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# Analysis of Awareness, Perception and Preference of Pharmaceutical Companies to the Use of Phenol from Indigenous Vegetables in Lagos State, Nigeria

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**Abstract** **Original Research Article**

Indigenous vegetables in Nigeria are under-exploited and under-utilized because of low information and awareness of specific nutrients and phytochemicals in some indigenous vegetables in which Nigeria is richly endowed with. This research analysed the level of awareness of pharmaceutical companies to phenol from indigenous vegetable and the preference, attitude and perception of pharmaceutical companies towards the use of phenol from indigenous vegetables. Data were collected with the aid of a well-structured questionnaire from 25 Pharmaceutical locally producing companies in Lagos State using purposive sampling technique. Descriptive statistics and conjoint analysis were used to analyze the data. The result of the descriptive statistics showed that 44% of the respondents were very aware that phenol is present in indigenous vegetable and 24% were moderately aware of the presence, extraction and use of phenol from vegetable to make drugs. The result also showed that 32% perceived the price of phenol from vegetable to be expensive, 40% perceived the quality to be fair, 40% felt effectiveness was moderate, 64% and 44% perceived the quantity to be small and cheaper respectively compared to the other sources of phenol. However, in terms of their attitude to phenol from indigenous vegetable, 88% of the respondents do not use phenol from indigenous vegetables and 12% of them make use of phenol from indigenous vegetable. The conjoint analysis showed that the best combination of attributes most preferred was cheap price (0.733), good quality (1.227), high effectiveness (0.173) and large quantity (-0.029). It was recommended that further research work should be carried on how improve quantity and quality of phenol from indigenous vegetable.

**Keywords:** Phenol, Indigenous Vegetable, Pharmaceutical Companies, Preference.



## BACKGROUND STUDY

One billion people around the world are still chronically poor and undernourished and are particularly concentrated in rural areas. Improvement in agricultural growth and productivity becomes very essential in reducing poverty especially in the poorest developing countries. In addition, if the worldwide population demand for food is going to be met in 2050, production has to be doubled (IEG World bank, 2010). The World Bank has also shown that in Sub-Saharan Africa (to which Nigeria belongs) the annual food increase needs to reach 4%, i.e. more than double the current figure in order to achieve food security (IBRD, 1989). Due to a number of factors which include rising population, increasing pressure on land resources, natural and man-made disasters such as drought, desertification, soil erosion and degradation (Raoult-Wack and Bricas, 2001), the problem of sustainable agricultural production and agribusiness has become a very critical subject. The practice of agribusiness has progressed predominantly over the decades all over the world, as of today, agribusiness is not only seen as a commodity industry but it is also crucial in improving agricultural growth in order to reduce poverty.(David *et al*., 2008). For agricultural growth and productivity to occur, agricultural produce must get to the consumers and post-harvest losses must be well taken care of which is very predominant in crop production in Nigeria especially in indigenous vegetable production (Ademola Alawiye, 2013).

Indigenous vegetable is one of the major crops produced in Nigeria and it features in many Nigerian

diets and essential delicacies. These incluse Igbagba (Garden egg, *Solanum macrocarpon*), Ugwu (Fluted pumpkin, *Telfairia occidentalis)* and Efo tete (Amaranth, *Amaranthus spp*). Indigenous vegetable play a vital role in nutrition and general improvement of health because it contains vitamins and minerals various substances which stimulate digestion, act as laxatives, pectin and phenolic compounds which play a part in regulating the body system. The production of indigenous vegetable is very important from an economic point of view in that it generates a fairly wide range of income for the producers in the rural and urban areas (Ibeawuchi *et al*., 2015). But many times, income actually realized from vegetable business is lower than expected because of problems such as pests and diseases, marketing which are very prominent during wet and dry season, post-harvest losses due to lack of storage facilities, little or inability to process the vegetables and the highly perishable nature of vegetables. These have worsened the income from vegetable business and food security status across households. These problems can be alleviated by adding value to the vegetables like drying it to expand its shelf life or processing it to extract useful products from it.

