

Improved soyabean technologies in processing and utilization adoption as supplement with local foods in Bauchi Local Government Area, Bauchi State, Nigeria.

Abstract

The study was carried out to determine the level of adoption of improved soyabean (*Glycine Max (L) Merrill*) processing and utilization technologies (innovations) as supplement with local food in Bauchi Local Government Area (LGA), Bauchi State, Nigeria. Bauchi LGA was purposively selected because there were many soyabean farmers in the area. Three villages and 15 farmers were randomly selected, totaling 45 farmers as sample size. Interview schedule was used to source relevant information from soyabean farmers on their socio- economic characteristics and level of adoption of the innovations. Twenty selected soyabean improved technologies were selected in relation to their local diets, to assess the level of adoption of supplementation with local diets. The result revealed that both old and young ranges from 20 to 70 years were involved in soyabean utilization and processing. The result also revealed that majority of the soyabean farmers were small-scale farmers and with large family members. The respondents had many years of processing experience (1-15years) but were using local methods which may not eliminate the anti-nutritional factors in soyabean. Majority of the farmers were illiterate having only Quranic education (58%), 33 had formal education at different levels while, 9% had no formal education. The regression analysis revealed that out of nine socio- economic characteristics used as predictors, only two (household size and labour) were positively significant at $P<0.001$ and processing was negatively significant at $P<0.05$ while, other six were not significant. The level of adoption of these innovations was poor with only three innovations widely adopted. These were soya “awara” (cheese) 73%, soya *daddawa* (36%) and soya *kunu* (36%), 10 innovations were poorly adopted while, 7 innovations had zero adoption. The poor adoption of these soyabean improved technologies may probably be due to lack of adequate education and inadequate extension services. To increase the adoption of these innovations, extension workers need to reach out to people not only in rural areas but also in urban areas. This is because soyabean is good for the poor and the rich, also to both old and the young for good health and vitality.

Key words: adoption, innovations, soyabean, processing and utilization.

Introduction

Soyabean (*Glacine Max (L) Merrill*) can be used as supplement for many Nigerian foods to improve the protein content of human diets. Soyabean ranks as one of the richest source of protein especially when used in combination with cereals to compensate for its sulphur amino-acids deficiencies (Odusanya, 2002). Soyabean is known to be free of cholesterol, has anti-cancer properties and its

very rich in such essential element as calcium, iron, zinc, phosphorus and various vitamins including vitamin A, B₆, thiamine, riboflavin and niacin (Table1) (Osho and Dashielly, 1998).

Edible soyabeans proteins are rarely consumed directly, but rather they are used as ingredient in foods. These foods receive additional heat treatment either during processing or cooking before consumption (Osho, 1993). According to Orlowski *et al*, (1997) vegetable protein, especially soyabean, hold promise for future human food use, soyabean yoghurt is such a product.

A key problem associated with soyabean is that it contains some anti-nutritional factors, which inhibit the availability of the desirable element such as proteins and minerals endowed in the grain (Weingartner, 1987, Osho, 1993). Commercial foods made with soyabean contain 5- 20% trypsin inhibitor, a level too small to have any adverse effects in the short time. According to Ihekorange and Ngoddy (1985), cooking improves texture and palatability quality. Certain treatment such as cooking, baking, roasting and other common means of food preparation are effective in eliminating the anti-nutritional effects of raw soyabeans. However, whole soyabean have a good balance of the essential amino-acids and are an excellent dietary source of calories, minerals and vitamins. (Table2). Eating soyabean products that is processed using the right methods (new improved innovations) will reduce malnutrition in children (Okoruwa, 2000) and promote good health in adult. Therefore, the main objective of this study is to assess the level of adoption of improved soyabean innovations in processing and utilization in human diets in the study area. Specific objectives are:

- To determine the socio-economic characteristics of the respondents
- To identify problems that is hindering the adoption of improved soyabean technologies
- To create awareness about the usefulness of soyabean in human diets through supplementation with local foods.

