

**PERCEIVED NUTRITIONAL AND MEDICINAL VALUES OF *MORINGA OLEIFERA* (ZOGALE)  
AMONG RURAL DWELLERS OF KATSINA STATE, NIGERIA**

<sup>1</sup>Ikwuakam, O. T., N. S. Sangotegbe<sup>2</sup>, and L. A. Akinbile<sup>2</sup>

1. Federal College of Education, Katsina, Nigeria
  2. Department of Agricultural Extension and Rural Development, University of Ibadan, Ibadan, Nigeria
- E-mail: ikwuosca@yahoo.com

**ABSTRACT**

*The study investigated perceived nutritional and medicinal values of Moringa oleifera among rural dwellers in Katsina State. A total of 140 rural dwellers were sampled through a multi-stage sampling technique. Frequency counts, percentages and means were used in presenting the data analysed, while Chi-Square and Pearson Product Moment Correlation were used to test the hypotheses. Result of analysis reveals that average age and household size were  $41.96 \pm 13.23$  and  $8.54 \pm 3.69$ . Majority were married (85.0%) while 47.1% had Quranic education. The study further reveals that majority (98.6%) had eaten Moringa in the past 20 years. Radio (mean = 2.27) friends (mean = 2.19) and health centres (Mean = 1.69) were the common sources of information on the benefits of Moringa. The level of awareness on the nutritional and medicinal values of Moringa was high among majority (67.1%). More than half (53.6% and 57.9%) perceived the medicinal (53.6%) and nutritional (57.9%) benefits of Moringa to be high. Religion ( $\chi^2 = 6.507$  and  $5.861$ ), level of exposure to information ( $r = 0.237$  and  $0.332$ ) and level of awareness ( $r = 0.484$ ; and  $0.383$ ) on benefits of Moringa had a significant relationship with respondents' perceived nutritional and medicinal benefits of the plant. The study concludes that awareness creation through various communication channels have been effective in enlightening respondents on the values Moringa*

**Key words: Medicine, nutrition, Moringa, rural dwellers, Katsina state**

**INTRODUCTION**

*Moringa oleifera* (horseradish tree in English) is a tropical tree crop whose numerous socio-economic applications and its propagation is arousing growing national and international interest. Other common names of *Moringa oleifera* include radish tree, drumstick, West India Ben, and Benzoline in French, Zogale in Hausa, Gawara in Fulfulde, *OkweOyiboin* Igbo, and *Ewe Igbale* in the Yoruba language.

As an edible plant, it has a wide variety of medicinal and nutritional virtues that have been attributed to its roots, bark, leaves, flowers, fruits and seeds (Kumar *et al.*, 2010 and Anwar *et al.*, 2007). According to Rebecca *et al.*, (2006), *Moringa*news (2008) and Verma *et al.*, (2009)

*Moringa* tree is cultivated and used as a vegetable (leaves, green pods, flowers, roasted seeds), for spice (mainly roots), cooking and cosmetic oil (seeds) and as a medicinal plant (all plant organs). Phytochemical analysis have also shown that its leaves are particularly rich in potassium, calcium, phosphorous, iron, vitamins A and B, essential amino acids as well as such known antioxidants such as B-carotene, vitamin C and flavonoids (Amaglo *et al.*, 2010 and Gowvishankar *et al.*, 2010).

It is also a perennial plant, which has been found to possess high socio-economic and cultural values in many countries of the world. In Malaysia, the seed is eaten like a peanut, thickened root used as substitute for horseradish while the foliage is

eaten as greens and in salads, vegetable curries as pickles and for seasoning (Morton 1991). Also the root in Nicaragua and India is used as good remedies for tumours and dropsy and as having not only high nutritional and medicinal values but also possesses mystical power to prevent about 300 diseases (Duke 1978)

However, among the Hausas of Nigeria, *Moringa oleifera* (zogale in Hausa) are consumed adequately, planted around homes to provide fence and on graves to prevent hyenas from exhuming corpse (Dixon, 2009). It is thus perceived as a sacred tree that has the potential to protect the living and the dead as well as numerous socio-economic values (Dixon 2009). Although what is not certain in literature is information on the perception of rural dwellers on the nutritional and medicinal values of *Moringa oleifera* in Katsina State. Thus there is need to examine the perception of rural dwellers in Katsina state on the nutritional and medicinal values of *Moringa oleifera* (Zogale). In order to achieve this goal, the following specific objectives were outlined in the study. They were to:

1. examine the socio-economic characteristics of the respondents
2. identify respondents' sources of Information on the nutritional and medicinal values of *Moringa oleifera*
3. determine respondents' awareness on nutritional and medicinal values of *Moringa oleifera*
4. describe respondents' perception on the nutritional and medicinal values of *Moringa oleifera*

The hypotheses stated that;

I There is no significant relationship between selected personal characteristics of the respondents and their perception on the nutritional and medicinal values of *Moringa oleifera*;

II There is no significant relationship between respondents' source of information and their perception on the nutritional and medicinal values of *Moringa oleifera*; and that

III There is no significant relationship between respondents' awareness and their perception on the nutritional and medicinal values of *Moringa oleifera*

## METHODOLOGY

The study was carried out in Katsina state. Katsina State is located in the North-Western region of Nigeria. The state, covers an area of 23,938 sq. km and is located between latitudes  $11^{\circ}08'N$  and  $13^{\circ}22'N$  and longitudes  $6^{\circ}52'E$  and  $9^{\circ}20'E$ . The state is bounded by Niger Republic to the north, by Jigawa and Kano States to the east, by Kaduna State to the South and by Zamfara State to the West. Katsina State has rich cultural values with annual rainfall ranging from 800mm to 1000mm.

Katsina State has a total of 34 Local Government Areas, out of which about 16 are rural. Therefore, the 16 rural LGAs were purposively selected for the study. Of the 16 LGAs selected, a total of 4 LGAs (25%) were selected using simple random sampling technique. These are Batagarawa, Dutsin-ma, Batsari and Mashi. The third stage involves random sampling of 7 communities in the LGAs selected; two communities in each, except in Batsari, where only one was selected. Snowball was then used to generate a list of households who have *Moringa* tree on their lands. An average of 50 households in each community was therefore generated. A total of 20 *Moringa* farming households were therefore selected across the 7 communities. The unit of analysis was the household head.

A structured interview schedule containing questions ranging from the respondents' socio-

economic characteristics, sources of information, awareness and perception on the nutritional and medicinal values of *Moringa oleifera* was used to collect data for the study. Frequency of accessing information on the benefits of *Moringa* were measured as respondents indicated whether it was always (3), occasionally (2), rarely (1) or never (0). Awareness of the nutritional and medicinal values of *Moringa* was also determined as respondents indicated if they were aware (1) or not aware (0) for each of the awareness statements. For perceived nutritional and medicinal values of *Moringa*, a five-point Likert-Type scale was used to assess respondents' level of agreement to each of the medicinal and nutritional values of *Moringa*. A score of 5, 4, 3, 2 and 1 was assigned to each strongly agree, agree, undecided, disagree and strongly disagree, for positively worded statements and a reverse for negatively worded statements. An index of each of sources information, awareness and perceived benefits was computed, and used for testing the hypotheses involving these variables. The mean awareness of the values of *Moringa*, as well as their perceived values were obtained and used to categorize respondents level of awareness and perceived values into high and favourable ( $\geq$  mean score) and Low and unfavourable ( $<$  mean score) respectively. Frequency counts, percentages and means were used in describing the data, while Chi-Square and PPMC were used to test the hypothesis 1, and hypotheses 2 and 3 respectively.

## RESULTS AND DISCUSSION

**Table 1: Personal characteristics of Households in the study area**

Variable	Frequency	Percentage	Mean $\pm$ SD
<b>Age</b>			
$\leq 30$	40	28.6	40.96 $\pm$ 13.22
31-40	40	28.6	
41-50	27	19.3	
51-60	22	15.7	
61-70	9	6.4	
$>70$	2	1.4	
<b>Sex</b>			
Male	87	62.1	