Virtually all the indigenous vegetables contain phytochemicals (phenol) which are non- nutrient plant chemicals (Bamishaiye, *et al*., 2011; Ibrahim and Fagbohun, 2013). Research reveals that the use of these indigenous vegetables and their extracts can be used as anti-oxidant, anti-microbial and nutraceutical (products derived from food or plants which have extra health benefits) products by pharmaceutical and food companies due to the phenolic compounds contained in them (Salawu *et al*., 2011). Phenol or polyphenol is one of the many chemical substances found in vegetables and it is the main dietary antioxidants which possess higher *in vitro* antioxidant capacity than vitamins and carotenoids (Gardner *et al*., 2000).

Phenol is a chemical substance widely used in hospitals, pharmaceutical companies and different types of industries like food, cosmetic etc. Phenol is used by industries in consumer products (in low concentrations) as a disinfectant in household cleaners mouth wash and as intermediaries for industrial synthesis such as starting material to make plastic, explosives (such as picric acid) etc. it is used in the hospitals as surgical antiseptic. It is also used by pharmaceutical companies to make drugs such as aspirin (Leroy, 2014). It is similarly the active ingredient in some over-the-counter oral anesthetics sprays used as a treatment for sore throats. Some phenol derivatives are used in the preparation of cosmetics preparations including sunscreen, hair colouring, lotions, ointments and skin lightening preparation. Concentrated phenol liquid is common used in the surgical treatment of ingrown toe nails. Minor uses of phenol include the manufacture of paint and varnish removers, lacquers, rubber, ink, illuminating gases, intensely colored tanning dyes, perfumes, soaps, herbicides, and adhesives. Phenol can be produced through cumene process or extracted naturally from various ranges of plants and other sources.

Despite the outstanding progress and efforts made in recent years by the pharmaceutical industry in the production and development of highly effective drugs for the treatment of wide range of disease, there has been an increasing trend of consumer preference for natural oxidants because of safety concerns, which has been a driving force to explore natural sources of antioxidants (James, 2013). In many cases, scientific information about these components is relatively scarce (Montgomery, 2004). Review of literature has revealed that nutrient and chemical constituents in more commonly consumed indigenous vegetable species in Nigeria has been studied to an extent (Oke, 1966) but lack of information and inadequate extensive studies on the specific nutrients and phytochemicals on the wide range of distributed indigenous vegetables in which Nigeria is richly endowed with is partially responsible for their under-utilization and under-exploitation (Kola, 2004). It is believed that if the pharmaceutical companies make use of phenol from indigenous vegetables, the increased demand would prevent the glut and post-harvest losses thereby scaling-up the production of indigenous vegetable in Nigeria, creating employment for the unemployed and also boosting the income of indigenous vegetable producers and marketers across the country which has great implications on the nation's food security. In view of this: This study seeks to assess the level of awareness of pharmaceutical companies to phenol from indigenous vegetable and estimate the perception and preference of pharmaceutical companies towards the use of phenol from indigenous vegetables.

## 2.1 LITERATURE REVIEW

### 2.1.1 Model selection

There have been various econometric models applied by different researchers to analyze attitude and perception of consumers but these various models have different uses and setbacks which is based on the validity of the model assumptions. Kariyawasam *et al*., (2006) used ordered logistic model to analyze overall consumer's attitude and perception towards food quality. The sample size is important in the sense that at least 10 per variable sample element is needed thereby making it unsuitable. Han and Harrison (2004) used multi- nominal logit model to analyze consumer's perception for biotech food labelling. The model was estimated separately for two different types of biotech foods, nonmeat and meat products and was expressed as follows:

Pr[] =

Where *J* is the dependent variable and the number of alternatives in the choice set. According to

Greene (2003), coefficients and marginal effects of the multi-nominal logit model are difficult to interpret because of the proliferation of parameters, which results in increased complexity in interpreting the estimates. Heng *et al*., (2013) used mixed logit model to analyze consumer attitude toward farm animal welfare, they used the theory of utility maximization in which the utility that each individual *i* derives from choosing an alternative *j* can be written as:

$U_{ij} = \beta_i X_{ij} + \varepsilon_{ij}$

Where $X_{ij}$ is a vector of observed variables consisting of attributes of the alternatives and individual characteristics. The parameter vector $\beta_i$ varies across individual with density $f(\beta|\theta)$. Where $\theta$ is the parameter vector that defines the distribution and represents the unobservable, error term assumed to be an independent and identical distributed extreme value.

