Consumer Preferences for Watermelon in Kano State, Nigeria: Implications for Breeding and Market Development

SUNUSI, YAKUBU AHMAD
Department of Agricultural Economics and Extension
Dangote University of Science and Technology, Wudil – Nigeria
AMINU SULEIMAN
Department of Agricultural Economics and Extension
Bayero University Kano – Nigeria
AMINU SALEH
Department of Agricultural Education
School of Vocational and Entrepreneurship Education
Kano State College of Education and Preliminary Studies, Kano - Nigeria

Abstract

 Understanding what consumers truly value in agricultural commodities is critical for aligning production, breeding, and marketing strategies. This study explores consumer preferences for different watermelon attributes in Kano State, Nigeria—an area with rising watermelon production and market activity. Using a multi-stage sampling technique, data were collected from 124 consumers across key retail outlets, supported by key informant interviews. The Consumer Preference Ranking Index (PRI) model, developed by A. Suleiman (2018), was applied to quantify and rank preferences across six key attributes: variety, size, weight, taste, skin color, and flesh color. Findings reveal that the Kaolack variety is the most preferred overall, particularly due to its large size, heavier weight, and deep red, spongy flesh. However, Sugar Baby was rated highest for taste, suggesting a trade-off between appearance and sweetness. Rothmans consistently ranked lowest across most attributes. Notably, all consumers showed a strong preference for fruits with glossy, fresh-looking skin—an indicator of quality and ripeness. These insights suggest a strong case for demand-driven breeding interventions. Breeders are encouraged to improve Kaolack by integrating sweetness traits from Sugar Baby to combine visual appeal with superior taste. Doing so can increase consumer satisfaction, reduce postharvest losses due to mismatches in supply and demand, and enhance the economic value of watermelon in local markets.

Keywords: Watermelon, Consumer Preference, PRI Model, Kano State, Variety Traits, Market Demand, Breeding Strategy

1. INTRODUCTION

Consumer preferences describes the attitudes of consumers for a particular product, be it goods or services that are formed based on an evaluation of existing product choices (Kotler and Keller 2008). Learning about consumer behavior does not only discuss what consumers buy, but also the reasons they buy, when, where, and how consumers buy these products and how often they make purchases (Schiffman et al, 2010). The level of preference that consumers reach for a product, is the beginning of the stage of consumer's loyalty to the product. Entrepreneurs therefore, have to learn to recognize

266

consumer's needs in order to produce products or services with market orientation based on the level of consumer preference for each product attribute. Consumer preferences indicate the degree to which a person likes or dislikes a type of product or service based on some identified characteristics. Preferences for food products is therefore an illustration of one's attitude towards food and one can make choices from products that have at least two different types of food with varied attributes or characteristics. Kotler (2000), outlined three components of preferences that affect food consumers and that all these components influence each other and are related to each other as follows:

1. individual characteristics include: age, gender, education, income and knowledge of nutrition,
2. Product characteristics include taste, color, aroma, packaging and texture,
3. Environmental characteristics include number of families, social level, season and mobility).

Several studies Lauren, M (2021), Yekimov S, (2021), Florencia, (2016), Lynn et al, (2012) and Thornton (2013) have been conducted to determine the consumer preferences of Agricultural products across the globe hence the need for such a study on Watermelon in North western Nigeria because of its economic potentials prevalence and widespread acceptance in the area. Watermelon (*Citrullus lanatus*) is an important Fruit vegetable crop, mostly grown for its sweet and juicy fruit. According to Robinson and Decker-Walters, 1997; and Jeffrey, 2011, the crop is mostly cultivated in warm climates all over the world. The crop is believed to originate from Africa even though the geographical location of the crop is not ascertained. However, the Kalahari Desert, accommodating some of the species found in their wild forms is one probable gene center (vander Vossen et. al, 2004) from where the production of the crop spread to Asia, Europe and to America. Watermelon is gradually becoming a widely recognized and cultivated Fruit vegetable crop with its global production   reaching 89.9 million mega grams (FAO, 2018). Currently, China is the leading country in watermelon production, followed by Turkey, United States, Iran and Republic of Korea (FOA, 2018, Huh *et al.* 2010; Wehner and Maynard, 2013). Africa however, accounted for only 5.4% of the Watermelon production in the 2008 (FAOSTAT, (2014), and this contributed to the world watermelon production with 4.6% of 99,194,223 tones. Nigeria produced more watermelons in 2011 (139,223 tons) than the leading fresh produce African exporter, Kenya, which produced 66,196 tons and South Africa that produced 77,993 tons The largest production of the crop in Nigeria comes from the northern part of the country where suitable Agro-ecology is found. Saleh, 2012 reported that Watermelon production has gained momentum in both North West and North Eastern Nigeria becoming a viable enterprise providing alternative commercial crop to the teeming population thereby improving their means of livelihood and also providing them with the required micro nutrients deficient in their diets FOA (2018).