### Personal characteristics of rural households

The result of analysis reveals that the average age of respondents was 41 years, as 28.6% were less than or equal to 30 years, the same proportion also aged 31-40 years old. This reveals that households in the rural areas of Katsina State comprised of more young household heads than their old counterparts. The study further revealed that majority of the households in the state was male-headed. Ekong (2003) also found that there are more male household heads of active productive age in the rural areas of southwest Nigeria than females. Distribution by religion shows that 95.0% of the respondents belonged to the Islamic faith, with very few found in Christianity and traditional religion. Results further showed that majority were married, with an average household size of 9 members. About 47.1% of the respondents had quranic education, while very few had attended tertiary and secondary education. Results further reveals that 98.6% consumed *Moringa* in one form or the other as revealed that about 69% of the respondents had been consuming *Moringa* for more than 20 years. However, it was most commonly cooked with groundnut cake, tomato and onions (Figure 1), as respondents rarely consumed it with yam (4.3%), as tea (9.3%) or dried and mixed with palp (3.6%). The result (Figure 2) shows that respondents sourced *Moringa* from own farms (60.0%) and market (52.9%) attests to the fact that the crop is readily available in rural areas of Katsina State.

Female	53	37.9	
<b>Religion</b>			
Christianity	6	4.3	
Islam	133	95.0	
Traditional	1	0.7	
<b>Marital Status</b>			
Married	119	85.0	
Single	18	12.9	
Divorced	3	2.1	
<b>Household Size</b>			
1-4	25	17.9	8.54 ± 3.69
5-8	42	30.0	
9-12	50	35.7	
13-16	23	16.4	
<b>Ethnic Group</b>			
Yoruba	2	1.4	
Igbo	13	9.3	
Hausa	121	86.4	
Others	4	2.9	
<b>Educational Attainment</b>			
No formal Education	11	7.9	
Primary Education	12	8.6	
Secondary Education	19	13.6	
Tertiary Education	18	12.9	
Postgraduate Education	14	10.0	
Quranic Education	66	47.1	
<b>Source of Moringa</b>			
Market	74	52.9	
Own farm	84	60.0	
Friends	6	4.3	

