PROXIMATE COMPOSITION AND SENSORY PROPERTIES OF BREAD PRODUCED FROM MALTED MAIZE –SOY FLOUR BLENDS

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ABSTRACT

The presence of gluten in wheat has been reported to cause problems in people with celiac disease (allergy to gluten) which is now of public health concern thereby causing an interest in gluten-free (GF) products. The study aimed at producing gluten-free bread using malted maize and soy bean flour in varying proportion and evaluation of the proximate and sensory properties using 100%wheat flour bread as control. Findings showed that the formulated bread samples had the following results; moisture (24.80%- 33.80%), ash (1.70%-0.25%), crude protein (11.38%-34.88%), crude fiber (0.50%-2.00%), oil extract (29.50-32.03%), carbohydrate (4.59%-24.57%) and energy value (409.28K/Cal-446.15 K/Cal). The sensory evaluation results of the bread samples showed that the highest total score was obtained from sample D (bread sample containing 85% malted maize: 15% soy flour). In conclusion, nutritious and acceptable bread was successfully produced using malted maize and soy flour blends. This study however recommends sample D (85% malted maize and 15% soy bean flour) because the product was the most nutritious and acceptable.

Keywords: *Proximate, Composition, Sensory, Properties, Produced.*

INTRODUCTION

Bread is conventionally a wheat flour-based food product that has become a major component of human diet and snacks in most part of the world (Edema, *et al.*, 2005).which is usually made from wheat, oat, barley, to mention but few because of gluten content. Gluten and protamine are the main fractions of gluten which provide viscosity, extensibility, elasticity and cohesive properties of dough (Gujral and Rosell, 2004). The presence of this gluten causes problems for consumers with celiac disease (CD: allergy to gluten). When persons with celiac disease eat foods containing gluten, their immune system responds by damaging the small intestine tiny finger-like protrusion, called villi, which lines the small intestine and enable the absorption of nutrients from food into the bloodstream, when this occurs, malnutrition sets in regardless of how much food a person consumes. However, the prevalence of celiac disease (CD) has caused an interest in gluten-free (GF) products because Celiac disease is a digestive disorder that damages the small intestine because of its sensitivity of gluten, which is found in wheat, rye, barley, and oats, this hereditary disorder

interferes with the absorption of nutrients from food (Bagolin, 2007). However, it is essential to produce an acceptable pastry product lacking gluten proteins.

Soybean could be an essential part of fundamental foods, as well as it could be used for enhancement of product quality (Ahmad *et al.*, 2014) because it contains up to 45% protein (Islam, *et al.*, 2007) with a digestibility valve of 91. 41% hence has a high bioavailability similar to animal protein (Zhao, *et al.*, 2004). It is also a good source of vitamins and mineral and supplies adequate amount of essential amino acids required for repairing the damage tissues.. Soybean protein is about four times of wheat, six times of rice grain and it is also rich in Ca, P and vitamins A, B, C and D (Islam *et al*., 2007; Serrem, *et al*., 2011). Soy consumption is associated with decrease in certain diseases including diabetes, atherosclerosis, and cancer (Ahmad, *et al.*, 2014).

Fortification of cereal with soy protein, especially when mixed in proper ratio, is one of the best sources of high quality protein alternative to animal protein for low income earners (Wadud, *et. al.*, 2004). Soybean flour has been used to improve protein quality and shelf life of bread (Mohammed, *et al.*, 2006; Sanchez, *et al.*, 2004).

Maize is one of the most important of cereals after wheat and rice, and is very widely distributed. It is one of the highest yielding grain crops (Ahn, 2009). It rich in crude fibre, protein, fat, carbohydrate, energy, vitamin A, B, C and E, potassium, phosphorus, calcium, magnesium, essential fatty acid and essential amino (accept lysine and tryptophan), it also contains beneficial phytochemicals (Rouf Shash, Prasad, kumar, 2016). Therefore, it is a good antioxidant, prevents constipation, reduced stomach acidity and reduced the risk of diabetes, colorectal cancer and heart diseases (Seed Guide, 2016).