Furthermore, the individual utility was specified for choosing one of the three egg products which was written as:

$U_{ij} = \beta_{0ij} + \beta_{1i}\,\text{Price}_j + \beta_{2i}\,\text{Colour}_j + \beta_{3i}\,\text{Organic}_j + \beta_{4i}\,\text{Vegetarian}_j + \beta_{5i}\,\text{Access}_j + \beta_{6i}\text{Cagefree}_j + \beta_{7i}\,\text{Density}_j + \beta_{8i}\,\text{No moulting}_j + \varepsilon_{ij}$

Where price, colour, organic, vegetarian, access, cage-free, density and no moulting are dummy variables representing egg product attributes with a value of 1 indicating their presence.

Farina and Almeida (2003) in analyzing consumer perception on alternative poultry used conjoint analysis calculating the importance that each attribute has in total aggregate utility of the product. They found out that all the attributes had a similar relative importance with consumers less sensitive to price and more concerned with attributes of quality. Mclennon (2002) in his research on consumer perceptions toward biotechnology and their preferences for biotech food labels analyzed consumer perception using conjoint analysis.

Numerous researchers {Athanasios and Mitchell (2005), Claret *et al*., (2012), George *et al*., (2013) and Jing Li and Simon (2016) have used different methods to examine buyer or user preferences and perception among them is conjoint analysis. Conjoint analysis is a multivariate technique developed specially to understand how consumers develop preferences for different products or services; it is widely used as a psychological research tool in marketing to verify product acceptance because it allows estimating consumer's preferences of a product by combining part worth utilities for each attribute (Bonilla, 2010). It is a technique that can be applied both to products available on the market as well as to hypothetical products (Farina and Almeida, 2003). Its applications are used primarily for new product or concept evaluation, pricing decisions, market segmentation, advertising, and distribution (Bonilla, 2010). The principle of conjoint analysis is to break down a product into its main attributes; it calculates the importance that each attribute has in total aggregate utility of the product. Hence, instead of analyzing the utility gained by the product as a whole, one analyzes the utility of each attribute. Thus, it is possible to verify which attribute the consumer values most (Baker, 1998). There are two stages involved in a conjoint study. The first step involves defining the product attributes and their respective levels. Second, is the experimental design and a choice of data collection method which is constructed of which is then presented to the respondents who then evaluates and puts them in order, according to his or her preferences (Farina and Almeida 2003).

Conjoint analysis is a technique that is used to examine how consumer's perception of attributes influence their preference for the products, it evaluates the relative importance or a product's attributes to consumers by determining a person's part worth utility for each attribute-level and having estimated part worth utility, total utility of individuals can then be estimated for any combination of attributes. Most conjoint analysis studies use Ordinary Least Square (OLS) in which the preference is the dependent variable and the product attributes are the independent variable which is subjected to regression analysis, the coefficients of the regression model are the part-worth utilities (Mclennon, 2002). The general model is introduced in the form of a consumer's utility function, which provides a convenient framework for evaluating consumers' preferences for alternative products. It assumes that a rational consumer will always maximize his/her utility by selecting the most preferred product from the set of alternative products based on the product's attributes, subject to the budget constraints. Given that consumers may not be able to explicitly judge the importance of different attributes and how they may make trade-offs between different attributes, it is more appropriate to ask consumers to provide overall preference ratings of product profiles whose attributes have been listed, and then analyze these results statistically to understand the importance of the attributes. A general linear form of the rating-based conjoint model following Lancaster (1971) can be expressed by the following equation:

$P_i = a_{i0} + \Sigma_j a_{ij} Attribute_j + e_i \; 1 = 1, ...,I$

$P_i$ is the utility or preference rating of the i-th individual, $Attribute_j$ represents the level of each of J attributes of the hypothetical product (j= 1, …,J),and $e_i$ is a random error term after which the part-worth values can be estimated using linear regression by converting the regression results into part-worth scores; the part-worth indicates the estimated change in the product rating for each individual based on the difference between the maximum and minimum levels; it reflects the strength of the individual consumer preference for

each level of each attribute (Novotorova and Mazzocco, 2008).

To determine the relative importance of different attributes to respondents, the trade-offs that individuals make between these attributes, as well as the overall benefit taking into account these trade-offs, a relationship must be specified between the attributes" utility and the rated responses. The simplest and most commonly used model is the linear additive model. This model assumes that the overall utility derived from any combination of attributes of a given good or service is obtained as the sum of the separate part-worths of the attributes. Thus,

$Uij = \beta_{ikl}X_{jkl} + \varepsilon_{ij}, i = 1,...,I, j = 1,..., J$

Where $K$ is the number of attributes, $L_k$ is the number of levels of attribute $k$, and $\beta_{ikl}$ is the respondents $i$'s utility with respect to level $l$ of the attribute $k$. $X_{jkl}$ is such a (0,1) variable that equals 1 if profile $j$ has attitude $k$ at level l, otherwise it equals 0.$\varepsilon_{ij}$is a stochastic error term, the parameters $\beta_{ikl}$ are the part-worth utilities.

The advantages of conjoint analysis are that the utilities of the products or attributes can be added up and the total is what the product is worth but with logistic model, one cannot estimate the value of the alternative by just adding up the utilities that it includes (Quirks, 2015). Since consumer perceptions of a product are based on more than one attribute, it enables researchers to identify and analyze the combination of selected levels of attributes that satisfies and influences consumers' decision by identifying the relative importance of each of the attributes of the products.

## 3.1 METHODOLOGY

The study area for this research is Lagos State. The study population are pharmaceutical companies that are producing in Nigeria in Lagos State. For this study, purposive sampling was used to select 25 from total pharmaceutical companies in Lagos State. Cross sectional data for this study were collected through the aid of well-structured questionnaire. on the awareness of pharmaceutical companies to phenol in vegetable, on their perception on the price, quality, efficiency, quality and comparative advantage and their preference to phenol in vegetable. The questionnaire which requires hierarchical steps of ranking was designed based on conjoint analysis technique based on the attributes of phenol which includes; price, quality, efficiency, quality in order to identify the relative importance the companies assigned to them and their part worth utilities. Price was chosen as one of the variables, because it is an important attribute in any decision. The price levels that were defined are; expensive, fair, and cheap. For efficiency; high, moderate and low. The last two attributes (quality and quality) had three levels each which are; good, fair, poor. The data were analysed using descriptive and conjoint analysis. The descriptive statistical analysis (tables, frequency and percentage) was used to evaluate the level of awareness and summarize the responses on perception of pharmaceutical companies on the attributes relating to phenol from vegetable. Conjoint analysis was employed to analyze pharmaceutical companies' perception of attributes which influence their preference for phenol from indigenous vegetables. A fractional factorial design was used which uses the orthogonal array in experimental design for each of the factor combination, each consumer is asked to give their score or preference for the most important items of phenol from vegetables attributes and designed the questionnaires.