1.1 Problem Statement

Previous studies by Muhammad, 2014, Saleh, 2012, Saleh, 2019) has shown that watermelon production enterprise has been recognized among smallholder producers in Kano State as a result of its huge economic potentialities as a profitable enterprise driven by high demand of the commodity in major cities and towns in the country and beyond. However, while consumers have varied preferences to the commodity attributes, there seems to be a clear absence of consumer-preference- targeted

production (CPTP) by failure of the producers to consider the rationality of the consumers as well as matching their preferences with the production outputs. In the same vein, there is no known local processing method or technology for the commodity in Nigeria at a time when processing of fruits and vegetables is getting higher attention worldwide as it seldom meets the preferences of the consumers, reduces the risk of glut, ensure year-round availability of the produce as well as enabling farmers get good prices for their produce (World Bank, 2018). Streamlining the production of watermelon to align with the needs of the consumers requires detailed and accurate information on the various attributes of the product that will   satisfy preferences consumer. This information should be made available to the watermelon breeders producers in the study area hence the need for this study.

1.2 Objectives to the Study
The broad objective of the research is to determine the commodity attributes that influences Watermelon consumption in the study area.
The specific objectives are to: determine the commodity factors, influencing the consumption of watermelon in the study area.

2. LITERATURE REVIEW

2.1 The Consumer Demand Theory
This study is based on Lancaster's *"new theory of consumer demand"* (1966), which stipulated that *"*consumers derive utility from characteristics or attributes of the good, rather than the good itself. There are three main assumptions governing this approach to consumer theory. The theory could be summarized as follows:

- Goods, does not provide utility to the consumer; rather, it possesses certain inherent characteristics or attributes, which give rise to utility
- A particular Good possess more than one characteristics or attributes, and many characteristics will be shared by more than one good
- A combination of Goods may possess characteristics or attributes different from those inherent to the goods separately.

It is also assumed that the attributes possessed by a Good is viewed as the same by all consumers. Therefore, the personal element in consumer choice arises only in the choice between collections of attributes.

2.1.1 Measurement of Consumer Preferences
Agwu, (2011) defined Consumer preferences as the subjective (individual) tastes, as measured by utility, of various bundles of goods. Preference permits the consumer to rank these bundles of goods according to the levels of utility derived by the consumer. Preferences therefore, are independent of income and prices. Generally, consumers make decisions by allocating their scarce income across all possible goods in order to obtain the highest level of satisfaction. Formally, we say that consumers maximize their utility subject to budget constraint. Utility is defined as the satisfaction that a consumer derives from the consumption of a particular good or service. The determinants of utilities are decided by a host of noneconomic factors. Consumer value is measured in terms of the relative utilities between goods. These reflect the consumer's preferences. Clay *et al,* 2005 stated that consumers of Fruits and Vegetables are usually influenced by such factors as the availability and accessibility of the product, as well as the desirability of the consumers. Consumer preference is an

indicator of how much of a product that consumers are willing to purchase, and is a function of income, relative prices and consumer priorities, preferences and choices. Identification of customer needs and desires constitute a critical aspect of marketing. Taste, perception and other commodity attributes have varying degrees of importance to different consumers. Convenience, that is the time and ease of preparation and consumption, is also a significant factor as consumers want products that fit into busy lifestyles. Producing the same horticultural produce will not necessarily contribute to increased consumption or to improving nutrition unless people want to purchase the products and can afford to do so (Clay *et al,* 2005). Since watermelon consumption is receiving attention in virtually all Nigerian towns and cities, the Knowledge of consumer preferences of the commodity in some selected states of the Country is therefore essential in developing the Watermelon markets. Breeders need to know what characteristics consumers want in terms of Taste, Colour of the flesh, Texture, Size and number of seeds it contains. Integrated pest management specialists need an estimate of the level of Fruit damage acceptable to consumers etc.

Furthermore, Florencia, (2016) stated that the choices or preferences of a consumer is dependent on both object- related (i.e. attributes and cues) and subject-related aspects (i.e. individuals lifestyle, income levels etc.). It is in line with this that this study mainly centered on attributes or characteristics of watermelon (i.e. attributes and cues) with a view of determining those prevailing characteristics mostly preferred by the consumers in order to serve as guide for producers and marketers across the study area.

In line with these postulations and assumptions therefore, the followings were also conceived for this study:

1. That the watermelon consumers willingly choose the location (Seller/Retailer) and select the watermelon to purchase among the different options available at the point of sale.

2. Consumers who have experience in watermelon consumption uses their prior knowledge and or utilities derived from previous consumption of the commodity to guide their preferences or choices

3. That consumers have the capacity to judge and express their preferences based on the commodity attributes with reference to previous consumption experiences.

4. It is also assumed that the views of the consumers on the various watermelon attributes will differ and or be similar to those attributes. However, these views can be seen as preferences expressed by the consumers; and that these preferences can actually be summarized using index as used previously in other studies and expressed as consumer preference ranking index (CPRI) as in the case of Lynn et al, (2012) in their study on colour preference and food choice among children, Thornton (2013) in his study on the validation of the colour preference index etc. There are many tools available for determining the consumer preference for a giving Commodity, However, the consumer preference ranking index model (PRI) developed by A. Suleiman (2018) is adopted for this study. The model offers a user-friendly approach that transforms qualitative consumer perceptions of commodity attributes into quantifiable preference indices.