Source: Field survey, 2013

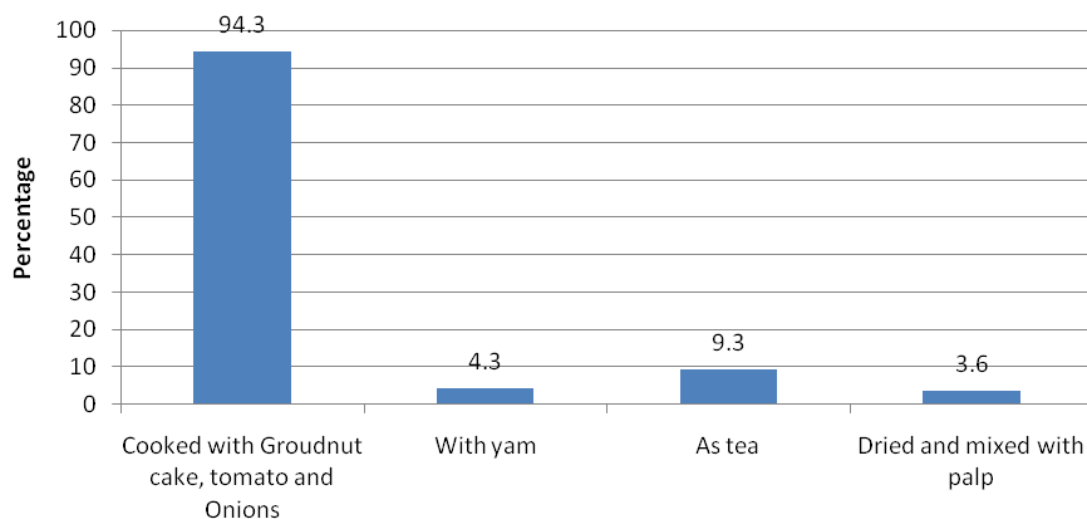


Fig. 1: Forms of consumprion of Moringa

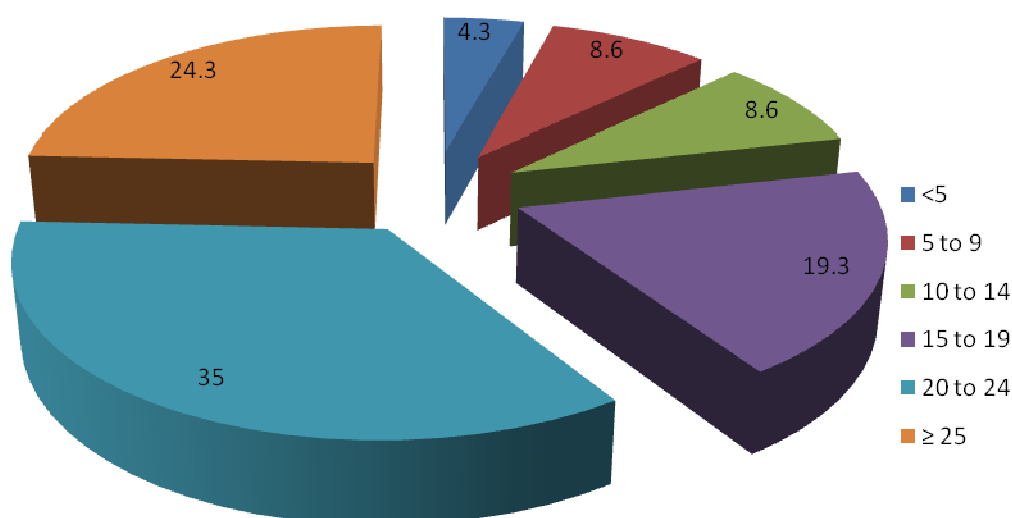


Fig. 2: Percentage No of years of Moringa consumption

#### Sources of information on the nutritional and medicinal values of *Moringa* (zogala)

Investigating the source of information used by respondents on the medicinal values of *Moringa*, the study (Table 2) reveals that radio (mean = 2.27), friends (Mean = 2.19), mosques (Mean = 1.30) and health centres (Mean = 1.69). The least used sources of information were churches (mean = 0.02), magazines/newspapers (Mean = 0.39) and

Internet (mean = 0.37). While the use of internet among respondents may be limited, due to their low educational qualification and availability of service, awareness of the various benefits can be channelled through religious organisations, especially, Islam, to which majority were members. Religion has a way of influencing decision and perception towards a particular innovation.

Table 2: Sources of Information on the nutritional and medicinal values of *Moringa* (zogala)

Sources	Always		Occasionally		Rarely		Never		Mean	Rank
Radio	81	57.9	25	17.9	25	17.9	9	6.4	2.27	1 <sup>st</sup>
Television	26	18.6	33	23.5	19	13.6	62	44.3	1.16	5 <sup>th</sup>
Community health extension workers	19	13.6	24	17.1	45	32.1	52	37.1	1.07	7 <sup>th</sup>
Friends	72	51.4	35	25.0	20	14.3	13	9.3	2.19	2 <sup>nd</sup>
Health Centres	57	40.7	21	15.0	24	17.1	38	27.1	1.69	3 <sup>rd</sup>
Magazines/Newspapers	2	1.4	19	13.6	10	7.1	109	77.9	0.39	8 <sup>th</sup>
Churches					4	2.9	136	97.1	0.02	10 <sup>th</sup>
Mosques	6	4.3	120	85.7	12	8.6	2	2.4	1.30	4 <sup>th</sup>
Association	25	17.9	28	20.0	26	18.6	61	43.6	1.12	6 <sup>th</sup>
Internet	10	7.1	8	5.7	6	4.3	116	82.9	0.37	9 <sup>th</sup>

Source: Field survey, 2013

#### Awareness of the nutritional and medicinal values of *Moringa*

Awareness is a necessary step towards having perception to a particular issue. The study reveals (Table 3) that the respondents were aware of most nutritional and medicinal values of *Moringa*. The

study reveals that 88.6% were aware of *Moringa* blood purification functions, while 86.4% were aware that *Moringa* is an important source of protein. This suggests that the various sources of information available to the rural dwellers were effective enough in creating awareness to the

respondents on efficacies of *Moringa*. However, majority (73.6%) of the rural dwellers were not aware that *Moringa* contains antioxidants that can prevent or delay complications from HIV/AIDS and that it can be used as anti-inflammatory supplements (51.4%). On the overall, (Table 4) the study further reveals that the level of awareness of

the nutritional and medicinal values of *Moringa* was high among 67.1% of rural dwellers of Katsina State. The result is in consonance with the findings of Odeyinka *et al* (2007) that most farmers in South-western Nigeria have knowledge of either planting or utilizing *Moringa oleifera* for its various values.