The total number of parameters to be estimated by conjoint analysis was calculated as thus;

Total number of parameters = total number of levels – total number of attributes + 1
Total number of parameters = 12 – 5 + 1
= 8

Hence, the total number of parameters estimated for this study is 8 and the independent variables are 7 and the model is specified as thus;

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4 X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + Ei$

$Y = \beta_0 + \beta_1$PRICE $+ \beta_2$QUALITY $+ \beta_3$EFFECTIVENESS $+ \beta_4$QUANTITY $+ Ei$ where$i = 1, 2,3,...8$

Where,
Y = Preference
$\beta_0$= Intercept
$X_1$, $X_2$ = Price of phenol from indigenous vegetable
$X_3$, $X_4$ = Quality
$X_5$, $X_6$= Effectiveness
$X_7$, $X_8$ = Quantity
The X variables are expressed as dummy variables

Where preference rating for the i-th individual price, quality, effectiveness and quantity are discrete variables represented by different levels.

## 4.1 RESULTS AND DISCUSSION

### 4.1.1 Result of level of awareness of phenol in indigenous vegetable

#### 4.1.1.1 Awareness level of pharmaceutical companies to the presence of phenol in vegetable

Results in Table 1 show that almost half (44%) of the respondents were very aware of the presence of phenol in vegetable while 8% were not aware and extremely aware of the presence of phenol in vegetable. This depicts that there is awareness among pharmaceutical companies in Nigeria. Also the pharmaceutical companies knew that phenol can be extracted from indigenous vegetables to make drugs.

**Table 1: Awareness level of pharmaceutical companies to the presence of phenol in vegetable, its extraction and use**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Awareness of the presence of phenol in vegetable** | | |
| Not aware | 2 | 8 |
| Slightly aware | 5 | 20 |
| Moderately aware | 5 | 20 |
| Very aware | 11 | 44 |
| Extremely aware | 2 | 8 |
| Total | 25 | 100 |

Source: Field survey, 2016

**4.1.1.2 Use of phenol extracted from Indigenous vegetable**

From Table 2, majority (88%) of the respondents do not use phenol extracted from indigenous vegetable while few (12%) use phenol extracted from indigenous vegetables to make drugs. The very low use in phenol from vegetable can be attributed to the high price related to extraction of phenol from vegetable and the low quantity of phenol in vegetable as portrayed in Table3.

**Table 2: Use of phenol extracted from vegetable**

| Variable | Frequency | Percentage |
|---|---|---|
| Yes | 3 | 12 |
| No | 22 | 88 |
| Total | 25 | 100 |

Source: Field survey, 2016

**4.1.2 Result of assessment of the perception of pharmaceutical companies to the use of phenol from indigenous vegetable**

From Table 3, with respect to price, 32% of the pharmaceutical companies think that the use of phenol from indigenous vegetable is very expensive while 4% of them think that it the use of phenol from vegetable is cheap. This suggests that even though the pharmaceutical companies are very much aware of the presence and use of phenol from indigenous vegetable to make drugs, they might not use it because they think it is expensive.

It also shows that 40% of the pharmaceutical companies evaluated the quality of phenol from indigenous vegetable to be fair and 12% believed phenol from vegetable to be very good. This infers that even though they are aware of phenol from indigenous vegetables, they may or may not use it because they believe the quality to be of average. With respect to effectiveness, it depicts that 40% of them believed phenol from indigenous vegetable to be moderately effective and 12% of them believed it to be low and very high. This suggests that they may or may not use phenol from indigenous vegetable.

It also shows that 64% of them opined that the quantity of phenol from vegetable is small and 4% of them accepted that the quantity is large. This suggests that even though they are aware of phenol from vegetable they would most likely not utilize it because they think that phenol from vegetable is low in quantity.

In addition, the table shows that 44% of them evaluated phenol from indigenous vegetable to be cheaper compared to other sources of phenol while 20% of them evaluated it to be assessable compared to phenol from other sources. Based on the evaluation of phenol from indigenous vegetable to be cheaper than other sources, the respondents might use the phenol from indigenous vegetable.

