Food Science and Quality Management www.iiste.org
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.14, 2013

Evaluation O F Cookies from (Wheat, Yam, And Soybean) Blend

Z. O. Apotiola and J.F. Fashakin;ly
Department of Food Technology, Lagos State Polytechnic, Ikorodu, Lagos
Department of Hospitality Management, Lagos State Polytechnic,
Ikorodu, Lagos
zoapotiola@yahoo.com, 08028298044

ABSTRACT

Cookies were produced from yam (*Dioscorea spp*), Soybean (Glycine max) and wheat (*Trititum, spp*) flour blends. Yam and soybean were processed into flour and used to substitute wheat flour at different proportions (80:10:10%, 70:20:10%; 60:30:10% and 50:40:10%) and 100% wheat as control. The functional properties and proximate composition of yam, soybean and wheat flours were determined. The proximate composition of cookies sample shows the moisture, protein, fat, ash, crude fibre and carbohydrate content ranged from 7.8 – 8.3%, 10.5 – 12.1%, 17.8 – 18.2%, 6.0 – 6.3%, 3.8 – 4.2% and 51.0 – 53.1%. There were significant differences ($p \leq 0.05$) except the ash content. The proximate composition of flour sample shows the moisture, protein, fat, ash, crude fibre and carbohydrate content ranged from 9.3-9.4%, 3.8 – 16.1%, 2.6 – 7.9%, 1.3 – 3.7%, 0.8 – 2.0%, and 60.9 – 81.1% respectively. There were significant difference ($p \leq 0.05$) between the flour samples except the moisture content of wheat and soybean which has the same value of 9.3%. The functional properties of the flour samples shows that the bulk density loosed, bulk density packed, water absorption capacity, oil absorption capacity, emulsifying capacity, swelling capacity and gelatination temperature ranged from 0.42 - 0.43, 0.75 - 0.77, 175 – 180, 150 – 163, 14.7 – 16.1, 1.40 – 1.50, and 66.4 – 67.7 respectively. There were significant differences ($p \leq 0.05$) in all the values. The physical properties of cookies samples show that the diameter and thickness ranged from 5.36 – 6.05; 1.71 – 1.87; there were no significant difference ($p \leq 0.05$) between composite cookies and 100% wheat cookies. However, the sensory evaluation of cookies shows that there were no significant differences ($p \leq 0.05$) with 100% cookies at higher replacement of wheat flour with yam. Flour could therefore be replaced with up to 20% with 10% of soybean and 10% of yam flour in cookies production without affecting the sensory qualities.

Key Words: Cookies, Yam, Soyabean, Wheat and Replacement

INTRODUCTION

Cookies are flat dry sweet biscuits. The word biscuit comes from the French word “biscuit”, twice cooked, and is a lateral description of what happened in the early days of biscuit making (Babara, 2002). In most part of the world, baked goods based on wheat flour are popular food stuffs. The product excels in colour, coherence, airiness, shelf life and absence of grittiness. Due to these reasons, the use of wheat flour for human consumption is increasing considerably even in countries where soil and climate do not lend itself to wheat cultivation.

Thus, it is expected that owing the strong urbanization and population growth, the increase in wheat consumption at the expense of indigenous product will increase (Ihekonroye and Ngoddy, 1985). In order to reduce the use of wheat flour for baked goods cookies can be produce from flours of cereals, roots, pulses and lastly legumes (Ruiter, 1978). Though, composite flour based foods are found to be different from wheat products and these differences includes the colour, coherence, airiness and shelf life but the use of composite flour necessitates the formulation flour mixtures consisting namely of indigenous raw materials such as sorghum, millet, yam, cocoyam, rice, groundnut, cowpea and having a composition that combines optimal nutritive value with good processing characteristics (Ruiter, 1978).

Okpala and Okoli, 2010 reported that cocoyam can be used in the production of cookies which makes it possible for other root and tubers to be used in the production of cookies. Soybean is a remarkable source of protein for both animals and human consumption and is also a leading source of edible oils and fat (Rita and Sophia, 2010).

Since soybean contain more protein content, the mixture of soybean flour with yam flour is mainly a form of fortification of protein and small amount of fat and oil from the soybean improves the nutritional quality of the cookies.

Objectives includes to produce cookies from composite of yam, soybean and wheat flour, to determine the physico-chemical properties of the cookies and flour, to determine the spread factor and thickness of the cookies, to determine the sensory properties of the cookies produced.