Materials and Methods

An investigation was carried out to assess the utilization of soyabean technologies as supplement with local foods in Bauchi Local Government Area (LGA) of Bauchi State, North eastern zone of Nigerian. The LGA falls within Northern Guinea Savannah Vegetation Zone (Keay, 1959)

Bauchi LGA lies within the western agricultural zone of Bauchi State. The western zone lies between 9°30' to 10°48'N and 8° 45' to 10° 15'E (BSADP, 1993). The study enjoys a tropical climate with long dry season period of seven months, October to April and a short wet season period of five months, May to September. The diurnal temperature varies from an average daily maximum of 31.6°C to a daily minimum of 13.1°C in January, while the relative humidity in August is 94% at 07.00. The LGA is made up of towns and villages which is the population for the study. There are no separate population figures for the towns and villages in the study area. The area has tropical soils of alluvial and colluvial origin. They are well drained and coarse textured with texture tending to the heavier sandy clay loams and clay loams for gravelly sandy loams (BSADP, 1982). Major crops grown include: sorghum, rice, groundnut, cowpea, millet, maize and soyabean. Also some vegetables and fruits are grown such as okro, *moringa*, water melon, pumpkin and carrots.

Sampling technique

Bauchi LGA was purposively selected for this study because majority of the farmers there produce and process soyabean as food for human consumption. A simple random sampling technique was used to select three villages from the LGA. These included: *Bayara*, *Miri* and *Turum*. Random cluster sampling technique was used to select 15 soyabean farmers from each village. Pilot survey was carried out in order to have an insight into the question that was really necessary for the study and as part of training programme for the numerous. This was done under close supervision. Forty five farmers were used for the study.

Data Collection

Data were collected through the use of interview schedule using trained enumerators. The schedules were designed to collect information relating to socio- economic characteristics of the respondents. These include: age, education level, household size, farm size, (in hectare (ha)), processing experience, information sources and adoption of improved soyabean processing and utilization, social participation, labour source and awareness. Twenty soyabean improved technologies (innovations) were selected for the study in relation to the local food of the people. These were: soya cheese (*awara*), soya *daddawa*, soya *kunu*, soya *yoghurt*, soya pap, soya vegetable soup, soya baby food, soya *chin-chin*, soya *kosssai*, soya bread, soya *tuwo*, soya *amala*, soya *moinmoin*, soya *danwake*, soya cake, soya *gari*, soya puff-puff and soya pancake. Hypothesis formulated stated that there is no significant effect of socio- economic characteristics of the respondents on soyabean innovation adoption.

Data analysis

Data collected were analyzed using descriptive statistics including frequencies, percentages and mean to explain and show the extent of adoption of some selected soyabean innovations and some selected socio-economics characteristics of respondents (independent variables). Multiple regression analysis was also used to measure the influence or effect of socio- economic characteristics of respondents on adoption of soyabean innovations in processing and utilization (dependent variables). Regression analysis is a body of statistical methods dealing with the formulation of mathematical models that depict relationship among variables and for the purpose of prediction and other statistical influence (Bhattachayya and Johnson, 1977).

Results

Socio- economic characteristics of the respondents

A total of 45 respondents, were interviewed from the study area. The respondents were both old and young men and women with ages ranging from 20 to 70 years. Household size ranged from 1 to 21 people, farm size ranging from 0.1 – 4ha. Majority of the farmers here were small-scale farmers. The processing experience ranged from 1 -15 years. This revealed that some of the farmers were aware of the usefulness of soyabean in human diet. (Table 3(a))

The educational status of the respondents in Bauchi LGA shows that majority have only Quranic education 58%, 22% had formal primary education, 4% had secondary, only 7% had tertiary education , while 9% had no formal education. (Table 3(b))

Table 4, shows the regression analysis result about influence of socio- economic characteristics of respondents on adoption of 20 soyabean innovations in processing and utilization. The result revealed that household size and labour were significant at $P<0.001$ and processing experience at $P<0.05$ while six predictors were not significant. Hence, the hypothesis that stated that there is no significant effect of socio- economic characteristics of farmers on adoption of improved soyabean technologies was rejected.