**Table 3: Assessment of the perception on phenol from vegetables by the pharmaceutical companies**

| Variable | Frequency | Percentage |
|---|---|---|
| **Price** | | |
| Very expensive | 7 | 28 |
| Expensive | 8 | 32 |
| Fairly expensive | 3 | 12 |
| Fairly cheap | 5 | 20 |
| Cheap | 1 | 4 |
| Very cheap | 1 | 4 |
| Total | 25 | 100 |
| **Quality** | | |
| Very good | 3 | 12 |
| Good | 8 | 32 |
| Fair | 10 | 40 |
| Poor | 4 | 16 |
| Total | 25 | 100 |

| Variable | Frequency | Percentage |
|---|---|---|
| **Effectiveness** | | |
| Very high | 3 | 12 |
| High | 9 | 36 |
| Moderate | 10 | 40 |
| Low | 3 | 12 |
| Very low | 0 | 0 |
| Total | 25 | 100 |
| **Quantity** | | |
| Large | 1 | 4 |
| Fair | 8 | 32 |
| Small | 16 | 64 |
| Total | 25 | 100 |
| **Comparative advantage** | | |
| Better compared to phenol from other sources | 9 | 36 |
| Cheaper compared to phenol from other sources | 11 | 44 |
| Assessable compared to phenol from other sources | 5 | 20 |
| Total | 25 | 100 |

Source: field survey, 2016

**4.1.3 Result of preference towards the use of phenol in vegetable by pharmaceutical companies**

**4.1.3.1 Part-worth or utility estimates for attributes of phenol from indigenous vegetable.**

From the result of the conjoint analysis shown in Table 4, it can be inferred that the most important attribute of phenol from indigenous vegetable is effectiveness which constitutes 36.95% of the total utility and the category of the effectiveness mostly preferred is high effectiveness with estimated utility of 1.533. The second most preferred attribute is quality which constitutes 31.77% of the total utility and the category of quality most preferred is good quality which has an estimated utility of 1.227. The third most preferred attribute is price which I about 19.63% of the total utility and the most preferred attribute of price is cheap price which has estimated utility of 0.733 and the least important attribute is quantity which constitutes 11.65% of the total utility and the category of quantity most preferred is large quantity with estimated utility of 0.173. This indicates that the pharmaceutical companies would prefer phenol from indigenous vegetable with the combination of attributes of cheap price, good quality, high effectiveness and large quantity.

**Table 4: Part-worth or Utility estimate for attributes of phenol from indigenous vegetable**

| Attribute | Level | Estimated utility | Importance values (%) |
|---|---|---|---|
| | Cheap | 0.733* | |
| Price | Fair | 0.120 | 19.63 |
| | Expensive | 0.613 | |
| | Good | 1.227* | |
| Quality | Fair | 0.213 | 31.77 |
| | Poor | -1.1440 | |
| | High | 1.533* | |
| Effectiveness | Moderate | 0.147 | 36.95% |
| | Low | -1.680 | |
| | Large | 0.173* | |
| Quantity | Medium | -0.027 | 11.65% |
| | Small | -0.147 | |

Source: Data analysis, 2016. * represents the most preferred level in the Attributes

## CONCLUSION

This study shows that the pharmaceutical companies are very much aware of the presence of phenol in indigenous vegetable, the extraction of phenol in indigenous vegetable and its use to make drugs. From the result of use of phenol from indigenous vegetable, it is shown that most of the pharmaceutical companies do not use phenol from indigenous vegetable and overall perception on the attributes of phenol shows that price of phenol is expensive; quality is fair, effectiveness is moderate, quantity is low and comparative advantage is cheaper compared to other sources of phenol. This depicted that even though the pharmaceutical companies are very much aware of the presence, extraction and its use, they still do not use it and this is due to its high price, fair quality and relatively low quantity.

The result from the conjoint analysis displayed that the respondents evaluated effectiveness as the most important attribute of phenol from indigenous vegetable with quality as the second most important attribute followed by quantity and price. The combination of attributes that upgrade the respondent's preference for phenol from indigenous vegetable is cheap price, good quality, high effectiveness and large quantity. Future research is there by recommended on comparative health advantage of phenol from indigenous vegetables, determining the indigenous vegetables with high phenol content and improving the quality of phenol from indigenous vegetables.

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