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Utilization of Indian spinach (*Basella* Linn.) in Ondo State, Nigeria

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This paper reports on the survey carried out among consumers on the uses of Indian spinach in Ondo State, Nigeria. Well-structured questionnaires were prepared and one hundred (100) questionnaires were randomly distributed to consumers in each of the 16 local government areas of Ondo State, Nigeria. Result showed that there are more female respondents (59.4 %) than the males (40.6%). This could have resulted from the fact that women make more informed decision on food security in homes. Most consumers are civil servants. Most consumers prefer Indian spinach to other commonly consumed vegetables and their choice is based on availability and taste. *Basella*, could be cooked sole, mixed with grounded seeds of egusi (*Citrillus lanatus*) or other vegetables. Respondents noted that Indian spinach contains carbohydrates, proteins, fats, vitamins and nutrient elements. They also noted that all the parts are useful (leaves, stems and roots) and they are useful in treatment of various ailments in folk medicine. This paper documents consumers' knowledge on *Basella* because information on consumers' knowledge of agriculture products is scarce. The researcher derived information on the genus *Basella*, uses and future prospect of the genus in the study area.

Key words: *Basella*, consumers, ethno-botany, respondents, utilization.

INTRODUCTION

Basella commonly referred to as Indian spinach is one of the traditional leafy vegetables among the Yorubas of the South Western, Nigeria. It is commonly referred to as amunututu in Yoruba language. There are three main types under cultivation (Adeyemi, 2007); *Basella alba*, *Basella rubra* and *Basella cordifolia*. Ozela et al. (2007) noted that *B. rubra* and *B. alba* were the most common species in the family Basellaceae.

Fleshy leaves of *B. alba* and *B. rubra* are used as vegetables (Adeyemi, 2007). The vegetable is rich in vitamins A, E, K, C, B_2, and B_9 (Grubben and Denton, 2004; Mensah et al., 2008). They have micro nutrients and macro nutrients and contain phytochemicals that exhibit antioxidant properties (Shruthi et al., 2012; Olajire and Azeez, 2011). *Basella* is a good source of proteins, calcium, iron and it lacks tannins (Palada and Chang, 2003; Roy et al., 2010). Kayode and Ige (2008) reported that the leaves and shoots of *B. alba* are used to cure boils and hot flushes in Ijesa land in Nigeria. Ethno-botanical uses of *B. alba* are well documented in

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Table 1. Socio-economic profiles of consumers.

Variable	Frequency	Percentage
Sex		
Male	637	40.6
Female	933	59.4
Total	1570	100
Ages in years		
15 - 24	310	19.7
25 -34	465	29.6
35 - 44	532	33.9
45 - 54	212	13.5
55 - 64	34	2.2
64 and above	17	1.1
Total	1570	100
Marital status		
Single	390	25.4
Married	1057	69.3
Divorced	56	2.9
Separated	22	1.4
Widowed	46	2.9
Total	1570	100
Educational attainment		
Primary 6, modern school, no formal education	171	10.9
OL/GCE/Grade 2	337	21.5
NCE/OND	459	29.2
HND/B.A/B.Sc/B.Ed	540	34.4
M.Sc/M.A/M.Ed/Ph.D.	63	4.0
Total	1570	100
House hold size		
1-5	1361	86.7
6-10	184	11.7
Above 10	25	1.6
Total	1570	100
Occupation		
Farming	253	16.1
Artisan	174	11.1
Trading	442	28.2
Civil Servant	548	34.9
Professional	153	9.7
Total	1570	100
Income per month		
< ₦5,000	124	7.9
₦6, 000 - 10,000	188	12.0
₦ 11,000 - 15,000	288	18.0
₦ 16,000 - 20,000	231	14.7
>₦ 20,000	745	47.5
Total	1570	100

Source: Field survey, 2012.

literatures (Shrutti et al., 2012).