Extent of adoption of soyabean innovations in the study area

Table 3 shows extent of adoption of the 20 selected soyabean innovations in the study area. Soya cheese had the highest of 73% adoption, soya *daddawa* and soya *kunu* had 36% adoption each, soya vegetable soup had 24% of adoption and 7 other innovations had zero adoption, these include soya yoghurt, soya feed, soya *kossai*, soya bread, soya *amala*, soya puff-puff and soya pancake.

Discussion

The use of soyabean as supplement with local foods and extent of adoption of improve soyabean technologies in processing and utilization (innovation) was examined. Twenty selected soyabean processing and utilization were used for the study in Bauchi LGA of Bauchi State, Nigeria. In Nigeria very limited information is available on adoption of processing and utilization of soyabean foods; also on factors influence their adoption

Socio- economic characteristics of respondents on adoption of soyabean innovations in the study area.

In the study area men and women were involved in the utilization of soyabean, mostly women are involved in the processing. The descriptive analysis (Table 3 (a) shows that the age of the respondents ranged between 20 to 70 years which revealed that both young and old were involved in the soyabean utilization. The household size ranged from 1 to 21 people. Probably people with large family members prefer to use soyabean to replace meat and fish which are very costly and soyabean products are cheaper. Processing experience ranged from 1 to 15 years. This revealed that some farmers have been producing and eating soyabean for sometime, but may not know how to process it in the right way. Soyabean processing technology methods are different from local methods of processing soyabean. According to the statement of some selected women processing it, they soak it 3 to 4 hours only, which is not enough to eliminate the anti-nutritional factors in soyabean. The processing technology recommend was overnight soaking which may be up to 15 to 18 hours or even 24 hours depending on the type of soyabean products to be produced. Soaking time should be longer, while cooking time should be shorter. Excessive heating may destroy certain amino acids like lysine and cystine in soyabean. (Enwere, 1998). Cooking of soyabean is very necessary because it helps to destroy some of the anti-nutritional factors in soyabean. The soaking overnight reduces some of the anti-nutritional factors, while cooking treatments adequately eliminate the lipoxigenase and partially tenderize the beans (Osho, 1993).

Table 3(b) revealed that the majority of the respondents had only Quranic education (58%), 33% had formal education at various levels, while 9% had no formal education. Ogunbameru and

Pandey (1992) reported that formal education enhances adoption of innovations. Egbuara, (1993) and Agbamu, (1993) stated that the more education a person has the more favourable attitude he or she has towards adoption of new improved technologies.

The regression analysis result revealed that household size and labour source were positively significant at $P<0.001$. This seems to be true because every member of a family is expected to take part in the family's work or business. Soyabean processing experience was negatively significant at $P<0.05$. This probably may be due to inadequate information about new improved processing methods. Other six predictors were not significant. There may be many factors responsible for this, such as inadequate extension services, lack of land to plant soyabean or lack of funds. All these constraints may affect adoption of innovation.

Extent of adoption of improved soyabeas technologies in the study area.

Twenty soyabean innovations were selected and used to assess the extent of adoption of soyabean improved technologies in the study area. Only three out of twenty were widely adopted (soya *awara* 73%, soya *daddawa* 36 % and soya *kunu* 36%). The use of soyabean products are for alleviating malnutrition in children (Okoruwa, 2000). The goal of agricultural extension is to disseminate agricultural technologies for improving productivity, farmers' welfare are household nutritional status (Savile, 1978)

In Benue State Sanginga *et al.* (1999) reported that many farmers were aware of the utilization innovations of soyabean in the local diets. Here the adoption was very high ranging from 6.4 to 98.7% adoption from 12 soyabean innovations considered for the study. Also in another study Atala *et al*, (1992) working in Samaru Zaria showed that 80% of women adopted soyabean supplementation of soya pap and soya soup. In many other countries of the world incorporation of soyabeans in diets were adopted and disseminated by extension agents in Sri Lanka and Zambia (Nelson *et al.* 1987 and Weingartner, 1987).

