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Evaluation of the Awareness Level of Ethno-botanical Values of *Moringa oleifera* Lam.in Oke-Ogun Area of Oyo State, Nigeria

[1]Ojedokun, C.A, [1]Idumah, F. O and [2]Adeleye, A. S

[1]Forestry Research Institute of Nigeria, Ibadan
[2]Moist Forest Research Station, Benin City, Edo State, Nigeria
Corresponding author: christyabiodun92@gmail.com

ABSTRACT

Moringa oleifera, commonly known as horseradish tree is a multipurpose tree of significant economic importance that has industrial, nutritional and medicinal value. It is against this background that this study sought to document the level of awareness, ethno-botanical value and acceptability of Moringa in the study area. It also seeks to know what uses they put the plant to, as well as the common name(s) with which the plant is known and described. Accidental sampling technique was used to select 250 respondents from 3 Local Government (Saki-west, Saki east and Atisbo) which were purposefully selected being the core agrarian community who are responsible for food production in Oyo State with many residents depending on roots and herbs in the treatment of various ailment and diseases; Oke-ogun Area of Oyo State comprises ten LGAs, out of which three were selected. Primary data were collected with the aid of well-structured questionnaires, Data were analyzed through the use of descriptive and inferential statistics; the results revealed that the level of awareness about the plant is high (77.6%), meanwhile 72.8% of the respondents used it as a source of alternative medicine while 14.4%, 1.5% and 2.5% use *Moringa oleifera* for food, soil manure and fodder respectively. It is interesting to know that almost all the respondents (88%) showed interest in cultivating the plant; this shows it is well acceptable in the study area. The results also showed that the common name(s) given to moringa in Saki-West and Atisbo, is "Gbogbonise/Awogbaarun" while it is called "Isu/ Sogele" in Saki-East. The study therefore, concludes that awareness should be intensified by relevant Government agencies on nutritional (as food supplement) agricultural uses and its industrial value in the study area; Individual household should also be encouraged by ADPs to cultivate the plant by making the planting materials available.

Keywords: *Moringa oleifera*, Awareness, Ethno-botanical value, Acceptability, Oke-ogun.

Introduction

Moringa oleifera is the most widely cultivated species of a monogeneric family, the Moringaceae that is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. Fahey (2005) noted that this rapidly-growing tree (also known as the horseradish tree, drumstick tree, benz olive tree, kelor, marango, mlonge, moonga, mulangay, nébéday, saijhan, sajna or Ben oil tree in some other places) was utilized by the ancient Romans, Greeks and Egyptians and is now widely cultivated and has become naturalized in many locations in the tropics. It is a perennial softwood tree with timber of low quality, but which for centuries has been

advocated for traditional, medicinal and industrial uses.

All parts of the Moringa tree (Fig. 1) are edible and have long been consumed by humans. According to Fuglie (1999), the many uses of Moringa include: alley cropping (biomass production), animal forage (leaves and treated seed-cake), biogas (from leaves), domestic cleaning agent (crushed leaves), blue dye (wood), fencing (living trees), fertilizer (seed-cake), foliar nutrient (juice expressed from the leaves), green manure (from leaves), gum (from tree trunks), honey- and sugar cane juice-clarifier (powdered seeds), honey (flower nectar), medicine (all plant parts), ornamental plantings, bio-pesticide (soil incorporation of leaves to prevent seedling damping off), pulp (wood), rope (bark), tannin for tanning hides (bark and gum), water purification (powdered seeds). Moringa seed oil (yield 30-40% by weight), also known as Ben oil, is a sweet non-sticking, non-drying oil that resists rancidity. It has been used in salads, for fine machine lubrication, and in the manufacture of perfume and hair care products (Tsaknis *et al*., 1999). This tree has in recent times, been advocated as an outstanding indigenous source of highly digestible protein, Ca, Fe, Vitamin C, and carotenoids suitable for utilization in many of the so-called "developing" regions of the world where undernourishment is a major concern. Highly digestible protein, Ca, Fe, Vitamin C, and carotenoids suitable for utilization in many of the so-called "developing" regions of the world where undernourishment is a major concern.