**Table 3: Distribution of respondents' awareness of nutritional and medicinal benefits of *Moringa oleifera***

Awareness	Aware		Not aware	
	F%	%	F	%
Source of vitamins A, B, C and E	122	87.1	18	12.9
Good source of Calcium, Iron, Zinc, Potassium, Magnesium.	111	79.3	29	20.7
Contains amino acids	99	70.7	41	29.3
Used as supplements in diets	117	83.6	23	16.4
Prevents anemia in adults and children	90	64.3	50	35.7
Lowers cholesterol reading of patients	90	64.3	50	35.7
Prevents malnutrition	116	82.9	24	17.1
Has blood purification value	124	88.6	16	11.4
Used to treat diabetes	101	72.1	39	27.9
Contains antioxidants that can prevent or delay complications from HIV/AIDS	37	26.4	103	73.6
Good source of protein	121	86.4	19	13.6
Supplements to diet of pregnant and nursing women	118	84.3	22	15.7
Alternative treatment to boost immunity	97	69.3	43	30.7
Anti-inflammatory supplements	68	48.6	72	51.4

Source: Field survey, 2013

**Table 4: Level of awareness of respondents on the nutritional and medicinal benefits of *Moringa oleifera***

Level Awareness	Range of scores	F	%	Mean	SD	Minimum	Maximum
High	1.0 – 9.0	94	67.1	10.08	2.82	1.00	14.00
Low	10.0 – 14.0	46	32.9				

Source: field survey, 2013

#### Perceived nutritional and medicinal values of *Moringa*

Results of perceived nutritional benefits of *Moringa* are outlined in Table 5. The study reveals that respondents were favourably disposed to the following values as indicated by their mean values; good for making seasoning (4.53), *Moringa* oil is good for human health (4.51), it contains high level of nutrients in correct proportion (4.49) and that it serves as a very good energy booster (4.47). Also, respondents perceived favourably, the statement that *Moringa* strengthens the immune system to protect the body against infection, has antibiotic

properties which is effective against many infectious organisms, and that *Moringa* provides a natural alternative for controlling diabetes than even artificial therapies as indicators of medicinal values. The result is supported by the findings of Farooq *et al.*, (2007) that various parts of the plants contain a profile of important minerals, and is a good source of protein, vitamins,  $\beta$  – carotene, amino acids and various phenolics. The leaves, roots, seed, bark, fruit, flowers and immature pods were also perceived to act as cardiac and circulatory stimulants and possessing anti-tumour (Makonnen *et al.*, 1997), antipyretic, antiepileptic,

anti-inflammatory, anti-ulcer (Pal *et al.*, 1995a), anti-hypertensive (Dahot, 1988), cholesterol lowering (Mehta *et al.*, 2003), antioxidant and anti-diabetic, (Ruckmani *et al.*, 1998), antibacterial and antifungal activities (Nickon *et al.*, 2003).

On the other hand, respondents were not favourably disposed to using *Moringa* as an alternative to medical advice in case of snake bites (2.13), using *Moringa* to cure tumour growth (2.33) and hypertension (2.46). The study, summarizing the respondents perceived nutritional (Table 6a) and medicinal (Table 6b) values of *Moringa* reveals (Table 6) that slightly above half (53.6%)

of respondents had favourable perception of the nutritional values of *Moringa*, implying slightly less than a half had unfavourable perceived nutritional values. The results further reveals that 57.9% of rural household had favourable perceived nutritional values of *Moringa oleifera* in the study area. This therefore suggests that awareness of the nutritional and medicinal values of *Moringa* did not completely translate to favourable perception of these benefits. This could mean that rural dwellers express doubts over the efficacy of *Moringa* in handling some of their serious health conditions, as indicated in Table 6.