Malting process is known as a way to promote and improve changes in the biochemical, sensory and nutritional characteristics of cereal grains (Lorenz, 2010). This process helps to make maize a suitable substitute for wheat in bakery industry and for formulating diets especially for people on gluten-free diets since the presence of wheat-gluten has been reported to be the cause of celiac disease (CD: allergy to gluten), and its prevalence is now of public health interest thus, necessitating an interest in gluten-free (GF) products. Hence, there is need for a strategic development and use of inexpensive local and less utilized staple grains in the production of popular foods as bread that is nutritionally adequate to meet the needs of this group, therefore this study aims at producing and evaluating the nutritional quality of bread from malted maize and soy flour blends.

Materials and Method

Source of Materials

The Maize (*Zea Mays*), Soybeans (*Glycine Max*) and wheat flour that was used for the production of bread were purchased from Bida Modern Market, Niger State.

Production of Malted Maize flour

The Maize Grains were malted using the method described by (Kulkarni, *et al.*, 2009). The Maize was sorted to remove debris and soaked for 12hrs in volume of water three

times its weight and drained. It was packed in a jute bag for germination under ambient temperature (25.1^{o}C) for 12hrs and water sprinkled twice daily. The germinated grains were washed and oven dried to a moisture content of 10% and then be dry milled using attrition mill

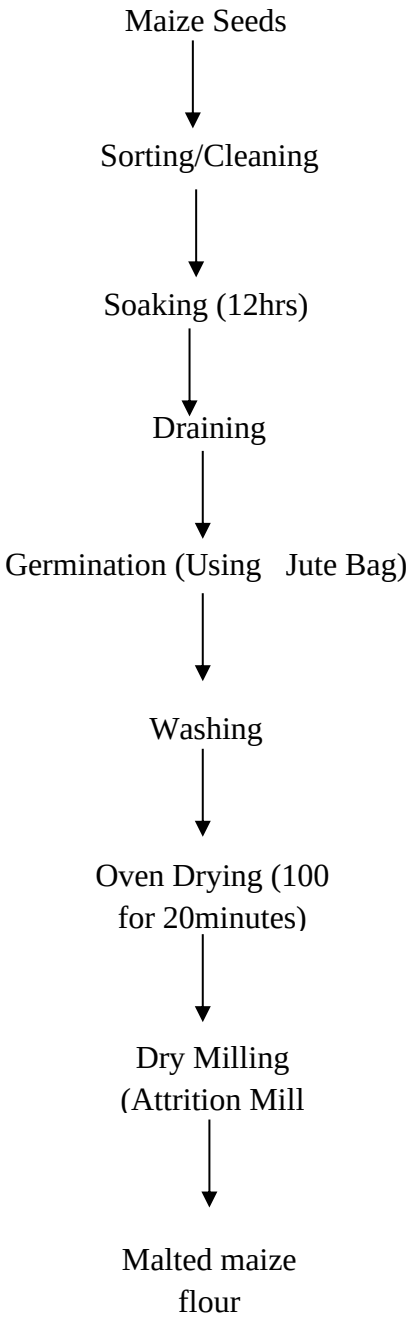


Fig.1: Flow Chart for the Production of Malted Maize Flour (Adapted from Kulkarna *et al.*, 2009).

Production of Soy Flour

The soybean seeds was sorted and cleaned. The soybean seed was soaked for 12hrs for 1day. It was dehulled to remove coat, the soybean seeds was blanched and drained. The seed was dried at 100 for 30 minutes. Then, it was milled using attrition mill and screened through 0.25 mm sieve.

