

**EVALUATION OF CONSUMER AWARENESS OF RISK ASSOCIATED WITH
MORINGA CONSUMPTION IN ILORIN METROPOLIS,
KWARA STATE, NIGERIA**

***¹Ayinde, O. E., ²Omotesho, K. F., ¹Animashaun, J. and ¹Atanda, O. A.**

¹Department of Agricultural Economics and Farm Management,
University of Ilorin, Nigeria.

²Department of Agricultural Extension and Rural Development,
University of Ilorin, Nigeria.

***Corresponding author's email address:** opeayinde@yahoo.com; opeyemi@unilorin.edu.ng

ABSTRACT

This study evaluated consumer awareness of risk associated with moringa consumption in Ilorin metropolis with a view to examining consumer level of awareness of the said risk as well as determining factors that influence their decision to consume Moringa product. Primary data were collected with the aid of a well structured questionnaire while (116) One hundred and sixteen respondents were randomly selected in the study area. The data were analysed using descriptive statistics, Kendall coefficient of concordance and Poisson regression model. The result shows that majority of Moringa consumers in the study area are female and it was also noted that most of the respondents are not aware of risk associated with Moringa consumption. The consumer perceived risks of Moringa consumption include loss of nutritional value from processing, contamination with microbes during processing, hypotension (low blood pressure), bleeding, dry mouth, loss of appetite, drowsiness, dizziness, depression, itching, anxiety, constipation, allergic reaction, stomach ache, change in weight, vomiting and miscarriage. A larger percentage of the respondents agree that there is nutritional loss and contamination with microbes during processing of Moringa. Majority of the respondents consumed Moringa products for its high nutritional value and medicinal values. However majority perceived its leaf products to present highest risk. Awareness of risk was found to have significant effect on consumer attitude towards the perceived risk at ($p = 0.05$). Most of the respondents perceived nutritional loss through processing and contamination during processing as a risky variable affecting moringa consumption. It is therefore recommended that more efforts should be made by moringa processors to improve on hygiene during the processing of moringa leaf into powder in order to enhance the consumer food security.

Keywords: Consumer Awareness, Risk, Moringa Consumption, Ilorin Metropolis, Kwara State, Nigeria

INTRODUCTION

Moringa is said to be the new hope in efforts at minimizing malnutrition and various related ailments. The leaves of this plant have been reported to have high amounts of essential amino acid with the right balance, as well as high amounts of minerals and vitamins (Fuglie, 1999). Anecdotal evidence from communities that use moringa as food and herb suggest that the leaves do not only provide good nutrition but they are also believed to suppress diabetes and hypertension in adults. The role of diet in the promotion and maintenance of a normal blood pressure has been established by the Dietary approach to stop hypertension diet study (Appel *et al.*, 1997).

There is a huge gap between general perceptions and recent scientific data. The hypotensive effect of both pods and leaves of *Moringa oleifera* has been demonstrated in rats (Faizi *et al.*, 1994, 1998). On the other hand, a major attribute of the moringa tree, often called the miracle tree is that it is the most nutritious vegetable on earth (Willis, 2003). Its nutritional content is unparalleled by any other vegetable. It contains 5 times more vitamin C than oranges, 2 times the vitamin A found in carrots, 4 times the calcium of milk, about the same amount of potassium as banana, almost 2 times the protein of milk and more iron than spinach (Broin, 2005; Fahey, 2005). According to Natural Standard Research Collaboration (2013), Moringa may increase the risk of bleeding when taken with drugs that increase the risk of bleeding. Some examples include aspirin, anticoagulants (blood thinners) such as warfarin (Coumadin®) or heparin, antiplatelet drugs such as clopidogrel (Plavix®), and nonsteroidal anti-inflammatory drugs such as ibuprofen (Motrin®, Advil®) or naproxen (Naprosyn®, Aleve®).

Acceptance of a product is largely determined by subjective knowledge with regards to the perceived risk and benefit associated with its consumption. Consumer knowledge on moringa product mainly depends on their trust on the information received, which is directly associated with the sources from which information is transmitted (Siegrist *et al.*, 2000; Koivisto *et al.*, 2003; Huffman *et al.*, 2004). Moringa product is a new product and is not yet widely accepted (Sutherland *et al.*, 2001) this might be as a result of consumer perceived risk associated with the consumption of the product.