(a) Moringa Trees

(b) Moringa Leaves

(c) Moringa Seeds

(d) Moringa fruits

Fig 1: Parts of *Moringa oleifera* (Source:https://www.shutterstock.com)

The *Moringa oleifera* tree is an outstanding source of nutrition, especially in areas where other food sources are scarce or seasonally unavailable. The leaves, stems, and seed pods of the tree can be prepared in a variety of different ways in order to provide solid nutritional value. Also known as a drumstick, the green seed pods are typically prepared in much the same way as green beans and have a characteristically asparagus-like flavor (HDRA, 2002). Even the flowers and leaves can be consumed. The leaves are especially nutritious and are eaten raw or served as a boiled greens dish that resembles spinach. The dried powder can be stirred into soups or sauces as a thickening agent or used to brew a healthful drink. Moringa leaves, pods, and roots contain large amounts of protein, amino acids, vitamins and minerals and provide valuable nutrition for populations in remote areas that may suffer from food shortages and lack of protein sources in their local environment (http://www.themoringa.com/nutritional-values).

In Nigeria, *Moringa oleifera* has many names: among the Hausas it is called "*Zogalla/zogallagradi and bagarwamaka*"; the Fulanis called it "*Gawara*", while the Yorubas calls it "ewe ile/ewe igbale or otiliigbo". These names are well documented in different literatures (Fuglie, 1999).*Moringa oleifera*, also known as bean tree, is used for fencing in northern Nigeria and is found almost everywhere in the country (Umar, 2007). Also, according to Salami and Gbadebo (2010), *Moringa oleifera* is a staple food material incorporated into an average meal as a condiment, which makes it highly acceptable among Hausa communities in Kano State, Nigeria.

Studies by Bukar *et al.* (2010) Oluduro (2012) and Alegbeleye (2018) for example, attest to the medicinal and nutritive values of *Moringa oleifera.* Unfortunately, *Moringa* is

underutilized in many rural dwellings especially in many parts of the country due to lack of or limited knowledge of its usefulness (Zaku *et al*., 2015).At the moment, the level of awareness of the ethno-botanical importance of this plant is still very low in the southern part of the country compared to the north Salami and Gbadebo (2010). There is, therefore, the need to create awareness regarding the benefits of Moringa.

The objectives of this study therefore, are to know the level of awareness of the usefulness of this all-important plant; to examine the factors influencing the awareness or otherwise of the plants as well as investigate the uses of the plants among the populace in the study area.

Materials and Methods

Study Area

This study was conducted in three Local Government Areas (LGA) namely: Saki East, Saki West and Atisbo. The three LGAs were purposefully selected out of the seven LGAs that made up Oke-ogun area of Oyo State (Fig. 2) because these three LGAs are the core agrarian community who are responsible for food production in Oyo State with many residents depending on roots and herbs in the treatment of various ailment and diseases. Oke-ogun is located between latitude 8.45^{o}N and 8.59^{o}N and Longitude 3.11^{o}E and 3.60^{o}E the South-west geo-political zone of Nigeria, but located west of Oyo State. The indigenes are predominantly of Yoruba ethnic but have some other groups who have settled there.