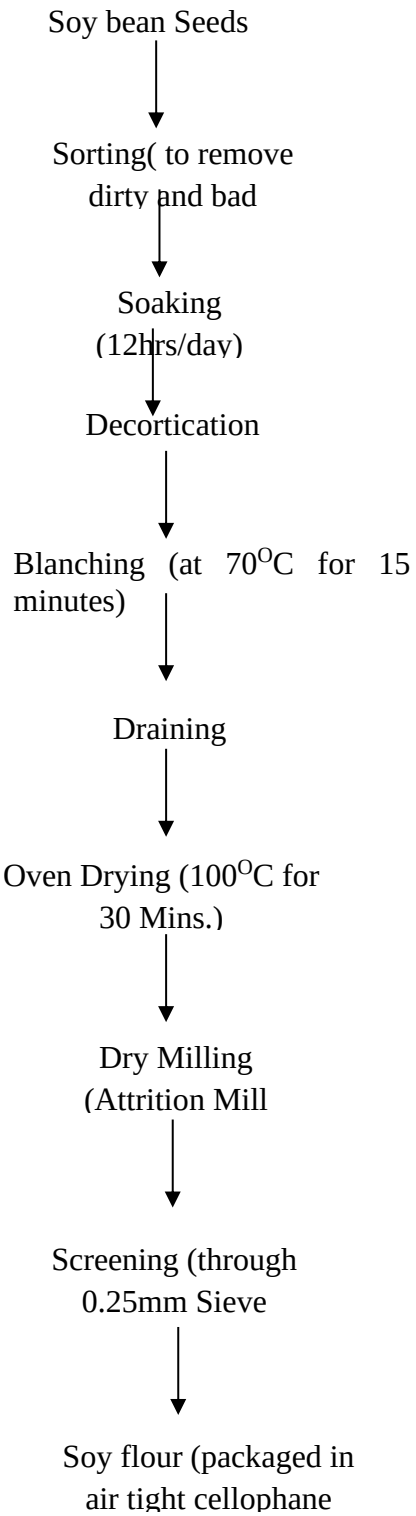


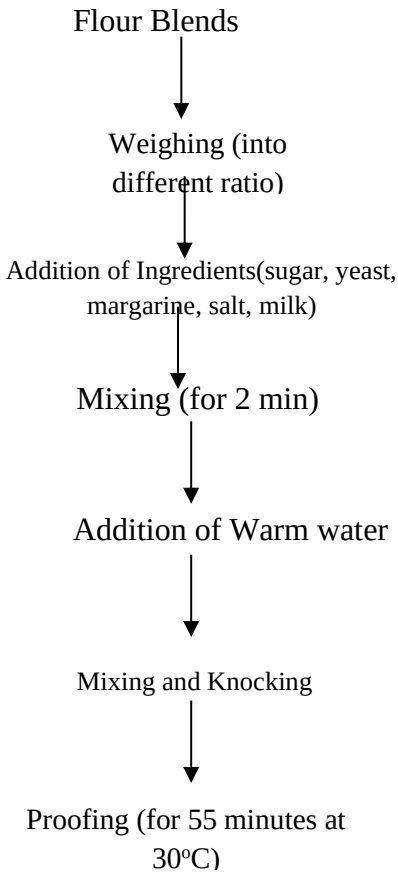
Fig.2: Flow Chart for Production of Soy Flour.

Formulation ratio for flour blends

Sample A: 100:0 wheat flour only (control)
Sample B: 95:5 (malted maize: soy flour)
Sample C: 90:10 (malted maize: soy flour)
Sample D: 85:15 (malted maize: soy flour)

Production of Bread

yeast was melted in warm water 500g of flour based on the above ratio were mixed with, 100g of sugar, half sachet of Nutmeg, 1 table spoon of milk, 1 tablet of vitamin C, 50g of water, 1 whisked egg was added to the four samples, it was mixed together, and added to the four samples separately, then it was mixed together and knead, it was placed on a flat clean surface, and been knead and knocked on the flat surface for 5 minutes. The dough was proofed for 55 minutes at 30, the dough was knead again and the divided into equal part, it was mould and smoothed and been placed on the baking pans and proofed for 25 minutes at 30, then it was baked for 30 minutes at 250^{o}C.



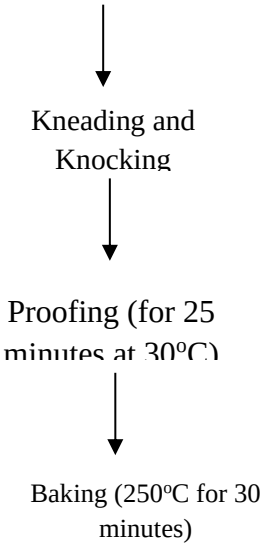


Fig.3: Flow Chart for Production of Bread

Proximate Composition

The proximate composition of the bread samples were determined according to the method of Association of Official Analytical Chemists (AOAC), (2010) at the National Cereals and Research Institute Baddegi, Niger State, Nigeria.

Sensory Evaluation

Sensory analysis of taste, appearance, texture and overall acceptability of the bread samples were evaluated using 20 panelist on a 9-point Hedonic scale which are:
9=like extremely, 8=like very much, 7=like moderately, 6=like slightly, 5=neither like nor dislike, 4=dislike slightly 3=dislike moderately, 2=like very much, 1=dislike extremely.

Statistical Analysis

Data obtained from both chemical and sensory properties of the samples was analyzed using ANOVA where Duncan's multiple range tests was used to compare the means at $p<0.05$.