The main objective of this study is to evaluate consumer awareness of risk associated with moringa consumption in Ilorin metropolis. The specific objectives are to:

1. evaluate consumer level of awareness of risk associated with Moringa consumption; and
2. Examine the socio-economic factors of consumer consumption behaviour in relation to the perceived risk.

METHODOLOGY

(i) Study area

The study was conducted in Ilorin, the capital city of Kwara State of Nigeria. Kwara State is located in the guinea savannah region of Nigeria and falls within latitudes $7^{\circ} 45' \text{N}$ and $9^{\circ} 30' \text{N}$ and longitudes $2^{\circ} 30' \text{E}$ and $6^{\circ} 25' \text{E}$. The State shares international boundary with Republic of Benin in the west. The capital of the state is Ilorin, the state is made up of 16 local government areas namely Asa, Baruten, Edu, Ekiti, Ifelodun, Ilorin-west, Ilorin-east, Irepodun, Isin, Moro, Kaima, Offa, Oke-ero, Oyun and Patigi (Kwara State diary, 2004)

(ii) Sampling Technique

The survey data that were used in this study were collected in Ilorin metropolis. Snowball-technique was used to select Moringa consumers. This technique was used because there was no known list of Moringa consumers in the study area. A total of one hundred and twenty Moringa consumers were randomly sampled in the study area.

(iii) Source of Data and Data Analysis

The main source of data for this study is the primary data that was collected with the aid of a well structured questionnaire. Data collected were subjected to analysis using descriptive statistics, Kendall coefficient of concordance and Poisson regression model.

Kendall Coefficient of Concordance

Following Kendall and Babington Smith (1939), suppose that object i is given the rank r_{ij} by a respondent number j , where there are in total n objects and m judges. Then the total rank given to object i is

$$R_i = \sum_{j=1}^m r_{i,j}, \quad \dots \dots \dots (1)$$

and the mean value of these total ranks is

$$\bar{R} = \frac{1}{2}m(n+1). \quad \dots \dots \dots (2)$$

The sum of squared deviations, S , is defined as

$$S = \sum_{i=1}^n (R_i - \bar{R})^2, \quad \dots \dots \dots (3)$$

and then Kendall's W is defined as:

$$W = \frac{12S}{m^2(n^3 - n)}. \quad \dots \dots \dots (4)$$

If the test statistic W is 1, then all the survey respondents have been unanimous, and each respondent has assigned the same order to the list of objects or concerns. If W

is 0, then there is no overall trend of agreement among the respondents, and their responses may be regarded as essentially random. Intermediate values of W indicate a greater or lesser degree of unanimity among the various respondents.

The Kendall's coefficient of concordance (W) was applied to measure the agreement of different respondents on their rankings of risks. This statistical analysis aims to ascertain whether the respondents within an individual group respond in a consistent manner or not. Values of W can range from 0 to 1, with 0 indicating perfect disagreement and 1 exhibiting perfect agreement (Daniel, 1978). If the Kendall's coefficient of concordance (W) was statistically significant at a pre-defined significance level of say 10% (0.10), then a reasonable degree of consensus amongst the respondents within the group on the rankings of the risks was indicated (Siegel and Castellan, 1988). In other words, a high or significant value of W reflects that different parties are essentially applying the same standard in ranking the risks.

Poisson Regression Model

According to Stefano *et al.*, (2006) Poisson regression analysis is a technique which allows to model dependent variables that describe count data. It is often applied to study the occurrence of small number of counts or events as a function of a set of predictor variables, in experimental and observational study in many disciplines, including Economy, Demography, Psychology, Biology and Medicine. In particular, in the last twenty years, Poisson regression model has been extensively applied in many contexts in bio-medical studies, including Epidemiology, to investigate the occurrence of selected diseases in exposed and unexposed subjects in observational prospective studies, or to evaluate the clinical course of patients in experimental and observational investigations in human clinical setting.

The dependent variable in this case is a count data and it represents the average number of times Moringa is consumed per day per week by respondents.

The general canonical regression specification for a variable Y that is a count of events is the Poisson regression,

$$F(y_i/x_i) = \frac{e^{-\lambda(x)} \lambda^i (x)^{(y)}}{\Gamma(1+y_i)} \dots \dots \dots (5)$$

Following Wooldridge (2002) the expected number of the events, y_i per period is given as:

$$E(y_i/x_i) = \text{var}[y_i/x_i] = \lambda = \exp(\alpha + X' \beta) \dots \dots \dots (6) \text{ for } i = 1, 2, \dots, m$$

Where $\lambda_i = \exp(\alpha + X' \beta)$.