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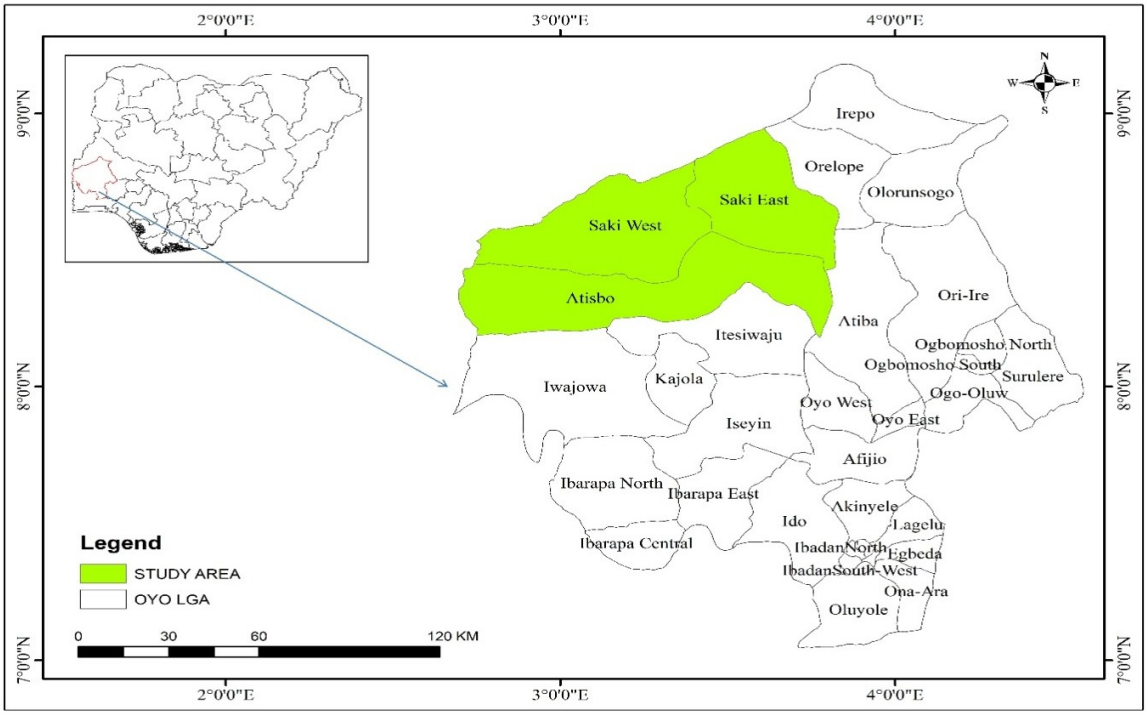

Fig 2

Sampling technique

The accidental sampling technique which involves a situation where anyone seen or come across is interviewed was used to select the respondents (Asika, 2006).A total of two hundred and fifty (250) respondents were interviewed across the study area comprising of 76 from Saki East, 119 from Saki West and 55 from Atisbo. The plant (*Moringa oleifera*) was shown to the respondents individually for identification. Both primary and secondary data were collected for the purpose of this study. Primary data were collected using structured and open-ended questionnaire, and questions to know the level of awareness, knowledge and willingness to plant *Moringa oleifera*, local name, local uses, when and how they get to know about the plant (*Moringa oleifera*) as well as the effect noticed when *Moringa* was used as food or medicine were elicited. Secondary data collected includes general information on the plant (*Moringa oleiferia*) from literature.

Method of Data Analysis

Data were analyzed through the use of descriptive and inferential statistics. Descriptive statistics such as simple percentages, frequency and means were employed to describe the socioeconomic characteristics of the respondents in the study area. The inferential statistics used was logistic regression model. It was used to test

the relationship between the respondents' personal characteristics and awareness.

Logit model specification

The modeling approach considers awareness as a dichotomous dependent variable, which takes '1' if awareness is present and '0' otherwise. The model produced in logistic regression is nonlinear and the outcome variable, Y, is the probability of having one outcome or another based on a nonlinear function of the best linear combination of predictors, with two outcomes. In binary regression models goodness of fit (R^2 values) are not important; the important feature is the expected signs of the regression coefficients and their statistical and/or practical significance. Therefore, the interpretation focuses on statistical significance, direction of the regression coefficients (either positive or negative), and the odds ratios. As specified in Agresti and Barbara (2009), Peng and So (2002) and following Zerihun *et al. (*2014), the simple logistic regression model has the form:

$$\ln\left(\frac{\pi}{l-\pi}\right) = \log(odds) => logY = \alpha + \beta x \quad (1)$$

When we take the antilog on both sides of Equation (1), we derive the equation to predict the probability of the occurrence of the outcome of interest as shown in Equation (2):

$$\pi = P(Y) = \frac{e\alpha+\beta x}{1+e\alpha+\beta x} \quad (2)$$

where
'p' is the probability of the outcome of interest (Y =1);
'a' is the Y intercept (constant of the equation);
bi' represents the regression coefficients of the explanatory variables (that is, vector of coefficients to be estimated);
x represents a set of predictors, and 'e' is the base of the system of the natural logarithms.