Results and Discussion

The moisture content of foods gives an indication of its freshness and shelf life. High moisture content subjects food products to increased microbial spoilage and short shelf life which can lead to deterioration (Okareh *et al.*, 2015). The result of proximate composition of bread samples as shown in table 1 below revealed that the moisture content of the malted maize and soy beans bread samples gradually decrease

with increase in the percentage substitution of soy flour. Generally, the control sample had higher moisture content (33.80%) compared to the moisture content of the formulated samples. However, the report of this study is similar to the findings of maryam *et al.*,(2016) in effect of soy flour on nutritional, physiochemical and sensory characteristics of gluten free bread and not similar to Islamiyat, *et al.,* (2016), which reported lower moisture content value (2.9-4.25%) of biscuit produced from malted sorghum and soy bean flour blends.The ash content is an indication of the mineral content of a food sample. The samples with the formulation of maize and soy beans were higher than the control (100% wheat flour), the ash content of the bread samples increases with the increasing soy flour substitution in the bread. However, legumes have been reported to be good sources of ash (Alabi and Anvonye, 2007) and cereals grains have been reported to have low level of ash (Murekatete, *et al.,* 2009). The ash content gives the overall estimate of the total mineral element present in the food.The protein content of the bread increased with increasing in the percentage substitution of soy flour which is in line with other studies (Islam, *et al.,* 2007; Onilude and Idowu, 2006). The protein content of the formulated samples was higher than the control (100% wheat bread). The increment in the protein content could be as a result of high protein content of soy flour which has been reported to be a good source of cheap protein (Nascimento *et al*., 2014). This high protein content has a nutritional importance in most developing countries, where many people and especially children can rarely take foods with adequate protein content because of the cost (Edema *et al*., 2001). In agreement with other studies by Ndife *et al.*,2011; Ayo *et al.,* 2014; Farzana and Mohajan 2015) crude fiber content increased gradually with the incremental addition of soy flour. The result indicated that the fiber content of the control (100% wheat flour bread) was lower than the formulated samples which could be attributed to the reduction of content fiber during processing .However, the fiber content obtained from the result (0.50 to 2.00%) is lower than the fiber content (2.56 to 3.54%) from Islamiyat *et al*., (2016). High amount of crude fiber is beneficial for their role in the regulation of intestinal transit; lower the serum cholesterol level, constipation, diabetes, colon cancer (Ishida *et al.,* 2000). It was revealed from the table that the fat content (oil extract) of the samples with substitution of soy flour were also more than that of the control sample (00% whole wheat flour bread) and the fat content increased with the increasing level of soy flour substition. This is similar with the result of obtained by Ayo *et al.,* 2014; Jimoh and Olatidoye, 2009; Awasihi *et al*., 2012). The increase in the fat content of the formulated bread may be attributed to the fact that soy beans are rich in fat (Reddy, 2004). The carbohydrate content of the bread decreased as the level of substitution with soy flour increased. Some studies have also reported decrease in carbohydrate content of baked goods when cereals were blended with legumes (Okpala and Okoli, 2011; Ayo *et al*., 2014 and Olaoye *et al*.,

2016). The carbohydrate content (4.59 to 24.57%) of the samples was lower than the carbohydrate content (47.08 to 59.95%) of malted sorghum- soy flour reported by Islamiyat *et al.*, (2016). In addition, the variation in the percentage carbohydrate content may result from variation in the proximate compositions as carbohydrate was calculated by difference (Bryant, *et al.,* 1998). The energy value ranged from 409.28-420.08 K/Cal. These values represent the amount of energy in food that can be supplied to the body for maintenance of basic body functions such as breathing, circulation of blood, physical activities and thermic effect of food.