Specifically, the explicit form of the Poisson regression as used in this study takes the form:

$$Y = \alpha + \beta X_1 + \beta X_2 + \beta X_3 + \beta X_4 + \beta X_5 + \beta Z_6 + \beta Z_7 + \beta Z_8 \dots\dots\dots(7)$$

Where,

Y= takes a discrete value representing the number of times Moringa is consumed per day by respondents,

X₁= Sex (Male or Female),

X₂= marital status of respondent (Single, Married, Widowed),

X₃= average monthly income of respondent,

X₄ =Age of the respondent,

X₅=livelihood activities (occupation engaged in),

Z₆= dummy variable, takes value of 1 if respondent is aware of any risk associated with the normal consumption of Moringa, and 0 otherwise

Z₇= dummy variable, takes value of 1 if respondent consume Moringa in the powder form and 0 otherwise

Z₈= dummy variable, takes value of 1 if respondent consume Moringa seed and 0 otherwise

α is the constant and β are the coefficients to be estimated and e is the error term.

RESULTS

SOCIO-ECCONOMIC CHARACTERISTICS OF RESPONDENTS

This section presents the socio-economic characteristics of the respondent.

The study revealed that 42.2% of the respondents were male and 57.7% female, 5.2% are within the age of 16-18, 50.9% were between 19-29, 22.4% were between 30-40, 14.7% were between 41-51 and 6.8% were above 51. Also, 51.7% of the respondents were single, 43.1% married and 4.3% widowed.

Table 1: Socio- Economic Characteristics of Respondents

Sex	Frequency	Percentage (%)
Male	48.7	42.2
Female	66.1	57.7
Age		
< 18	5.8	5.2
19 – 29	58.0	50.9
30 – 40	25.5	22.4
41 – 51	16.2	14.7
> 52	6.96	6.8
Marital status		
Single	59.2	51.7
Married	49.9	43.1
Widowed	4.9	4.3
Educational Status		
No formal	4.64	4.3
Adult	0.9	0.8
Primary	5.8	5.2
Secondary	18.56	16.3
Tertiary	87.0	75.7
Occupation		
Public sector	35.9	31.9
Private	25.5	22.4
Student	42.9	37.1
Artisan	9.3	8.6
Farmer	0.9	0.8
Monthly income		
< 5000	15.1	13.8
6000 – 25,000	35.9	31.9
26,000 – 45,000	18.6	16.4
46,000 – 65,000	18.6	16.4
> 66,000	24.4	21.5

Source: field survey, 2013

The modal class of level of education is Tertiary education. This implies that 75.7% of the respondents attend tertiary institution, 16.3% have secondary education, 5.2% have primary education, 0.8% have adult education and 4.3% have no formal education. It was observed that 31.9% of the respondents worked in the public sector, 22.4% private sector, 37.1% were students, 8.6% artisans and 0.8% farmers. It was also observed that 13.8% of the respondents earned ₦5000 and below monthly, 31.9% earned between ₦6,000-25,000 monthly, 16.4% earned between ₦26,000-45,000 monthly, 16.4% earned between ₦46,000-65,000 and 21.5% earned over ₦66,000 monthly.

Consumer knowledge of risk associated with Moringa consumption

Table 2: Consumer knowledge of Perceived Moringa risk

Awareness of risk	Frequency	Percentage (%)
Yes	45	38.8
No	71	61.2

Source: field survey, 2013

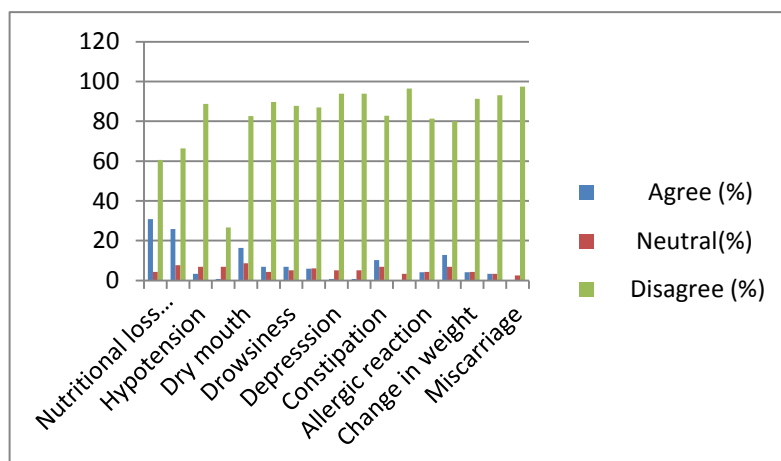
It was observed that 61.2% of the respondents are not aware of the risk associated with Moringa consumption while 38.8% are aware of the risk. This may be that majority of the respondents derive nutritional benefit from Moringa consumption than perceiving it as being risky.