The dependent variable Y_{1i}

$$= \begin{cases} 0 \text{ if household is not aware of the values of Moringa} \\ 1 \text{ if household is aware of the values of Moringa} \end{cases}$$

Taking the log of Equation (2) we have the following logit model for estimating coefficients:

$$ln\left(\frac{P(Y)=1}{P(1-P)}\right) = \alpha^* + \beta_1{}^*X_1 + \beta_2{}^*X_2 + \cdots \beta_n{}^*X_n + e \quad (3)$$

Finally, we estimated Equation (3) using statistical software to find the best linear combination of predictors to maximize the likelihood of obtaining the observed outcome frequencies. The estimation results and economic interpretations are presented in the next section. Interpretations are given in terms of odds ratios and not in terms of marginal effects. Marginal effects are suitable for linear probability models, whereas in the case of binary response models, odds ratios give more intuitive meaning. If the odds ratio, Exp (ß), is greater than 1, we interpret it as the odds are 'exp (ß)'times larger. If the odds ratio is less than 1, we take it as the odds are 'exp (ß)' times smaller, holding all other variables constant (Gujarati 2004; Menard 2001).

The Logistic Regression model is expressed explicitly as

$LnY = b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_5+b_6X_6+e_i$

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Y= Knowledge about moringa (1, if respondent has knowledge of moringa; 0 if otherwise).
X_1= Age of respondent (in years)
X_2= LGA of respondent
X_3 = Gender of respondent
X_4= Marital status of respondent
X_5 = Household size of respondent
X_6= Educational qualification of respondent
e_i= Error term

Logistic (multiple) regression model for the covariates

Multiple logistic regression model adopted to ascertain the particular level(s) of covariates that influence respondents' knowledge about Moringa is presented below:

$$Y_i = \frac{\exp(X'\beta)}{1 + \exp(X'\beta)} + \varepsilon_i \quad (4)$$

Where

$$Y_i = \begin{cases} 1 \text{ with probability } \pi \text{ if respondent is aware of Moringa} \\ 0 \text{ with probability } (1-\pi) \text{ if respondent is unaware of Moringa} \end{cases}$$

$\beta = Vector\ of\ parameters$ and
$X' = Vector\ of\ covariates$
$\varepsilon_i = Error\ term$

Three variables are considered as covariates in this study:

i. Age = Quantitative variable
ii. LGA = Qualitative variable with three (3) levels
iii. Educational qualification = Qualitative variable with five (5) levels.

For LGA, Atisbo is considered the reference/base point upon which to compare other levels owing to the perceived distance (dissimilarity) to the remaining two locations. The variable `No formal education' was also chosen as the reference point to compare other levels for educational qualification variable. Consequently, the variable $X'\beta$ explicitly written is given as:

$$X'\beta = \beta_0 + \beta_1 X_{Age} + \beta_2 X_{SakiWest} + \beta_3 X_{SakiEast} + \beta_4 X_{Pri} + \beta_5 X_{Sec} + \beta_6 X_{Ter} + \beta_7 X_{Voc}$$

Results and Discussion

Table 1 shows the socio-economic characteristics of the respondents. Out of the 250 respondents interviewed 46% were males while 54% were females. The marital status of respondents showed that 58%, 40.8% and 1.2% were married, singles and the widowed respectively. Those within 21-40 (63.6%) and = 20 (17.6%) age ranges were groups with the highest frequency of knowledge about *Moringa*. About 50.4% of the respondents have tertiary education while about 22.8% have secondary education; others are 11.2%, 10% and 5.6% for no formal education, vocational and primary education respectively. Majority (67.2%) of the respondents are Christians while about 32% and 0.8% are Muslim and traditionalists respectively.