Obviously, farmers need to produce soyabean in order to increase adoption of processing and utilization technologies of soyabean. There are several constraints affecting production and utilization of soyabean which need to be addressed by government and extension workers.

In conclusion, adoption of improved soyabean technologies in processing and utilization depended on a number of factors, mostly awareness, education and socio- economic characteristics of the people. Processing knowledge and extension communication programmes will increase adoption of soyabean innovations in the study area and in Nigeria as a whole. According to Atala *et al*, (1992) knowledge of extent of adoption of soyabean utilization and major factors affecting the adoption could be utilized in designing an effective extension or education programme on soyabean utilization.

227 **Table 1.** Nutritional composition of soyabean (per 100g)

	Nutrient	Value
228	Protein (%)	40
229	Carbohydrates (%)	30
230	Fat (%)	20
231	Water (%)	10
232	Calcium	226mg
233	Phosphorus	554mg
234	Iron	8.4mg
235	Vitamin A	80iu
236	Vitamin B ₁	1.1mg
237	Vitamin B ₂	0.3mg
238	Niacin	2.2mg
239	Energy (cabries)	392

240 Osho *et al.* (1995) cited by Osho and Dashiell (1998)

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242 **Table 2.** Amino acid content of soyabean (100g)

	Amino acid	Raw soyabean	Defatted flour	Protein concentrate	Protein isolates
243	Tryptophan (g)	0.53	0.68	0.83	1.11
244	Threonine (g)	1.52	2.04	2.47	3.13
245	Isoleucine (g)	1.77	2.28	2.94	4.25
246	Leucine (g)	2.97	3.82	4.91	6.78
247	Lysine (g)	2.42	3.12	3.92	5.32
248	Methionien(g)	0.49	0.63	0.81	1.13
249	Phenylalanine (g)	1.90	2.45	3.27	4.59
250	Valine (g)	1.82	2.36	3.06	4.10
251	Arginine (g)	2.83	3.64	4.64	6.67

252 FAO/ WHO (1983)

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255**Table 3(a).** Socio- economic characteristics of respondents in Bauchi LGA

256	Variables	Min.	Max	X	Sex	C.V %
	Age (in years)	26	70	48.6	1.6	0.04
257	Household size	1.0	21	9.7	0.7	0.07
258	Farm size (ha)	0.1	4	0.8	0.2	0.14
259	Processing experience	1.0	15	4.0	0.5	0.11

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263**Table 3(b).** Distribution of respondents by educational status in Bauchi LGA

265	Educational levels	Frequency	Percentage
	Quaranic education	26	58
266	Adult education	4	9
267	Primary education	10	22
268	Secondary education	2	4
269	Tertiary education	3	7

n=45

270

271 **Table4.** Regression analysis of adoption of improved soyabean technologies in processing and
272 utilization with respondent's socio- economic characteristics in Bauchi LGA

	Predicator	Coefficient	t- ratio
273	Constant	31.420	2.69
274	Age	0.024	0.28 ^{Ns}
275	Education level	-0.547	0.86 ^{Ns}
276	Household size	0.956	6.94 ^{***}
277	Farm size	-0.042	-1.18 ^{Ns}
278	Processing experience	-0.365	-2.54 [*]
279	Information source	0.063	0.03 ^{Ns}
280	Labour source	0.056	4.17 ^{***}
281	Awareness	-1.010	-0.77 ^{Ns}
282	Social participation	-2.292	-0.90 ^{Ns}

$R^2=78.1\%^*$

283 **Ns** = not significant

284 ^{*} = significant: P<0.005level

285 ^{***} = significant: P<0.001 level

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287 **Table5.** Extent of adoption of the 20 selected soyabean innovation in Bauchi LGA

	Soyabean innovations	Frequency	%
288	Processing technologies		
289	Soya cheese (awara)	33	73
290	Soya daddawa (condiment)	16	36
291	Soya milk	8	18
292	Soya kunu	16	36
293	Soya yoghurt utilization technologies	0	0
294	Soya pap	1	2
295	Soya vegetable soup	11	24