Perceived risks of Moringa

Table 3.0: Ranking of perceived risk

Perceived Risk	Agree (%)	Neutral (%)	Disagree (%)
Nutritional loss through processing	30.9	4.3	60.6
Contamination during processing	25.8	7.7	66.3
Hypotension	3.4	6.8	88.7
Bleeding	0.8	6.8	26.6
Dry mouth	16.3	8.6	82.6
Loss of appetite	6.8	4.3	89.7
Drowsiness	6.8	5.1	87.8
Dizziness	5.9	6.0	87.0
Depression	0.8	5.1	93.9
Itching	0.8	5.1	93.9
Constipation	10.2	6.8	82.7
Anxiety	0	3.4	96.5
Allergic reaction	4.2	4.3	81.3
Stomach ache	12.8	6.8	80.1
Change in weight	4.2	4.3	91.3
Vomiting	3.3	3.4	93.0
Miscarriage	0	2.5	97.4

Source: field survey, 2013



Graphical representation of perceived risks ranking

As revealed in the graph, a larger percentage of the respondents disagree of the perceived risk associated with moringa consumption, while some of the respondents agree that nutritional loss through processing and contamination during processing are the major perceived risk of moringa.

Table 4: Test of concordance of respondents perceived risk

	Nutritional loss through processing	Contamination with microbes during processing	Hypotension	Bleeding	Loss of appetite
Contamination with microbe	0.5*	0.6			
Hypotension	0.2*	0.2*	0.4		
Bleeding	0.2*	0.2*	0.4*	0.4	
Loss of appetite	0.2*	0.3*	0.3*	0.4*	0.5
Dry mouth	0.2*	0.3*	0.4*	0.4*	0.4*

Source: field survey, 2013

It was observed that there is a reasonable degree of agreement among the respondents with respect to the identified constraints indicated in Table 6. This implies that a respondent that perceive contamination with microbe during processing as a risk also perceive it to have nutritional loss during processing. Also, a respondent that perceive hypotension is likely to perceive nutritional loss through processing and contamination with microbes during processing as a risk, a respondent that perceive bleeding as a risk is also likely to perceive nutritional loss, contamination with microbes during processing and hypotension as a risk. Specifically, there is a high concordance for the respondents to perceive these risks indicated with a significant level of 5%.

Socio-economic determinants of consumer consumption behaviour in relation to the perceived risk

The result of socio-economic determinant that influences consumers attitude to Moringa consumption before and after the perception of risk associated with Moringa is presented in Table 5. The Poisson regression model was used to model respondents' behaviour. It is assumed that respondents' attitude to the perceived risk was in the form of either reduction in quantity of Moringa consumed or reduction in the number of times of consumption. The Poisson model was used to determine consumer behaviour in terms of reduction in quantity of Moringa consumed.

Table 5: Poisson Analysis Result

Predictor variables	Coefficient	Std error	T	P value
Male	-3.74	3.46	-1.08	0.283
Age	-0.02	0.30	-0.08	0.938
Single	5.67	12.47	0.45	0.650
Married	-2.88	11.58	-0.25	0.804
Widowed	7.46	12.20	0.61	0.542
Tertiary	5.83	6.10	0.96	0.341
Public sector	4.77	5.50	0.87	0.388
Private sector	5.33	5.76	0.93	0.356
Income	-5.58e ⁻⁰⁶	0.00	-0.10	0.917
Aware of risk (Yes)	16.86	5.17	3.26	0.002**
Powder (Yes)	13.22	5.20	2.54	0.013**
Seed	2.37	4.03	0.59	0.559
Fresh leaf(consume)	2.77	3.25	0.85	0.396
Constant	-39.48	19.49	-2.03	0.046
Sigma	8.3	1.72		
Log likelihood = -72.05				
LR chi ² (17) =44.32				
Prob > chi ² = 0.0003				

Source: field survey, 2013

Key note: double (**) asterisks indicate significance of p value at 1%

The Poisson model as shown by the significance of the (p=0.01) indicated that the model with the variables is significantly different from the model without the variables. As shown in Table 7, awareness of risk significantly explains the difference in the quantity of Moringa consumed before and after risk perception at (p = 0.01).