Haghiri et al. (2009) reported on consumers' low levels of awareness of agricultural production services and the need to raise public awareness and understanding of technologies in order to foster consumers' acceptance. Chamberlain et al. (2013) pointed out that consumers are less informed about agricultural products. This paper documents consumers' knowledge on the utility values of *Basella* because information on consumers' knowledge of agriculture products is scarce. The level of knowledge of the ecology and reproductive of edible species combined with their use (the frequency of consumption and market value) and their biological characteristics (life forms, availability periods) assist to shape their management or procurement practices in community, households and among individuals.

MATERIALS AND METHODS

Well-structured questionnaires were prepared and validated at the Department of Sociology and Anthropology, Faculty of Social Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria. Sampling was done in Ondo State of Nigeria where it is eaten largely. There are 18 local government areas in the state however sixteen out of the eighteen local government areas were used for this study. The two local government areas that were not used for the ethno-botanical studies are Ilaje and Eseodo. These are located in the riverine areas of the state, where the main occupation is fishing. One hundred (100) questionnaires were randomly distributed to consumers per local government area. Questionnaires were distributed between the hours of 10.00 am - 6.00 pm on working days and 8.00 am and 6.00 pm on weekends. Data collected were analyzed using simple descriptive statistics.

RESULTS AND DISCUSSION

Table 1 shows the sex of consumers. 40.6% were males while 59.4% were females. This shows that there are more female consumers. The table shows that 19.7% the consumers were between the ages of 15-24 years, 29.6% were between the ages of 25-34 years, 33.9% of the respondents were between the ages of the ages of 35-44 years; 13.7% were between the ages of 45-54 years, 2.2% were between the ages of 55-64 years while 1.1 % of consumers were 65 years of age and above. Table 1 also shows that singles constitutes 25.4% of the respondent, 67.3% were married, 2.9% were divorced, 1.4% were separated and 2.9% were widowed. This study indicated that there are more married consumers than the singles. The table reveals that 10.9% of the respondents had either primary 6, modern school certificate or no formal education. 21.5% of respondents had OL/GCE/Grade II, 29.2% had NCE/OND and 34.4% had HND/B.A/B.Ed while 4.0% had M.Sc /M.A M.Ed and Ph.D. The majority of the respondent on this study had HND/B.Sc/B.A/B.Ed; showing that there are more of literate consumers and who are civil servants (34.9%) and earn above ₦20, 000.00 (47.5%). Ahmad et al.

Table 2. Consumers knowledge of *Basella* varieties.

Variety of *Basella* known	Frequency	Percentage
One	55	3.5
Two	1389	88.5
Three	121	7.7
Four	5	0.3
Total	1570	100

Source: Field survey, 2012.

(2007) noted that education is one of the most important factors in acceptance, rejection, adoption and dissemination of useful information to other fellows for their benefits.

The house hold size of majority of the consumers interviewed as shown in Table 1 reveals that most house hold size is between 1-5 (86.7%); 11.7% had house hold size of 6-10, while only 1.6% of the consumers have house hold size greater than 10. This study shows that majority of the respondent have 1-5 house hold size and this within the recommended household size of 4 per family. The small household size identified with the consumers is likely to be related to the literacy level of the respondents.

Table 1 also shows that 16.1% of the respondents were into farming, 11.1% were artisan, 28.2% were traders, 34. 9% were civil servant, 9.8% were professional. This study shows that most consumers of *Basella* were civil servant. Table 1 show that the income of 7.9% of the consumers was below ₦ 5,000, 12.0% of the consumers earned between ₦ 6,000 to ₦ 10.000, 18.0% have income between ₦ 11,000 to ₦ 15,000, 14.7% earn between ₦16,000-₦ 20,000 while 47.5% had above ₦20, 000. Majority of the consumers earned above ₦ 20,000. This may be due to the fact that most of the consumers are civil servants.

Table 2 shows that 3.5% of the consumers indicated that they knew only one variety; 88.5% of consumers know two varieties; 7.7% indicated that they knew three varieties while 0.3% indicated that they knew four. From this study, majority of respondents noted that there are two varieties.