**Table 5: Distribution of respondent' perceived nutritional and medicinal values of *Moringa***

Values	SA	A	U	D	SD	Mean	Status
<b>Health values</b>							
A very good source of all amino acids	52.9	25.7	17.1	4.3		4.27	F
Helps in food digestibility	59.3	20.7	14.3	2.9	2.9	4.31	F
Very good natural energy booster	65.0	21.4	10.7	1.4	1.4	4.47	F
Provides good nourishment by supplying all essential nutrients to the body.	48.6	39.3	10.7	1.4		4.35	F
<i>Moringa</i> cannot make a good tea	4.3	26.4	30.7	14.3	24.3	2.72	U
<i>Moringa</i> is good for making food seasoning	60.0	32.9	7.1			4.53	F
<i>Moringa</i> oil is good for human health	64.3	25.7	7.1	2.9		4.51	F
It contains a high level of nutrient in correct proportion	62.1	26.4	10.0	1.4		4.49	F
It provides good nutritional supplement for HIV/AIDS patients	19.3	15.7	29.3	20.0	5.7	3.23	U
<i>Moringa</i> will rather pollute than purify water	30.7	16.4	20.7	22.9	9.3	2.64	U
<b>Medicinal values</b>							
<i>Moringa</i> has antibiotic properties, which is effective against many infectious organisms	58.6	22.1	7.9	1.4		4.38	F
Strengthens the immune system to protect the body from infections	50.0	35.7	12.9	1.4		4.34	F
Cures headaches and migraines with high effectiveness and immediacy.	14.3	28.6	35.7	21.4		3.36	U
Used to cure asthma with little or no side effects	26.4	15.0	39.3	14.3	5.0	3.44	U
Provides good alternative in the treatment of rheumatism	26.4	17.9	40.0	10.7	5.0	3.50	U
<i>Moringa</i> cannot restrict tumour growth in any way	27.1	23.6	41.4	5.0	2.9	2.33	U
Hypertension is a very strong disease that cannot be managed by <i>Moringa</i>	32.9	22.9	12.9	28.6	2.9	2.46	U
Provides a natural alternative for controlling diabetes than even artificial therapies	42.1	30.7	17.1	8.6	1.4	4.04	F
Cannot prevent human body from malaria infection	15.7	22.1	40.7	19.3	2.1	2.70	U
That <i>Moringa</i> can detoxify the body are all lies	15.7	16.4	29.3	31.4	7.1	2.98	U
One better seek medical advice for treating venomous bites than result to <i>Moringa</i>	40.7	17.1	30.7	11.4		2.13	U
<i>Moringa</i> can be good for increasing libido	32.9	20.0	37.1	7.9	2.1	3.74	F

F = favourable; U = unfavourable

**Source:** Field survey, 2013

**Table 6: Categorization of respondents' perceived nutritional and medicinal benefits of *Moringa***

Perceived values	Range of scores	F	%	Mean	SD	Minimum	Maximum
Unfavourable	30 – 39	65	46.4	39.52	3.52	30.00	48.0
Favourable	40 – 48	75	53.6				
Unfavourable	30 – 38	59	42.1	39.38	3.78	30.00	49.0
Favourable	39 – 49	81	57.9				

Source: Field Survey, 2013

#### Relationship between respondents selected personal characteristics and perceived benefits of *Moringa oleifera*

The study testing the relationship between selected personal characteristics of respondents and perceived nutritional values of *Moringa oleifera* reveals that religion ( $\chi^2$ -value = 6.507), ethnic group ( $\chi^2$ -value = 11.783), educational qualification ( $\chi^2$ -value = 14.235) and length of time in which *Moringa oleifera* had been consumed ( $\chi^2$ -value = 31.206) had significant relationships with their perception on nutritional values of *Moringa* in the study area. This implies that religion, (Islam) and high educational qualification has been instrumental in building the understanding of rural dwellers to form favourable perception towards nutritional benefits of *Moringa*. The result further suggests that respondents who have over the years consumed *Moringa* have grown to experience its nutritional values and therefore have developed

favourable perception towards this plant. The study further reveals that religion ( $\chi^2$ -value = 5.861), educational qualification ( $\chi^2$ -value = 11.875) and friends as a source of *Moringa* ( $\chi^2$ -value = 8.606) had significant relationship with perceived medicinal values of the plant. *Moringa* had been consumed ( $\chi^2$ -value = 18.677) and use of friends as a source of *Moringa* ( $\chi^2$ -value = 6.637) had significant relationship with the respondents' perception. The study further suggests that friends greatly influenced the respondents in developing favourable perception on *Moringa's* medicinal benefits. The finding is line with Robles-de-la-torre and Hayward, (2001) who stated that the perception/interpretation and meaning an individual derives from a reality is a function of many factors like personality, association, age, experience, and learning. Hence, important socio-demographics of a given subject play a fundamental role in shaping people's views.