Furthermore, in the Poisson regression model, consumption of Moringa powder was also found to have significant effect on consumer attitude at (p = 0.01).

CONCLUSION

From the study conducted, it was found that respondents exhibited different risk attitudes. This study also pointed out the consumer perceived risk of moringa. Poisson regression model indicated significant socio-economic variables and risk attitude of consumer on consumer consumption behaviour. This indicate that there is a risk taking behaviour present in the consumers as a result of their socio-economic characteristics. In view of this, policy for moringa consumer should incorporate their risk attitude and their socio-economic characteristics. Such policy may improve consumer consumption of moringa.

RECOMMENDATIONS

In view of findings, this study recommends the need for sensitization and to further enhance the knowledge of consumers on the risk of Moringa. More efforts should also be made by moringa processors to improve the hygiene when processing consumer leaf to powder.

REFERENCES

- Appel, L. J., Moore, T. J., Obar Zaneke, E., Vollmer, V. M., Svetkey, L. P., Sacks, F. M., Bray, G. A., Vogt, T. M., Cutler, J. A., Windhauser, M. M., Lin, P. H., Karanja, N. A., (1997). ‘‘Clinical Trial of the Effects of Dietary Patterns on Blood Pressure’’ DASH Collaborative Research Group, *New England Journal of Medicine*, 336(16), pp.1117-1124
- Broin, M., (2005). ‘‘Composition Nutritionnelles des feuilles de *Moringa oleifera*’’.
- Daniel, W. W., (1978) *Applied Nonparametric Statistics*, Houghton Mifflin, Boston.
- Fahey, J. W., (2005). Moringa oliefera: A Review of the Medicinal Evidence for its Nutritional, Therapeutic and Prophylactic Properties. *Trees of Life Journal* (1), pp 2
- Faizi, S., Siddiqui, B. S., Saleem, R., Siddiqui, S., Aftab, K., (1994). ‘‘Isolation and Structure Elucidation of New Nitrile and Mustard Oil Glycosides from *Moringa oleifera* and their Effect on Blood Pressure’’ *Journal of Natural Products*, 57(9), pp.1256-1261
- Faizi, S., Siddiqui, B. S., Salem, S., Siddiqui, S., Aftab, K., Shaheen, F., Gililani, A. H., (1998). ‘‘Hypotensive Constituents from the Pods of *Moringa oleifera*’’. *Planta Medica*, 64, pp. 225-228
- Foidl, N., Harinder, P. S., Markar and Klaus Becker, (2001). The Potential of *Moringa oleifera* for Agricultural and Industrial Uses. *The Miracle Tree*, Edited by Lowell, J. Fuglie, Darkar, Senegal, pp 45-76
- Fuglie, L. J., (1999) The Miracle Tree: *Moringa oleifera*: Natural Nutrition for the Tropics. *Church World Service*, Dakar, pp 68
- Kendall, M. G., Babington Smith, B., (Sep 1939). "The Problem of m Rankings". *The Annals of Mathematical Statistics* 10 (3): 275–287

- Koivisto Hursti, U-K. And Magnusson, M. K. (2003). Consumer Perceptions of Genetically Modified and organic Foods. What Kind of knowledge Matters? *Appetite*, 41: 207-209
- Ramachandran, C., Peter, K. V. and Gopalakrishnan, P. K (1980). Drumstick (*Moringa oleifera*): A Multipurpose Indian Vegetable. *Economic Botany*, 34(3), pp 276-283
- Siegel, S. and Castellan Jr, N. J. (1988) *Nonparametric Statistics for Behavioural Sciences*. 2nd Edition, McGraw-Hill, New York.
- Siegrist, M., Cvetkovich, G. and Roth, C. (2000). Salient Values Similarity, Social Trust and Risk/Benefit Perceptions. *Risk Analysis*, 20: 353-362.
- Sutherland J. P., Folkard G. K. and Poirier Y. L. (2001): *Moringa oleifera*. The Constraints to Commercialisation, Paper presented at Workshop on Development potential for Moringa products October 29th - November 2nd, 2001, Dar es Salaam, Tanzania
- Woodridge, J. M. 2002. Econometric analysis of cross sectional data and panel data. Cambridge and London: MIT press