Among the respondents 77.6% have heard about *Moringa* before now and about 20.4% had no knowledge while about 2% of the respondents gave no response. Sources of how they get to know about the plant revealed that majority of the respondents (66.7%) got to know through friends and family members; about 3.1% knew about *Moringa* through Government organizations like Agricultural Development Project(ADP), while others got to know through other means like hospitals (4.6%), the media (16.4%). This implies that Government organizations have not really done much to create the necessary awareness

about the benefits of *Moringa* in the study area.

Investigation into the local name by which *Moringa* plant is known in the study areas revealed that it is called "Gbogbonise /Awogba arun" (meaning "cure for all diseases") in Saki-West and Atisbo while the respondents from Saki-East call it "Isu/Sogele''.

Table 1: Socio-economic Characteristics of Respondents on the Awareness of the Ethno-botanical values of *Moringa oleifera*

Variable	Frequency	Percentage (%)
Gender		
Male	115	46.0
Female	135	54.0
Total	**250**	**100**
Marital status		
Single	102	40.8
Married	145	58.0
Widowed	03	1.2
Total	**250**	**100**
Age		
= 20	44	17.6
21 – 40	159	63.6
41 – 60	40	16.0
= 61	07	2.8
Total	**250**	**100**
Educational level		
Primary	14	5.6
Secondary	57	22.8
Tertiary	126	50.4
Vocational	25	10
No Formal Education	28	11.2
Total	**250**	**100**
Religion		
Christians	168	67.2
Muslim	80	32.0
Traditionalists	02	0.8
Total	**250**	**100**
Knowledge of *Moringa*		
Yes	194	77.6
No	51	20.4
No Response	05	02
Total	**250**	**100**
Source of Information		

Media	32	16.4
Friends & Family	130	66.7
Hospital	09	4.6
Government Org.	06	3.1
Others	18	9.2
No Response	55	-
Total	**250**	**100**

Source: Field Survey, 2016

Uses of *Moringa* in the Study Area

Moringa can simply be described as a multipurpose tree On the ethno-botanical importance of *Moringa*, majority (56.8%) of the respondents indicated that they use it as a source of alternative medicine while 11.2%, 1.2% and 2.0% only use it for food, soil manure and fodder respectively; this shows that the awareness of the benefits of *Moringa* is relatively high in the study area. This finding is corroborated by Ajayi *et al.* (2017). The results further revealed that *Moringa* is used for the treatment of a number of diseases and ailments with malaria and typhoid topping the lists (87.2%) followed by ulcer and diabetes (12.6%). Other ailments and diseases listed include: hypertension, measles, piles, infertility, stomach cramps, toothache, cough, and tuberculosis to mention but few. These observations are supported by the findings of Egbuna (2015) and Sahay *et al.* (2017) who found out the *Moringa* possesses anti-bacterial, anti-viral, anti-fungal, anti-inflammatory, anti-spasmodic and diuretic properties. This may well explain why *Moringa* is a very useful plant to the people in the study area.

Table 4: Uses of *Moringa*in the Study area

Uses	Frequency	Percentage
Food	28	11.2
Medicine	142	56.8
Soil Enrichment	3	1.2
Fodder	5	2.0
Multiple response	17	6.8
No response	55	22.0
Total	**250**	**100**

Source: Author, computed from the survey data

Figure 3 below revealed that 89.2% of the respondents who used *Moringa* in one way or the other to cure one ailment or the other found it to be effective on them as they feel some sense of relief whenever it was taken, while about 2.06% claimed that they experienced some negative side effects on them.