**Table 7: Relationship between respondents' selected personal characteristics and perceived nutritional and medicinal benefits of *Moringa***

Variables	Nutritional benefits					Medicinal benefits				
	$\chi^2$	df	P	CC	Sig	$\chi^2$	Df	p-	CC	Sig
Sex	0.70	1	0.403	0.070	NS	2.71	1	0.100	0.138	NS
Religion	6.51	2	0.039	0.211	S	5.86	2	0.050	0.200	S
Ethnic group	11.78	3	0.008	0.279	S	14.29	3	0.003	0.304	S
Marital Status	1.70	2	0.427	0.110	NS	0.135	2	0.935	0.031	NS
Edu. Qualification	14.24	5	0.014	0.304	S	11.87	5	0.037	0.280	S
Length of time <i>Moringa</i> had been consumed	31.21	5	0.000	0.427	S	9.45	5	0.092	0.251	NS
Friends as a source of <i>Moringa</i>	1.032	1	0.310	0.086	NS	8.606	1	0.003	0.241	S

#### Relationship between respondents' level of information exposure, awareness and their perceived benefits of *Moringa*

The study reveals that level of exposure to information ( $r = 0.237$ , and  $0.332$ ) and level of awareness ( $r=0.484$  and  $0.383$ ) (Table



8)respectively had significant relationship with respondents' perceived nutritional and medicinal values of *Moringa oleifera*. This shows that awareness creation using different media has been instrumental in helping the rural dwellers understand better the nutritional and medicinal values of *Moringa*, and this has consequently translated into them, forming favourable perception towards the values of this plant. This corroborates the findings of Dixon *et al.*, (2009) which shows that awareness had positive and significant influence on perception of values of *Moringa oleifera*.

**Table 8: Relationship between respondents' level of exposure to information and awareness and perceived nutritional and medicinal benefits of *Moringa***

Variables	Nutritional benefits			Medicinal benefits		
	R	p	S	r	p	s
Level of exposure to information	0.237	0.0211	NS	0.332	0.000	S
Level of awareness	0.484	0.000	S	0.383	0.000	S

Field survey, 2013

## CONCLUSION

The study concludes that rural households in Katsina State comprised more of young than old household heads with relatively large size. Similarly, the rural dwellers not only planted *Moringa* on their farms for aesthetic and ornamental purposes, but consumed and derived the nutritional and medicinal values of the plant. The various available media used in creating awareness among rural dwellers on the benefits of *Moringa* were effective, leading to high level of awareness of these values among majority. This also manifested in the favourable perceived nutritional and medicinal benefits *Moringa* among more than half of the rural dwellers in Katsina State. The study further concludes that rural dwellers lack awareness of few important medicinal values of the plant and that Islam

provided an important medium in creating awareness and increasing the understanding of rural dwellers on the medicinal and nutritional values of *Moringa*. The length of time for which rural dwellers in the state had consumed *Moringa* as well as sourcing *Moringa* from friends also had direct relationship with their perception of *Moringa* benefits.

## RECOMMENDATIONS

From the foregoing, the following recommendations are being made:

1. Awareness should be more and put especially on those important medicinal values the respondents lacked awareness of. This can be achieved through television and radio jingles, community health workers and resident doctors in the local health centres of the study area.
2. The use of audio-visuals should also be employed while disseminating *Moringa*-related innovation to the rural dwellers, since many of them have low level of formal education
3. Dissemination of *Moringa* related innovation should take into account the various forms in which *Moringa* can be consumed apart from the ones already known by the respondents. This is with a view to increasing the benefits derivable from its consumption among rural dwellers.