Table 1: Proximate composition of the Bread samples

Parameters	A	B	C	D
Moisture (%)	$33.80^{d} \pm 0.00$	$30.00^{c} \pm 0.03$	$27.40^{b} \pm 0.03$	$24.80^{a} \pm 0.02$
Ash (%)	$0.25^{a} \pm 0.06$	$1.50^{b} \pm 0.00$	$1.62^{bc} \pm 0.03$	$1.70^{bc} \pm 0.02$
Crude protein (%)	$11.38^{a} \pm 0.03$	$21.00^{b} \pm 2.83$	$29.53^{c} \pm 0.04$	$34.88^{d} \pm 0.02$
Crude fiber (%)	$0.50^{d} \pm 0.03$	$1.00^{c} \pm 0.00$	$1.50^{b} \pm 0.03$	$2.00^{a} \pm 0.04$
Oil extract (%)	$29.50^{a} \pm 0.12$	$30.01^{b} \pm 0.00$	$31.55^{c} \pm 0.02$	$32.03^{d} \pm 0.03$
Carbohydrate (%)	$24.58^{a} \pm 0.12$	$16.49^{b} \pm 2.80$	$8.4^{b} \pm 0.04$	$4.59^{ab} \pm 0.01$
Energy value (K/Cal)	$409.28^{d} \pm 0.64$	$420.08^{c} \pm 0.11$	$435.67^{c} \pm 0.25$	$446.15^{d} \pm 0.31$

Values are mean ±standard mean of duplicate determination mean along the row not followed by the same superscript are significantly different ($p<0.05$).

Keys:
A= wheat flour (100%)
B= malted maize and soy flour (95:5)
C= malted maize and soy flour (90:10)
D= malted maize and soy flour (85:15)

Sensory properties of bread samples

The organoleptic properties of the bread samples as revealed in the table 2 below showed that Taste is the most prominent factor in a person's choice of a particular food product (Farzana and Mohajan, 2015). There was a decrease in score for taste from 5.00-8.05 with increase in the soy flour percentage, this could be because the choice of the panelists was influenced by the taste of commonly consumed wheat bread. The result obtained from the study is the same as other similar studies. Appearance is an important sensory attributes of any food because of its influence on acceptability. It is parameter for judging as it also shows the suitable raw materials used for the

preparation, provides information about the formulation and quality of the product. The result also revealed that the score appearance of the bread samples increased with the increased in soy bean flour. Thus, this could be attributed to raw material used in the production. However from the study, the darker colour of the bread samples with soybean flour which may be due to the presence of yellow pigment in the soybean and millard reaction during processing (Banureka and Mahendran 2011;Olatidoye and Sobowale, 2011).

In term of the general acceptability sample D was liked very much by the panelist and also sample B and C was produced with incorporation of soy bean at 8% and 10% respectively was like moderately as rated from 9-point hedonic scale. Some studies have shown that addition of soy flour to other flour produced acceptable products (Awasthi *et al.*, 2012; Banureka and Mahendran, 2011, Farzan and Mohajan, 2013).

Table 2: Sensory composition of the samples

Parameters	A	B	C	D
Taste	$5.00^{c} \pm 0.00$	$6.20^{bc} \pm 3.71$	$7.35^{ab} \pm 42.48$	$8.05^{a} \pm 1.88$
Appearance	$4.75^{c} \pm 0.91$	$4.50^{bc} \pm 3.44$	$6.40^{ab} \pm 3.17$	$7.46^{a} \pm 2.21$
Texture	$6.50^{a} \pm 1.96$	$6.20^{a} \pm 1.88$	$5.40^{b} \pm 1.27$	$4.90^{bc} \pm 1.77$
General acceptability	$6.38^{bc} \pm 2.62$	$6.40^{b} \pm 1.96$	$7.41^{ab} \pm 2.62$	$8.50^{a} \pm 0.89$

Values are mean ±standard mean of duplicate determination. mean along the row not followed by the same superscript are significantly different ($p<0.05$).

Keys:

A= wheat flour (100%)

B= malted maize and soy flour (95:5)

C= malted maize and soy flour (90:10)

D= malted maize and soy flour (85:15)

Conclusion and Recommendation

Nutritious and acceptable bread was successfully produced using malted maize and soy flour blends. Moisture content, fiber content, crude protein, carbohydrate and energy value of the bread samples showed significant variation at $p \leq 0.05$ except for ash content where there was no significant difference between samples C and D. However, for the taste, aroma, appearance and general acceptability of the bread samples there was significant difference $p \leq 0.05$. but there was no significant difference between samples A, B, C and D in term of the texture. Therefore, sample D (85% malted maize and 15% soy bean flour) is recommended for patients with celiac disease on gluten-free diet because the product was the most nutritious and acceptable.

References

Ahmad, A., Hayat, I., Arif, S., Masud, T., Khalid, N. &Ahmed, A.(2014). Mechanisms involved in the therapeutic effects of soybeans (Glycine Max). *International Journal of Food Properties,* 17, 1332-1354.