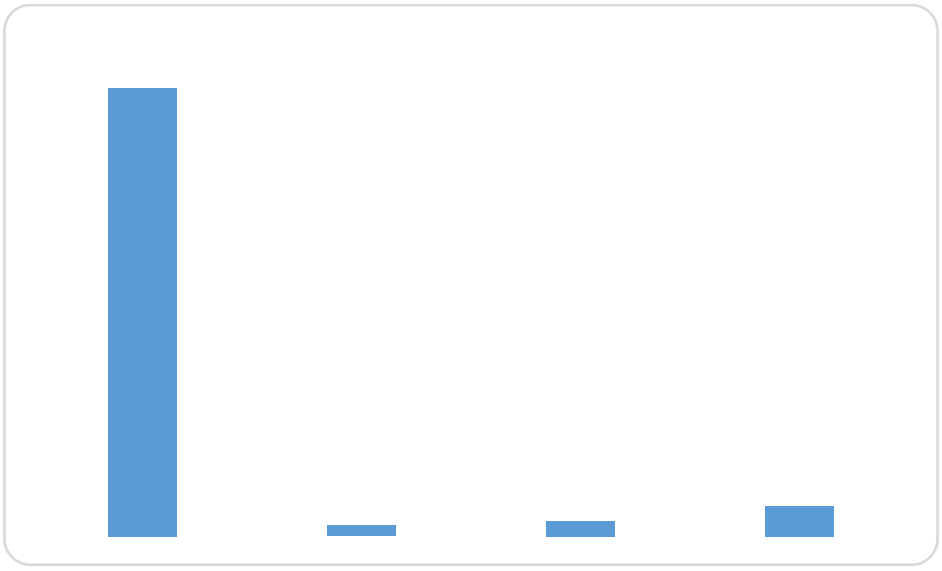

Fig.3: Effects Noticed after taking *Moringa*.

On whether they are willing to cultivate *Moringa*, majority, (88%) of the respondents showed interest in doing so while about 2.8% would not like to cultivate it because according to them they do not own a farmland or a plot of land of their own while 9.2% of the respondents were indifferent whether or not to cultivate it (Fig.3).

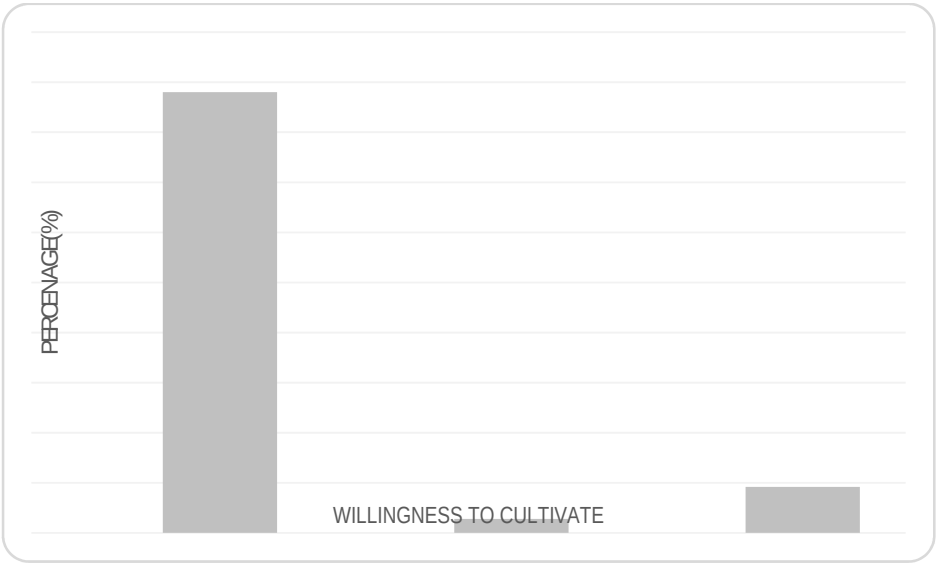

Fig. 4: Willingness to cultivate or not

Determinants of Awareness of *Moringa*

Table 5 shows the results of the logistic regression of factors influencing respondents' knowledge about *Moringa*. Results reveal that local government areas of residence of respondent as well as their educational qualification were statistically significant in determining the respondents' awareness of *Moringa*. In other words, the knowledge about the significance of *Moringa* among the respondents was influenced by the local government area they reside and the level of education of the respondents. The results implied that respondents are more aware of Moringa in one area than in others in the study area. Also, the result of the study suggests that education plays a significant role on the level of awareness of the respondents about the ethnobotanical values of *Moringa* in the study area. This finding is in agreement with Farinola (2014) who asserted that education had a positive and significant effect on the awareness of respondents about *Moringa*.