## REFERENCES

- Amaglo N.K, Bernett, R.N, LoCurto, R.B, Rosa, E.A.S, LoTurco, V, Gluffrid, LoCurto, A, Crea, F and Timpo, G.M (2010). Profiling Selected PhytoChemical and Nutrients in Different Tissues of the Multipurpose tree *Moringaoleifera* in Ghana. *Phytother. Res* 21, 17-25

- Awar F, Latif S, Ashraf, M and Gilani, A.H (2007). *Moringa oleifera* a food Plant with Multiple Medicinal Uses. *Phytother. Res.* 21: 17-25
- Dahot, M.U. (1988). Vitamin contents of Flowers and Seeds of *M. oleifera*. *Pak. J. Biochem.* 21:1 –24.
- Dixon .O., Simsola. M. Odeyinka, Victor. O. Okorie, and Moses. A. Akinsuyi (2009) Gender Analysis of Socio-Cultural Perception of *Moringa oleifera*. Amongst Farmers in Southwestern Nigeria. *Journal of International Women Studies* Vol 10: .4 May
- Duke, J.A (1978). *The Quest for Tolerant Germplasm*. ASA Special Symposium 32, Crop Tolerance to Suboptimal Land Conditions. *Am. Soc. Agron. Madison.* June.
- Ekong, E. Ekong (2003). *An introduction to rural sociology*. Uyo; Dove Education Publishers, Pp. 341-371
- Farooq, A., Sajid, L., Mohammad A. and AnwarulHassang G. (2007). *Moringa oleifera*: a food plant with multiple medicinal uses. *Phytotherapy Research* 21: 17 - 25.
- Fuglie, L.J., (2001). The Miracle Tree: The Multiple Attributes of *Moringa* Technical Centre for Agricultural and Rural Cooperation (ACP-EU). Wageningen, The Netherlands.
- Gowrishankar, H, Kumar, M, menon, V Divi, S.M, Saravanan, M, Magudapathy, P, Panigrahi, B. K, Nair, K.. G. and Venkataramaniah (2010). Trace Element Studies on *Tinaspora Cordifolia* (Menispermaceae), *Ocimumsntum* (Lamiaceae), *Moringa oleifera* (Moringaceae) and *Phyllanthusniruri* (Euphorbiaceae) using Pixe. *Biol Trace Elem. Res.* 133, 357-363
- Makonnen, E., Hunde, A. and Damecha, G. (1997). Hypoglycaemic effect of *M. stenopetala* Aqueous extract in Rabbits. *Phytother. Res.* 11:147 – 148
- Mehta, L.K., Balaraman, R., Amin, A.H., Baffa, P.A. and Gulati, O.D. (2003). Effects of fruits of *M. oleifera* on the Lipid Profile of Normal and hypercholesterolaemic Rabbits. *J. Ethnopharmacol.* 86:191 – 195.
- Moringa* news. *Moringa* network. URL <http://www.Moringanews.org>. Accessed on 4/9/2008
- Morton, J.F. (1978). The horse radish tree: *M. pterigosperma* (Moringaceae). A boon to arid lands. *Economic Botany.* 45:318 – 333.
- Nickon, F., Saud, Z.A., Rehman, M.H. and Haque, M.E. (2003). In vitro antimicrobial activity of the compound isolated from chloroform extract of *M. oleifera* Lam. *Pak. J. Biol. Sci.* 22:1888 – 1890.
- Odeyinka, S.M, D.O. Torimiro, J.O. Oyedele and V.O. Asaolu (2007). Farmer's Awareness and Knowledge of *Moringa oleifera* in Southwestern Nigeria: A Perceptual Analysis. *Asian Journal of Plant Sciences*, 6: 320-325.
- Pal, S.K., Mukherjee, P.K. and Saha, B.P. (1995a). Studies on the Antiulcer activity of *M. Oleifera* Leaf Extract on Gastric Ulcer Models in Rats. *Phytother. Res.* 9:463 –
- Rebecca, H.S.U., Sharon, M., Arbainsyah, A. and Lucienne, D. (2006). *Moringa oleifera*: medicinal and socioeconomic uses. *International Course on Economic Botany. National Herbarium Leiden, Netherlands.* Pp2-6

- Robles-de-la-torre, G., and Hayward, V. "Force can Overcome Object Geometry in the Perception of Shape Through Active Touch". *The Nature* 412 (2001). 445–8
- Ruckmani, K., Kavimani, S., Anandan, R. and Jaykar, B. (1998). Effect of *Moringa oleifera* Lam on Paracetamol – induced hepatotoxicity. *Indian J. Pharm. Sci.* 60:33 – 35.
- Verma, S .C., Banerji, R., Misra, G., and Nigam, S. K. (2009). 'Nutritional Value of *Moringa oleifera*. *The Current Science* 45(1976).769–74.