Table 3 shows the ethno botanical uses of *Basella.* 91.0% of the consumers reported that *Basella* is used for fertility enhancement; 94.7% of the consumers indicated that it is used for the treatment of diabetes; 91.8% of the consumers indicated that it is used for the treatment of dysentery. 95.9% of the consumers showed that *Basella* is used in the treatment of constipation while 4.1% of the consumers indicated that it is not used for treating constipation. 86.8% of the consumers interviewed indicated that *Basella* is used for the treatment of rheumatism. 93.7% of the consumers indicate that *Basella* is used for the treatment of cold while 6.3% indicated that it is not used for the treatment of cold. 91.8% of the consumers indicated that *Basella* is used for the treatment of boils and blisters while 8.2% of the consumers noted that it is not used. This study shows that 61.3% of the consumers noted that *Basella* is used for the treatment of gonorrhea while 38.7% indicated that it is not used for the treatment of gonorrhea. 95.8% of the respondents indicated that *Basella* is used for the treatment of hot flushes or internal heat while 4.3% indicated that it is not used for treatment of hot flushes or internal heat.

Table 4 shows consumers preference with regard to the varieties of *Basella* available. 41.7 and 58.3% male and female, respectively showed their preference for the green stemmed form (*B. alba*) 36.3 and 63.7% of males and female respectively showed their preference for red stemmed form (*B. rubra*) while 38.0 and 62.0% male and female, respectively, indicated that they could take any of two varieties. 73.5% of the respondents indicated their preference for *B. alba*, 19.5% indicated their preference for *B. rubra* while 7.0% indicated that any of two varieties can be taken by them.

The Chi square (Table 5) shows that there is no relationship between the choice of *Basella* variety and gender. Table 6 shows that the choice of the variety of *Basella* that is consumed is determined by sweetness, easy digestibility, availability and medicinal importance. 84.8% of the respondents indicated that the variety of *Basella* they eat is determined by its sweetness; 60.3% noted that that their choice is determined based on easy digestibility; 67.8% of respondents indicated that the choice is determined by its medicinal importance and 25% noted that availability is a factor that determines the choice of *Basella*.

B. alba and *B. rubra* are localized vegetables because each locality has a particular type of vegetable her people eat. The forms of *Basella* sown and consumed by consumers have resulted from different agronomic practices, availability of the seeds and market demand for the vegetable. Adeyemi (2007) reported that *B. alba* is preferred to *B. rubra* from survey carried out in Ondo State and the reasons include availability, easy digestibility and attractiveness.

Table 7 shows the price of quantity that will be adequate for a family of four. 28.7% of consumers indicated that ₦50 worth of the vegetable will be adequate, 55.5% of the consumers indicated ₦100 worth, 13.9% indicated ₦150 worth while 1.9% indicated that above ₦150 worth will be available and majority of the respondent noted that ₦100 worth of vegetable is adequate for a family of four. This indicates that the vegetable is a means to ensure food security in homes.

Table 8 shows the relationship between the educational status of consumers and the quantity of *Basella* consumed by a family of four. Among consumers with indicated that ₦50 worth of *Basella* was adequate for a family of four, 46.4% indicated ₦ 100 worth; 7.8% of the

Table 3. Consumers' knowledge of the ethno-botanical uses of *Basella*.

Use	Frequency of yes	Percentage of yes	Frequency of no	Percentage of no
Fertility enhancement	1429	91.0	141	9.0
Treatment of diabetes	1487	94.7	83	5.3
Treatment of dysentery	1442	91.8	128	8.2
Treatment of constipation	1505	95.9	65	4.1
Treatment of rheumatism	1362	86.8	208	13.2
Treatment of cold	1471	93.7	99	6.3
Treatment of boils and blisters	1442	91.8	128	8.2
Treatment of gonorrhea	963	61.3	607	38.7
Treatment of hot flushes or internal heat	1504	95.8	66	4.2

Source: Field survey, 2012; *multiple choices allowed.

Table 4. Consumer's varietal choice.

