14th day of the PER study and lasted for 7 days. While the net protein ratio (NPR) determination was done on the 10th day of the PER study. Daily records on weight gained, food and protein intake and fecal output by the rats were kept and used in calculating the PER, NPR and apparent and true digestibilities using standard procedure pellet and Young (1980).

### Statistical Analysis

All experimental and analyses where carried out in triplicate and the mean calculated. Data were subjected to analysis of variance (ANOVA) using a general linear model Wahua (1999). If a significant F-test was noted, means were separated using Duncan’s multiple range test Wahua (1999). Significance was accepted at P ≤ 0.05 level.

### Results and Discussion

The proximate composition of epiti prepared from the maize/soybean flour blends are shown in Table 3.

Epiti prepared from 100% maize flour sample A, control had the lowest crude protein content of 7.98% compared to 26% for epiti prepared from maize/soybean flour blend substituted with 70% soybean flour (sample G). This was expected and is in agreement with the report of Akubor and Onimawo (2003) and Akubor (2004).

Table 3 also reveals that as the level of soybean substitution increases in the Epiti, the protein, fat and ash content increases with corresponding decrease in moisture and carbohydrate content. This is also in agreement with the report of Alabi and Anuoye (2007).
Samples were prepared from maize/soybean flour blends as follows A=100:0; B=85:15; C=75:25; D=65:35; E=50:50; F=40:60, G=30:70. abc means with the same superscript within the same column do not differ DMRT (P < 0.05). Sensory characteristics of epiti prepared from maize/soybean flour blends.

Table 4, shows the sensory characteristics of epiti prepared from the traditional all maize flour (sample A, control) and those prepared from maize/soybean flour blends (B-G).

The epiti was evaluated for firmness, texture, flavour, heaviness, smoothness, color and overall acceptability. There were no significance difference (P > 0.05) in preference to the control (sample A) of the epiti prepared from maize/soybean flour blends containing 15% - 35% soybean flour.

The result shows that addition of soybean flour to epiti up to 35 levels had no adverse effect to the above mentioned sensory attributes. This is in agreement with the findings of Alabi and Anuonye (2007).

However, soybean flour substitution in maize/soybean flour blend beyond 35% result in unacceptable epiti when compared with the traditional epiti (100% maize). Akubor and Onimawo (2003) reported acceptability up to 40% level of soybean substitution.

1. Mean hedonic scores or taste panel scores where 9-like extremely; 1=dislike extremely, n=ten assessors, duplicated
2. Prepared from maize: soybean flour as follows = 100:0; B=85:15; C=75:25; D=65:35; E=50:50; F=40:60; G=30:70.

Table 5: Nutritional Parameters of test diets containing epiti or ikwoka prepared from maize/soybean flour blends compared to casein*

<table>
<thead>
<tr>
<th>Nutritional parameter</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food intake (g)</td>
<td>25.50</td>
<td>25.40</td>
<td>28.35</td>
<td>32.90</td>
<td>38.70</td>
<td>42.52</td>
<td>50.68</td>
<td>65.66</td>
</tr>
<tr>
<td>Protein intake (g)</td>
<td>5.06</td>
<td>5.81</td>
<td>6.25</td>
<td>7.00</td>
<td>7.96</td>
<td>8.13</td>
<td>8.35</td>
<td>9.80</td>
</tr>
<tr>
<td>Body weight gain (g)</td>
<td>6.35</td>
<td>7.01</td>
<td>9.21</td>
<td>18.62</td>
<td>15.23</td>
<td>16.72</td>
<td>22.42</td>
<td>30.41</td>
</tr>
<tr>
<td>Protein efficiency ratio</td>
<td>1.25</td>
<td>1.21</td>
<td>1.47</td>
<td>2.60</td>
<td>1.91</td>
<td>2.06</td>
<td>2.69</td>
<td>3.10</td>
</tr>
<tr>
<td>Net protein ratio</td>
<td>1.09</td>
<td>1.12</td>
<td>1.34</td>
<td>2.33</td>
<td>2.50</td>
<td>2.48</td>
<td>2.02</td>
<td>3.60</td>
</tr>
<tr>
<td>Apparent digestibility (%)</td>
<td>45.6</td>
<td>47.39</td>
<td>51.38</td>
<td>58.72</td>
<td>66.33</td>
<td>67.92</td>
<td>66.62</td>
<td>86.32</td>
</tr>
<tr>
<td>True digestibility</td>
<td>54.87</td>
<td>61.69</td>
<td>63.49</td>
<td>70.82</td>
<td>73.35</td>
<td>72.35</td>
<td>80.25</td>
<td>90.13</td>
</tr>
</tbody>
</table>

* Superscript with different letter in the same column are significantly different P (<0.05).

Rats fed diets formulated with 100% maize flour (traditional epiti) had how weight gains and poor protein quality as indicated by the low protein efficiency ratio as shown in figure 1. This finding is in agreement with the reports of Baptist (1996), Akinrele and Edwards (1971) in Banigo and Akpupuman (1987).

The weight gained by rats fed on epiti diet (A-C) containing up to 35% soybean flour were similar but lower than these rats fed on diet (D-F) containing 35% to 60% soybean flour (table 5); indicating that the use of higher levels of soybean flour in the formulation of epiti increased weight gained by the rats.

Thus, epiti prepared with 35% -60% soybean flour substitution, substantially improved nutritional value of the epiti shown by the high values of the protein efficiency ratio, net protein utilization, apparent and true digestibility (table 5). This result is in agreement with the findings of Akubor and Oninawo (2003), Achinewhu (1981) and Oyeeke (1992).
However, it should be noted that the while epiti prepared with 35% - 60% soybean flour substitution resulted in a significantly (P <0.05) higher protein efficiency ratio than the epiti prepared with 100% maize flour (traditional) sample A; Beyond 35% level of soybean substitution result in unacceptable epiti by the consumers.

Prepared from cowpea flour maize flour blends as follows: =100:0; B=85:15; C=75:25; D=65:35; E=50:50; F=40:60; G=30:70; H=Casein. Only means followed by different superscript with the same row differ significantly (DMRT P ≤ 0.05).

5. Experimental Rat Feed

Fig 1: Bar Chart of per of experimental rats feed with test diet Containing epiti prepared from Maize/Soybean flour blends Compared to casein.
Maize/Soybean:
A=100:0, B=85:15; C=75:25, D =65:35, E=50:50, F=40:6, G=30:70, H=CASEIN

6. Conclusion

The results of this study have shown that substituting soybean flour in maize/soybean flour up to 35% improve the protein content and nutrition value of epiti and result in similar sensory attribute with epiti produced from 100% maize (traditionally prepared epiti) beyond 35% level of soybean substitution, result in further improvement nutritional quality of epiti but such epiti was unacceptable to the consumers.

References


![Bar Chart of experimental rats feed](image-url)
blends for Food Preparation proceeding of the 28th Annual Conference/AGM .Nigeria Institute of Food Science and technology Oct. 21 – 14 Ibadan P46 – 47.