MATERIALS AND METHOD

RAW MATERIAL

The yam and soy bean were purchased from a retail outlet in Sabo Market, Ikorodu, Lagos. Wheat flour and all other baking ingredients such as eggs, baking powder, fat, milk and flavourings were also obtained from the same source.

PREPARATION OF YAM FLOUR

The method of (Binta et al, 2010) was adopted in the preparation of yam flour. 10kg of yam was washed, peeled, cubed, blanched, steamed for few minutes and dried. The dried cube was grinded mechanically using an attrition machine to form yam flour. The Yam flour was packaged in an airtight HPDE film until ready for further use.

PREPARATION OF SOYBEAN FLOUR

The method of (Oluwamukomi et al, 2005) was adopted in the preparation of soybean flour. 4kg of soybean (Glycine max L merrial) were sorted, washed and boiled in water at 100^{o}C for 30 minutes. It was dehulled manually, washed, drained and oven dried at 55^{o}C for 16 hours. The dried particles were milled in an attrition machine to obtain the flour followed by sieving using a sieve with 300um aperture and then kept in an airtight HDPE film until ready for further use.

FORMULATION OF BLENDS

The wheat yam, soybean flours were mixed at different proportion (80: 10: 10%, 70: 20: 10%, 60: 30: 10%, 50: 40: 10%) while 100% wheat flour served as standard. a mixer was used for mixing samples to achieve uniform blending.

PROXIMATE COMPOSITION : Protein, fat and oil, Crude fibre, ash, moisture and carbohydrate were determined by the methods prescribed in AOAC, 1990 while functional properties were by Pearson, 1976

PREPARATION OF COOKIES

Cookies was prepared according to the modified method of (Okaka, 1997) with some modification in the recipe; flour 300g, fat 200g, sugar 125g, salt 5g, 2whole eggs, milk 7teaspoonfuls, Nutmeg 1.5g, vanilla flavor 2 teaspoonfuls, and baking powder 5g. The fat and sugar were mixed until fluffy. Egg and milk were added while mixing continued for about 40 minutes. Appropriate amounts of flour, baking powder, salt, nutmeg, vanilla flavouring were slowly introduced into the mixture. The dough was rolled and cut into circular shapes of 5cm diameter and baked in the charcoal oven until it was fully baked.

SENSORY EVALUATION

The sensory properties of cookies were determined using a twenty member panelist consisting of students from different department of Lagos State Polytechnic. Cookies samples prepared from each blend were presented in coded white plastic plate, using a 9 point hedonic scale with a scale ranging of 1 to 9 with 1 representing the least score (dislike extremely) and 9 the highest score (like extremely). The order of presentation of samples was randomized. Sachet water was provided to rinse the mouth between evaluations. The panelists were instructed to evaluate the coded samples for crispiness, colour, taste, texture and overall acceptability (Akinjaiyeju, 2009).

DETERMINATION OF PHYSICAL PROPERTIES OF COOKIES:

The weight of the biscuit was measured by weighing on a weighing balance (model mettler PE 1600, mettle Instrument Corporation, Greinfensee, Zurich Switzerland) with an accuracy of 0.1mg). The diameter was measured with a calibrated ruler as described by Ayo et al (2007). The thickness of cookies was measured by placing six cookies on top of each other followed by a duplicate reading recorded by shuffing cookies as described by AACC (2000). All the measurements were done in two replicates of six cookies each and all the readings were divided by six to get the values per cookie. Spread factor (sf) was calculated according to the following formula

$$SF = (D/T \times CF) \times 10$$

Where CF is the correction factor at constant atmospheric pressure (1.0 in the present study).

RESULTS AND DISCUSSION

RESULTS

Table 1: Proximate Composition of Flour

Samples	Moisture Content	Protein	Fat	Ash	Crude Fibre	Carbohydrate
Wheat	9.27±0.06a	3.83±0.06a	2.63±0.06a	1.30±0.10a	0.80±0.10a	81.17±0.06c
Soybean	9.30±0.10a	16.10±0.20b	7.87±0.06b	3.73±0.06c	2.07±0.06c	60.93±0.25a
Yam	9.47±0.06b	9.47±5.83ab	2.87±0.06c	1.6±0.10b	1.80±0.10b	78.13±0.15b

Mean in the same column followed by the same letter are not statistically different ($p \leq 0.05$).