Forms preferred for consumption	Sex		
	Male	Female	Total
Green stemmed (frequency)	475	665	1140
(Percentage)	41.7	58.3	100
Red stemmed (frequency)	110	103	303
(Percentage)	36.3	63.7	100
Any of the two (frequency)	41	67	108
(Percentage)	38.0	62.0	100
Total (frequency)	626	925	1551
(Percentage)	40.4	59.6	100

Source: Field survey, 2012.

Table 5. Chi-square test to show the relationship between choices of *Basella* forms and gender.

Chi-square test	Value	df	Assump. Sig (2 sided)
Pearson Chi square	3.326[a]	3	0.344
Likely hood ratio	3.361	3	0.339
Linear by linear Association	1.845	1	0.174

Source: Field survey, 2012.

Table 6. Criteria for choosing forms of *Basella*.

Criteria	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Sweetness	1331	84.8	239	15.2
Easy digestibility	947	60.3	623	39.7
Availability	392	25.0	1178	75.0
Medicinal	1065	67.8	505	32.2

Source: Field survey, 2012; *Multiple choices allowed.

Table 7. Price of quantity of *Basella* adequate for a family of four.

Price of quantity	Frequency	Percentage
₦50	444	28.7
₦100	859	55.5
₦150	216	13.9
Above ₦150	30	1.9
Total	1549	100

Source: Field survey, 2012.

Table 8. Relationship between educational status and worth in naira of *Basella* consumed.

Highest education status	Price of quantity adequate for a family of four				
	₦50	₦100	₦150	>₦150	Total
Primary six/modern school certificate/no formal education	70 42.2%	77 46.4%	13 7.8%	06 3.6%	166 100
OL/GCE/GRD 2	85 25.8%	200 60.6%	38 11.5%	07 2.1%	330 100
NCE/OND	129 28.4%	259 57.0%	61 13.4%	05 1.1%	454 100
HND/B.A/B.Sc/ B. Ed	141 26.9%	291 55.5%	84 16.0%	08 1.5%	524 100
M.Sc /M.A/M.Ed/Ph.D	15 23.8%	25 39.7%	20 31.7%	03 4.8%	63 100
Total	440 28.6%	852 55.4%	216 14.1%	29 1.9%	1537 100

Source: Field survey, 2012.

respondent noted that ₦150 worth is okay while 3.6% primary six/modern school/no formal education, 42.2% noted that above ₦150 worth is required.

Among respondents having OL/GCE/Grd 2, 25.8% indicated that N50 worth is adequate, 60.6% noted that ₦100 worth is adequate 11.5% noted that ₦150 worth is adequate and 2.1% noted that above N150 worth of *Basella* is adequate to feed the family of four. Among NCE/OND older, 28.4% indicated that ₦50 worth of *Basella* is adequate for a family of four, 57.0% noted that ₦100 worth is adequate and 13.4% noted that ₦150 worth is adequate and 1.1% noted that above ₦150 worth is adequate for a family of four among the HND/BSC/B.A/B.ED, 26.9% noted that ₦50 worth is adequate for a family of four, 55.5% indicated that ₦100 worth is adequate for consumption,16.0% noted that ₦150 is okay and 1.5% noted that above ₦150 is adequate for a family of four. Among the M.Sc/MA/M.Ed /Ph.d, 23.8% noted that ₦50 worth is adequate for consumption, 39. 7% noted that ₦100 worth is adequate, 31.7% noted that ₦150 worth of *Basella* is adequate for consumption and 48% indicated that above ₦150 is required for a family of four, In this study, majority of the respondent irrespective of their educational status indicated that ₦100 worth of *Basella* is needed for consumption by a family of four. Among respondents having M.Sc\MA\M.Ed\Ph.d.; there was an increase in percentage of respondents (31.7%) who noted that N150 worth was adequate for consumption. There is a sharp increase in the trend among respondents that indicated that ₦150 worth of vegetable is adequate. This may be due to better information that they have on the benefit derived from eating vegetables and better income.

Chi square tests (Table 9) show the relationship

Table 9. Chi square tests to show the relationship between the quantities of *Basella* consumed and educational attainment of consumers.

Chi square test	Value	df	Assump. Sig (2 sided)
Pearson Chi square	48.746[a]	12	0.000
Likely hood ratio	43.951	12	0.000
Linear by linear association	10.971	1	0.001

Source: Field survey, 2012.