Table 5: Logistic Regression Result for factors influencing respondents' knowledge about moringa

Variable	B	S.E.	Wald	Sig.	Odd Ratio
X_1(Age)	0.0310	0.024	1.634	0.201	1.032
X_2(LGA)	1.112	0.256	18.877	0.000*	3.041
X_3(Gender)	-0.360	0.369	0.950	0.330	0.698
X_4(Marital status)	0.838	0.484	2.994	0.084	2.311
X_5(Household)	-0.202	0.253	0.636	0.425	0.817
X_6(Educ)	0.742	0.571	1.140	0.005*	2.099
Constant	-.932	.873	1.140	0.286	0.394

Source: Author, computed from the survey data
**Significant at 5%*

In order to determine the exact level of covariates (LGA and educational qualification) that significantly influenced respondents' awareness about Moringa, regression analysis was further conducted on the levels of covariates that were found to be statistically significant in influencing respondents' knowledge of Moringa. The result is presented in the Table 6 below:

Results from the table show that respondents from Saki West and Saki East LGAs are more aware about Moringa than their counterparts in Atisbo LGA probably because, the zonal office of the Agricultural Development Programme which is responsible for the execution of agricultural programmes, dissemination of information and other extension services is situated in Saki. Furthermore, the odds that respondents with primary education will have better knowledge of Moringa is about 6 times (5.738) higher than respondents with no formal education. Similarly, respondents who had tertiary education are about twelve times (11.659) more aware about Moringa than those with no formal education.

Hosmer and Lemeshow goodness of fit test shows that the level presented a non–statistically significant result (p–value = 0.507), signifying that the model could

effectively predict the level of Moringa awareness from the specified covariates. The variables used in this model could explain approximately 82% of the variation observed in the dataset.

Table 7: Multiple Logistic regression estimates for the covariates

Variable	Beta value	Std error	Wald	Df	p - value	Exp (beta)
Atisbo (reference)			20.958	2	< 0.001	
Saki West	0.089	0.586	0.023	1	0.879	1.093
Saki East	-1.761	0.53	11.05	1	0.001	0.172
No Formal Education (reference)			16.559	4	0.002	
Primary	1.747	0.932	3.515	1	0.061	5.738
Secondary	1.877	0.736	6.513	1	0.011	6.535
Tertiary	2.456	0.613	16.031	1	< 0.001	11.659
Vocational	1.775	0.727	5.968	1	0.015	5.901
Constant	-1.176	1.059	1.233	1	0.267	0.308
-2log likelihood			204.00			
Cox and Snell R^2			0.162			
NagelkerkeR^2			0.254			
Omnibus test of model coefficients						
• Chi square			7.275			
• Df			8			
• Sig.			0.507			
• % correct prediction			81.5			

Source: Author, computed from the survey data

Conclusion and Recommendations

Moringa oleifera is a plant that is well accepted in the study area irrespective of tribe and religions. From the results of the assessment, it was revealed that *Moringa oleifera* is well known for its medicinal properties than any other uses like, as food supplements, fodder for farm animals and source of soil manure among others. Therefore, effort should be made by relevant Government agencies like ADP extensions to create more awareness about the nutritional value of the plant. Knowing the medicinal values of the plant, efforts should as well be made to by cosmetics and laundry industries to process it into various forms that can easily be used and consumed as is being done in some other counties.

It is recommended that individual households should be encouraged to plant *Moringa* either in their compound or their farm; this could be made possible by making the planting materials available at our local ADP centers at a cheaper rate. Relevant Government agencies should step up their level of awareness about the numerous uses of *Moringa oleifera*.

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