Table 2: Functional Properties of the Flour Samples

Samples	Bulk Density Loosed	Bulk Density Packed	Water Absorption Capacity	Oil Absorption Capacity	Emulsifying Capacity	Swelling Capacity	Gelatination Temperature
Wheat	0.42±0.00a	0.75±0.00a	180.00±0.00a	155.00±0.00 b	15.00±0.00 a	1.40±0.00b	66.63±0.15b
Soybean	0.43±0.00b	0.77±0.00c	175.00±0.00b	163.00±2.89 c	16.17±0.29 b	1.5.00±0.00a	67.70±0.26b
Yam	0.42±0.00a	0.75±0.00b	180.00±0.00a	150.00±0.00 a	14.67±0.29 a	1.40±0.36b	66.40±0.17a

Mean in the same column followed by the same letter are not statistically significant level ($p \leq 0.05$).

Table 3: Proximate Composition of Cookies

Samples	Moisture Content	Protein	Fat	Ash	Crude Fibre	Carbohydrate
ADE	7.83±0.06a	10.46±0.15b	18.20±0.10b	6.23±0.06b	4.103±0.10c	53.17±0.15c
BDE	8.27±0.15b	12.17±0.15d	18.17±0.15b	6.07±.06b	3.8±0.06b	52.52±0.16a
CDE	7.77±0.12a	11.57±0.06c	18.03±0.15c	6.30±0.00b	4.20±0.10c	53.10±0.20c
DDE	8.13±0.15b	10.85±0.12b	17.87±0.15a	6.20±0.10b	3.93±0.06ab	52.00.±0.30a
EDE	8.37±0.12b	14.47±0.06a	17.83±0.06a	6.30±0.10b	4.07±0.06bc	51.07±0.32a

Mean in the same column followed by the same letter are not statistically significant ($p \leq 0.05$).
ADE = (100% Wheat Flour).
BDE = (Wheat Flour/Yam/Soybean, 80,10,10)
CDE = (Wheat flour/Yam/Soybean; 70:20:10)
DDE = (Wheat flour/Yam/Soybean; 60:30:10)
EDE = (Wheat flour/Yam/Soybean; 50:40:10

Table 4: **Physical Properties of Cookies from Wheat, Yam, Soybean, Flour blends**

Blends	Diameter (cm)	Thickness (cm)	Weight (g)	Spread factor
100% Wheat flour	6.05±0.03a	1.87±0.05a	29.44±0.20b	37.33±0.20a
80:10:10	5.99±0.01a	1.86±0.05a	29.26±0.14b	35.76±0.20b
70:20:10	5.85±0.02a	1.85±0.04a	30.62±0.08a	34.00±0.20c
60:30:10	5.40±0.01a	1.85±0.08a	30.56±0.30a	31.85±0.20e
50:40:10	5.36±0.00a	1.71±0.12a	30.42±0.03a	31.53±0.20e

Mean in the same column followed by the same letter are not statistically significant ($p \leq 0.05$).
WH: Wheat flour, YF: Yam flour; SF: Soyflour

Table 5: Sensory Evaluation of Cookies Prepared From Composite Flour

Samples	Crispiness	Colour	Taste	Texture	Overall Acceptability
ADE	4.20±0.42c	4.40±0.52c	4.20±0.92b	4.30±0.67c	4.60±0.52c
BDE	4.60±0.70c	4.30±0.67c	4.40±0.52c	4.40±0.52c	4.40±0.70c
CDE	4.00±0.67c	3.90±0.99ab	4.20±0.79c	3.80±0.92ab	3.90±0.57ab
DDE	4.00±0.94ab	3.80±0.79ab	4.30±0.82b	3.60±0.97ab	3.60±1.07a
EDE	3.40±0.97a	3.50±0.85a	3.70±1.06a	3.10±0.99a	3.20±0.79a

Mean in the same column followed by the same letter are not statistically significant ($p \leq 0.05$).