Table 10. Ways of preparing *Basella* for consumption.

Way	Frequency	Percentage
Sole	67	4.3
Cooking with melon	1358	86.5
Boil and add stew	122	7.8
Mixed with other vegetables	23	1.5
Total	1570	100

Source: Field survey, 2012.

Table 11. Percentage desirability of *Basella* and other commonly eaten vegetables.

Vegetables	Most desired (%)	Average (%)	Little (%)
Basella	53.1	29.7	5.20
Celosia	3.10	13.1	46.1
T. triangulare	4.00	18.2	25.1
Telfaria occidentalis	39.8	42.5	17.7

Source: Field survey, 2012; *Multiple responses allowed.

Table 12. Reasons for consumers' ranking.

Reason	Frequency	Percentage
Desirability	856	54.5
Medicinal	204	13.0
Nutritional	214	13.6
Availability	296	18.9
Total	1570	100

Source: Field survey, 2012.

between quantity of *Basella* consumed and educational attainment. The quantity consumed is not dependent on the educational attainment.

Table 10 shows the methods of preparing *Basella* for consumption. Forty three percent of the consumers indicated that *Basella* is cooked alone (sole); 86.5% cook *Basella* with melon; 7.8% boil and add stew and 1.5% of the consumers mix *Basella* with other vegetables. The level at which consumers desire *Basella* and other commonly eaten vegetables is shown in Table 11. 53.1% of the respondents indicated that they desire *Basella* most, 29.7% of the respondents indicated average desirability and 5.2% of the respondents showed little desirability for *Basella*. With respect to *Celosia argentea* most desirability was shown by 3.1% of the respondents, 13.1% indicated average desirability and 46.1% indicated little desirability. As for *Talinum triangulare*, 4.0% of the respondents indicated it is their most desired vegetable, 18.2% indicated average desirability, and 25.1% showed little desirability. With respect to *Telfaria occidentalis* most desirability was shown by 39.8% of the respondents, 42.5% indicated average desirability and 17.7% indicated little desirability.

This study shows that majority of consumers desired *Basella* most. Table 12 shows that majority of consumers made the choices between the vegetables based on their desire (54.5%); 13% based their choice on the medicinal value of the vegetable; 13.6% of the respondents based their choice on nutritional value of the vegetable and; 18.9% based their choice on the availability of the vegetable. Table 13 shows the consumers' knowledge of nutrient constituents of *Basella.* 20.3% of the respondents noted that there is trace element in *Basella*. 92.8% of the respondents noted that vitamins are present in *Basella*, 2.2% noted that there is carbohydrate in *Basella* while 88.8% noted that *Basella* contains protein. From this study, majority of the consumers are aware that proteins and vitamins are present in the vegetable. This results shows that the awareness of the presence of micro and macro nutrient element in *Basella* should be created. This will improve the consumption and cultivation of *Basella.*

Conclusion

This study has been able to fill the knowledge gap with regards to documenting the utilization of *Basella* in the study area. Haghiri et al. (2009) reported on consumers' low level of awareness of agricultural production services and the need to raise public awareness and understanding of technologies in order to foster consumers' acceptance. Chamberlain et al. (2013) pointed out that consumers are less informed about agricultural products. The result shows the need to create awareness of utilitarian value of the vegetable. The level of know-

Table 13. Consumers knowledge of nutrient elements in *Basella*.

Nutrient constituent	Frequency of yes	Percentage of yes	Frequency of No	Percentage of No	Total
Trace element	319	20.3	1251	79.7	1570
Vitamins	1457	92.8	113	7.2	1570
Carbohydrates	34	2.2	1536	97.8	1570
Proteins	1394	88.8	176	11.2	1570

Source: Field survey, 2012; *Multiple responses allowed.

ledge of their use (the frequency of consumption and market value) combined with the ecology and reproductive of edible species and their biological characteristics (life forms, availability periods) assist to shape their management or procurement practices at community, households and individual levels.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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