296	Soya feed	0	0
297	Soya baby food	3	7
298	Soya chin-chin	2	4
299	Soya kossai	0	0
300	Soya bread	0	0
301	Soya tuwo	2	4
302	Soya amala	0	0
303	Soya moin-moin	1	2
304	Soya danwake	2	4
305	Soya cake	2	4
306	Soya gari	1	2
307	Soya puff-puff	0	0
308	Soya pancake	0	0

References

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- 311 **Agbamu , J.U. (1993).** Analysis of farmer's characteristics associated with adoption of soil
312 management innovation in Ikorodu LGA of Lagos State. *Nigeria Journal of Agricultural Extension*,
313 *7:57-66*
- 314 **Atala, T.K, Ajia, T.D, and Olukosi, J.O. (1992).** Adoption of soyabean utilization innovations
315 among women in Samaru village of Sabon-Gari Local Government Area of Kaduna State, Nigeria.
316 *Agricultural System in Africa. 2:18-24*
- 317 **Bhattachayya, G.K. and Johnson, P.G. (1977).** Statistical concepts and methods. John Wiley and
318 Sons, New York, 636pp.
- 319 **BSADP (1982).** Development Statistics. Bauchi State Agricultural Development Projects.
- 320 **BSADP (2002).** Bauchi State in brief. Prepared by Bauchi State Agricultural Development Project
321 (BSADP), 13PP
- 322 **Egbugara, E.A. (1993).** Economic status and rural women's involvement in agriculture in Imo
323 State. *Journal of Rural Extension and Development. 1:87-93*
- 324 **Enwere, N.J. (1998).** Foods of plant origin: Processing and utilization with recipes and
325 technologies profiles. Afro –Orbis Publications Ltd., Nsukka, 301pp
- 326 **Idachaba, F.S. (1985).** Rural infrastructures in Nigeria, Ibadan. Ibadan University Press, 987pp
- 327 **Ihekoronge, A.I. and Ngoddy, P.O. (1985).** Integrated food science and technology for the tropics.
328 Macmillian Education Ltd., London and Oxford, 386pp
- 329 **Keay, R.W.J. (1959).** An outline of Nigeria vegetation, Government Printer, Nigeria, 55pp

- 330 **Nelson, A.I., Wei, L.S. and Weingartner, K.E (1987).** Home and village preparation of soya
331 products: **In:** soyabean in the tropics. S.B.Singh, K.O. Rachie and K.E. Dasheiiell (eds.) pp. 179-184
- 332 **Odusanya, R. (2002).** Powerful benefits of soyabean: Food, beverages and seasonings. Saturday
333 Punch, January 12, p.33
- 334 **Okoruwa, A.E. (2000).** Integrating crop production and utilization research to reduce malnutrition:
335 soyabean production, processing and utilization reduce malnutrition in West Africa. **Invested**
336 **Symposium Paper for the South Africa Nutrition Congress 2000, Durban, South Africa.** 5pp
- 337 **Osho, S.M. (1993).** Development soyabean Technologies for small-scale and industrial levels. **A**
338 **manual workshop on small- scale and industrial level processing of soyabean.** July, 1993,
339 Ibadan, Nigeria.
- 340 **Orlowski, J.K., Nelson, A.I. and Wei, L.S. (1979).** Efffect of formulation and processing variables
341 on the quality of soyabean yoghurt. University of Illinois, Urbana, illinois 6180. Research
342 conference II, Colorado, USA, West view Press, p34.
- 343 **Sanginga, P.C., Adesina, A.A. Manyong, V.M., Otite, O. and Dashiell, K.E. (1999).** Socia
344 impact of soyabean in Nigeria's Southern Guinea Savanna,IITA, Ibadan, Nigeria, 32pp.
- 345 **Savle, (1978).** Extension in rural communities. Amanual for agricultural and home extension
346 workers. Oxford , 148pp.
- 347 **Weingartner, K.E.(1987).** Processing, nutrition of soyabean . **In:** S.B. Singh, K.O. Rachie and
348 K.E. Dashiell (eds.) soyabean for the Tropics. John Weiley and Sons Ltd., New York, pp 149-177.
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