DISCUSSION

Proximate composition of flours shows that there were significant differences ($p \leq 0.05$) in carbohydrate, crude fiber, ash, protein and fat between yam, wheat and soybean flour. The carbohydrate range from 60.9% - 81.2%. There were significant difference between yam, wheat and soybean flour. Wheat flour has the highest value of 81.2% while soybean has the least value of 60.9%. The total carbohydrate content and indicate that these type of flour are classified as food of the group 1 or food energy supplier of nutritive and economical value which could represent good sources for industrial flour and starch (FAO, 1998). The crude fibre range from 0.8% - 2.0%. There were significant differences ($p \leq 0.05$) between yam, soybean and wheat flour. Soybean flour has the highest value of 2.0% while wheat flour has the least value of 0.8%. The protein, fat and ash content increased with the incorporation of wheat flour and other ingredients. The values above agree with those reported in the commercial label for similar products. Soybean has the highest fat and ash content of 7.8% and 3.7% and protein content of 16.1% respectively. Soybean has been reported to contain appreciable amount of minerals and fat. Also fat acts as flavours returner and help to improve sensory qualities of baked products (Ikepeme et al, 2010).

The result of the functional properties of the sample in Table 2 shows that water absorption capacity range from 175 – 180. There were no significant differences ($p \geq 0.05$) in water absorption capacity between wheat and yam flour. Soybean flour has the lowest water absorption capacity of 175. Carbohydrates have been reported to influence water absorption capacity of foods (Echendu et al, 2004). The ability of protein to bind water is indicative of its water capacity. The observed variation in water absorption among the cowpea flours may be due to different protein concentration, their degree of interaction with water and their conformational characteristics (McWatters, et al, 2003). On the other hand McWatters, et al (2003) reported that lower water absorption capacity is due to less availability of polar amino acids in flour. This effect could probably due to loose association of amylose and amylopectin in the native granules of starch and weaker associative forces maintaining the granules structure . Water absorption capacity is important in bulking and consistency of product as well as in baking application (Lorenz and Collins, 1990). This result also shows that the yam, wheat and soybean flour have a good gelatination temperature. The gelatination range from 66.4 – 67.7. There were no significant difference ($p \geq 0.05$) between soybean and wheat flour, soybean flour has the highest gelatination temperature of 67.7% while yam flour has the least value of 66.4. High swelling capacity has been reported as part of the criteria for a good quality product (Nlba et al, 2001). The swelling index of the flour sample ranged from 1.40-5.0. There were no significant difference ($p \geq 0.05$) between wheat and yam flour which was 1.40 while soybean flour has the highest swelling capacity of 1.5. Swelling capacity is the measure of ability of starch to immobile water and swells (Ikegwu et al, 2009).

The oil absorption capacity ranged from 150-163. Soybean flour has the highest oil absorption capacity of 163 while yam flour has the least value of 150. There was significant difference ($p \leq 0.05$) between yam, soybean and wheat flour.

The emulsifying capacity range from 14.67 to 16.7. There were significant differences ($p \leq 0.05$) between yam, soybean and wheat flour. Soybean flour has the highest emulsifying capacity of 16.2 while yam flour has the least value of 14. 7.

The bulk density loosed of the flour sample ranged from 0.42 - 0.43. There were no significant differences between wheat and soybean flour while soybean flour has the highest value of 0.43. Bulk density gives an indication of the relative volume of packaging material required and high bulk density is a good physical attribute when determining the mixing quality of a particulate matter. The bulk density is a reflection of the load the flour sample can carry, if allowed to rest directly on one matter. The density of processed products dictate the characteristics of its container or package product density influences the amount and strength of packaging material, texture or mouth feel (Fola, et al, 2011).

The bulk density packed ranged from 0.75-0.77. There were significant difference ($p \leq 0.05$) between yam, soybean and wheat flour soybean has the highest value of 0.77. According to Basman et al (2003) higher bulk density is desirable for greater ease of dispensability of flours. In contrast, however, low bulk density would be an advantage in the formulation of complementary foods (Ugwu and Ukpabi, 2002).

The results of the proximate composition of the cookies are shown in (Table 3). The results show that the blend BDE had the highest protein content of 12.2% while samples EDE and ADE had the lowest value of 10.5% respectively. There was no significant difference ($p \leq 0.05$) in protein content between ADE and BDE. According to Padmaja, (1995), protein content of the tuber based composite flours could be elevated through the incorporation of legume flours. The blend BDE had the highest carbohydrate content of 53.1% while the blend ADE had the lowest value of 51.1%. Total carbohydrate content was high, and this agrees with the findings that cocoyam being high in starch content should be eaten with other high protein foods (Enomfon and Umoh, 2004). Fat acts as flavours retainer and help to improve sensory qualities of baked products (Ikepeme et al, 2010). The fat content of sample ADE, BDE and CDE ranged from 18.0% - 18.2%. There was no significant difference ($p \leq 0.05$) in fat content of samples ADE, BDE and CDE, while samples DDE and EDE had the same significant values of 17.8%. As it was observed from the table an increase in yam flour lead to an increased in moisture content.