Awasthi, I., Siraj, P.,Tripathi, V., (2012).Development of soy fortified high protein and high calorie supplementary biscuits. *Indian journal of scientific research*, 3,51.

Ayo, J., Ayo, V., popoola, C., Omosebi, M., and Joseph, l., (2014). Production amd evaluation of malted soybea- acha composite flour bread and biscuit. *African journal of food Science and Technology,* 5, 21- 28.

Bagolin Do Nascimento, A., Medeiros Rataichesck fiates, G., Dos Anjos, A., and Teixeira, E (2007). Availability, cost and nutritional composition of gluten-free products. *British Food journal*, 116, 1842- 1852.

Edem, D., Ayatse, J., and Itam, E. (2001). Effect of soy protein supplementation on the nutritive value of 'gari'(farina) from Manihot esculenta. *Food Chemistry*,75, 57-62.

Edema M. O, sanni A. I, sanni L. O, (2005). Evaluation of maize-soybean flours blends for sour maize bread production in Nigeria. *Africa. J. Biotechnol* 4(g) :911-918.

Farzana, T., and Mohajan, S.(2015). Effect of incorporation of soyflour to wheat flour on nutritional and sensory quality of biscuits fortified with mushroom. *Food Science and Nutrition* , 3,363-369.

Gujral, H.S. & Rosell, C.M. (2004). Improvement of the breadmaking quality of rice flour by glucose oxidase,*Food research international*,37,75-81.

Islam, T., Chowdhury, A., Islam, M. and Islam, S. (2007). Standardization of bread Preparation of bread preparation from soyflour. *International journal of sustainale crop production*, 2,15-20.

Islamiyat, F.B., Ade, O.A., James, A.A. and Zaniab, O.K. (2016). Production and Quality evaluation of biscuits produced from malted sorghum- soyflour blends. *Journal of Advances in Food Sciences and Technology.* 3(3):107-113.

Jimoh, K., and Olatidoye, O.(2009). Evaluation of physicochemical and rheological charateristicsbof soybean fortified yam flour. *Journal of Applied Biosciences*, 13,703-706.

Lorenz, K. (2010), cereal sprouts composition, nutritive value, food Applications. *CRC critical reviews in food science and nutrition*, 13, 353-385.

Ndife, J., Abdulraheem, L., and Zakari, U. (2011). Evaluation of the nutritional and sensory quality of functional breads produced from whole wheat and soya bean flour blends. *African Journal of Food Science*, 5, 466-472.

Okpala LC, and Okoli EC. (2011) Nutritional evaluation cookies produced from pigeon pea flour, cocoyam flour and sorghum flour blends. *African J. Biotechnol*. 10(3):433-438.

Olaoye, O., Onulide, A., and Idowu, O.(2006). Quality characteristics of bread produced from composite flours of wheat , plaintain and soybeans. *African Journal of Biotechnology*, 5, 1102- 1106.

Onilude, A. A., sanni, A.L., and Ghalo, M. I.(2000). Effect of process improvement on the physiochemical properities of infant weaning food from fermented composite blends of cereal and soybeans plant food. *Human nutrition*. 54(54):239-250.

Rouf shash, T., Prasad, K., Kumar, P. (2016). Maize- A potential source of human nutrition and health: A review. *J. cogent food and agric*. 2(1).

Sanchez, H,., Osella, C. and De Latome, M.(2004).Use response surface methodology to optimize gluten free bread fortified with soyflour and dry milk. *International Food Science and technology* , 10, 5-9.

Serrem, C., Kock, H., and Taylor, J. (2011). Nutritional quality, Sensory quality and consumer acceptability of Sorghum and Bread wheat biscuit s fortified with defatted soyflour. *International Journal of Food Sciences &Technology,* 46,74-83.

Wadud, S., Abid, H., Ara, H., Kosar, S. and Shan, W.H. (2004).production, quality evaluation and storage stability. Vegetable protein-based Baby foods. Food Chemistry, 85, 175-179.

WWW.The teaching friendly Guide, (2016). Nutritional value of maize.

WWW.Wikipedia soybean, 2016.

Zhao, Q., Selomulya, c., Xiong, H., Chen, X.D., Li., X., Wang, S., and Sun, W. (2014). Rice drg protein as an alternative to soyprotein isolate: comparison of nutritional properties. *International journal of food properties, 17, 1791-1804.*