The physical properties of cookies prepared from wheat, yam and soybean flour blends as well as 100% wheat flour is presented in Table 4. The diameter, thickness, weight and spread ratio of cookies ranged from 5.36 to 6.05cm, 1.71 to 1.87cm, 29.26 to 30.62g and 31.53 to 37.33 respectively; there was no significant ($p \geq 0.05$) difference in diameter and thickness between composite cookies of (BDE, CDE, DDE and EDE) and 100% wheat cookies. The weight of composite cookies differed significantly ($p \leq 0.05$) with 100% wheat flour cookies. Addition of soyflour to yam and wheat flour decreased the thickness and spread factor or composite cookies while the weight increased.

The increase in weight of composite cookies due to addition of soyflour could be attributed to high bulk density of soyflour. The higher bulk density of yam-soyflour blends could also account for higher weight of composite cookies than 100% wheat cookies while the decrease in thickness and spread factor of the composite cookies as reported by Mridula et al (2007) was due to the addition of soyflour which could attribute to higher protein content of soyflour (Table 3).

Singh et al (1993) have reported a decrease in spread factor with increased protein in the cookies.

Table 5 shows colour, crispiness, texture and taste ranged between 3.50-4.40, 3.40-4.60, 3.10-4.40 and 3.70-4.20 respectively. It is evident from the results that significantly ($p \leq 0.05$) highest was by cookies prepared from ADE 4.4 while significantly ($p \leq 0.05$ lowest by cookies prepared from EDE 3.5. Judges disliked the cookies prepared from sample EDE with respect to colour when subjected to sensory evaluation.

The crispiness values ranges from 3.4 to 4.6, there is no significant difference ($p \leq 0.05$) between the samples except sample EDE which can be attributed to increase in volume of yam flour.

Cookies prepared from BDE have the highest significant ($p \leq 0.05$) score of 4.4 while lowest score of 3.1 was obtained in the cookies prepared EDE.

There were significant differences ($p \leq 0.05$). Maximum score of 4.4 was scored by cookies prepared from sample BDE respectively while minimum score of 3.7 was scored by the cookies prepared from EDE. Judges disliked the cookies prepared from the EDE sample with respect to taste when subjected to sensory evaluation.

Overall Acceptability: The statistical analysis regarding the overall acceptability of cookies prepared from wheat, yam and soybean blend is shown in Table 5. The result shows that supplementation significantly affected the overall acceptability of the cookies. The value range from 3.2 – 4.6; there were no significant difference ($p \geq 0.05$) between sample ADE and BDE, also there was no significant difference ($p \geq 0.05$) between sample DDE and EDE respectively while sample CDE differed significantly ($p \leq 0.05$). Maximum score of 4.6 was scored by cookies prepared from sample ADE and BDE respectively while minimum score 3.2 was scored by the cookies prepared from EDE. Cookies prepared from EDE has been rejected by judges with respect to overall acceptability. The results of the sensory evaluation of the cookies prepared from the different treatments of the composite flour are according to the findings of Gambus, et al (2003), who reported increasing the levels of flaxseed flour, matric flour and cowpea flour in the biscuit which resulted in significant decrease in the sensory attributes of the cookies. The result of the study shows that substitution of wheat flour with yam and soybean flour increased the protein content which was the basis of the study. It was further revealed that 10% of yam and 10% soybean with 80% wheat flour blends produced the overall best result across all parameter and nutrients. Flour could therefore be replaced with up to 20% with 10% of soybean and 10% of yam flour in cookies production without affecting the sensory qualities. The use of soybean and yam flour in cookies making would greatly enhance the utilization of this crop in sub-Saharan African countries like Nigeria where the crop has not been optimally utilized.

REFERENCES

Alabi, M. O. and Oluwatosin, B. C. (2001): Creating Awareness on utilization of Soybean flour for baked products in the catering industry; A preliminary study of soy cake, physical properties and acceptability. Unpublished.

AOAC, (1990): Methods of Association of official chemists. Official methods of Analysis, 15th edition Virginia Assoc. official Analytical chemist USA. Pp: 1141.

AACC, 2000. Approved methods of the American Association of Cereal Chemist.
10th Edition, American Association of Cereal Chemists Press, St. Paul, MN.

Ayo, J. A.; Ayo V. A., Nkama, I.; and Adewori; R. (2007): Physical in-vitro digestibility and organoleptic evaluation of "Acha" wheat buicuit supplemented with soybean flour Niger food j. 25: 77-89.

Barbara, H. (2002): From Hardtack to Home fries: An uncommon History of American Cooks and Meals. Free Press UK. P. 30 – 35.

Binta, S., Jummai, H. U.; and ANN, P. (2010): Food properties and Nutrition HMT 234. UNESCO Nigeria Technical and Vocational Education revitalization Week 9.

Chinma, C. E, Igbabul, B.D. and Omotayo, O. O. (2012): Quality characteristics of cookies prepared from unripe plantain and deffated sesame flour blends. Am. J. Food Technology 7:398 – 408.

Echendu, C. A.; Onimawo, I. A. and Somtochi, A. (2004): Production and Evaluation of Doughnuts and Biscuits from Maize – Pigeon pea flour Blends. Nig. Food j. (22): 147 – 153.

Enomfon – Akpan J. and Umoh I. B. (2004): Effect of heat and tetracycline treatments on the food quality and acidity factors in cocoyam (Xanthosoma sagitti folium [L] schott] Pak. J. Nutr., 3: 240 – 243.

FAO (1998): Carbohydrates in human nutrition food and Nutrition Rome. Paper. 66.

Fraser, E. A. (2000): Heavy metals from wheat grown in sewage sludge. Harvard University Press. Pp. 252 – 254.

Gambus, A.; Kanemaki, M.; Sanchez-Diaz, A. and Labib, K. (2003): Functional proteomic identification of DNA replication proteins by induced proteolysis in vivo. Nature 423, 70 – 74.

Ikepeme, E. E.; Eyong, M.E. and Ekanem, E. C. (2008): Relationship between schistosoma haematobium infection and urinary tract infection among children in South Eastern, Nigeria. Niger post grad. Med. J. 15 (2): 89-93.

McWaters H.G.; Hall, A.; Bastow, R.M. Davis S. J. Hanano S., Hibberd, V., Doyle, M.R.; Sung, S., Halliday, K. J.; Amasino, R. M. and Millar A.J. (2003): The time for coffee gene maintains the amplitude and timing of Arabidopsis circadian clocks. J. plant cell. 15., (11): 2719 – 2729.

Okpala, L. C. and E. C., Okoli (2011): Nutritional evaluation cookies produced from pigeon pea, cocoyam and sorghum flour blends. Afr. J. Biotednology, 10: 433 – 438.

Oluwamukomi, M. O.; Oluwalana , I. B. and Akinbowale, O. F. (2011): Physicochemical and sensory properties of wheat-cassava composite biscuit enriched with soyflour. Afr. J. food sci 5 (2): 50 – 56.

Mridula, D.; R. K. Gupta and Manikantan, M.R. (2007): Effect of incorporation of sorghum flour to wheat flour on quality of biscuits fortified with defatted soyflour. Am. J. Food Tech., 2: 428 – 434

Ihekoronye, A.T. and Ngoddy, P. O. (1985): Integrated Food Science and Technology for the Tropics. McMillian Publisher Limited, London pp 266 – 282 and 366 – 368.

Ikegwu, O. J., Nwobasi, V.; Odoh, M. O. and Oledinma, N. U. (2009): Evaluation of the pasting and some functional properties of starch isolated from some improved cassava varieties in Nigeria. Afri.j. Biotechnology 8 (10): 2310 – 2315.

Nasr, S. I. and Abufoul (2004): Using free fat water melon (Citrullus vulgaris) seed kernels in preparing high protein biscuits. Al-Azhar University Gaza, Gaza Palestine 7: 45-54.

Okaka, J. C. (1997): Cereals and Legumes: Storage and Processing Technology. Data and microsystem publishers, Enugu, Nigeria. Pp. 11 – 124

Pearson, D. (1976): Chemical Analysis of foods. 7th edition, Edinburgh, Churchil Living Stone. Pp 204 – 210.

Rita, E. S. and Sophia, D. (2010): Utilization of soy bean flour in the production of bread. Pakistan Journal of Nutrition 9(8): 815 – 818.

Singh, R. J.; Nelson, R. L.; Randali, L. and Chung. G. (2007): Genetic Resources, Chromosome Engineering and Crop Improvement: Oil seed crops. Taylor and Francis publication vol. 4. P. 15.