3. METHODOLOGY

The study was conducted in Kano state which falls under the Sudan Savannah agro-ecological zone of Nigeria. It is largely situated in the Sudan savannah agro-ecological

except for its southern border which predominantly shows traces of Northern Guinea Savannah. It lies between latitude 13.53° N and 10.25° N and longitude 7.40°E and 10.53°E, and is about 480km from the edge of Sahara Desert (KNSG, 2006). According to Ahmed at, al. (2018), the projected estimated population figure of the state in 2018 rose to 13,376,892 million people. These factors enabled the production and marketing of several crops like watermelon hitherto not known or cultivated in the area. Thus, ensuring the state to become the major Commercial as well as Marketing center across Northern Nigeria hosting some international markets like Dawanau (Grains) and Na, ibawa-Yan-lemo (Fruits and Vegetables) among others.
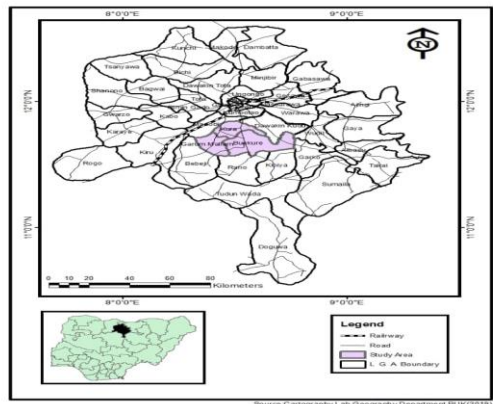

Figure 1: Map of Kano State showing the selected Local Government areas

3.1 Sampling Procedure

Multistage sampling procedure was used to select consumers for the study. The watermelon consumers were randomly selected from different sections of the state. However, most of the consumers were drawn Na, ibawa Yan-lemo Market because of the higher concentration of the consumers, marketers and the marketing activities of the commodity in the area. Different retail outlets across the state metropolis were selected in an attempt to reflect the diverse income, social and educational status that make up the entire population. Specifically, retail outlets at locations such as Karfi, Na, ibawa yan- lemo Market, Nassarawa GRA, Ahmadu Bello way, Nassarawa Hospital, and BUK road were selected and included for the consumer survey. Recognizance visits were conducted across the aforementioned locations and retailers of watermelon were identified and listed. Also, preliminary information on average number of customers per retail outlet was obtained from the retailers. This served as the basis for sample size determination and distribution across the retail outlets in the two states. Overall, two hundred and thirty (124) watermelon consumers were interviewed across the state as shown in table 1. Enumerators were stationed at the identified retail outlets awaiting the arrivals of the consumers who were considered for the interview only after they purchased and paid for the watermelon. The first interviewed consumer served as the basis for selecting the subsequent consumers at an interval of 1(one) until the entire sample allocated to the outlet was exhausted.

Table 1 Sample size for the Consumers of Watermelon.

	Number of Customers (Sample Frame)	Sample Size
Kano:		
Na, ibawa Yan-lemo Market	105	63
Karfi	62	28
BUK Road	25	8
Ahmadu Bello Way	25	8
Nassarawa Hospital	22	5
CBN Round about	30	12
Sub total	269	124

Source: Field survey 2025.

In addition, a total of 20 key informant producers and 10 consumers of the commodity were identified across the states for qualitative interviews.

3.2 Method of Data Collection

Prepared questionnaires were used by enumerators to obtain data from the watermelon consumers across the states. Data collected covers information on the socio-economic characteristics of the watermelon consumers such as age, sex, marital status, household size, educational status, years of experience in watermelon consumption, etc. Enumerators were stationed in the identified watermelon retail outlets. The enumerators solicited for participation of consumers in the survey at the point of watermelon purchase. Consumers that obliged to provide information were interviewed using the structured questionnaire.

3.3 Data Measurement Techniques

According to Muhammad (2014) and Saleh (2012, 2020) there were three main varieties of watermelon widely grown in the area namely: Kaolack, Sugar Baby and Rothmans. Among these three, Kaolack with varied size and light green color sprinkled with greenish dots all over its surface was the most commonly produced variety across the study area. It is followed by sugar baby having dark green coloured skin and then Rothmans with light green color and stripes of dark colored chains running across the entire length of the fruit. Sugar baby and Rothmans are produced in the area almost at the same proportion. The predominance of Kaolack among the producers was according to key informant interview as a result of its adaptability in the area as well as its widespread acceptance among consumers. Generally, Watermelon fruits are sorted into grades (1, 2, 3.) as it is being harvested.

3.3.1 Measurement of watermelon weight

Previous study (Saleh, 2012) revealed that were three main watermelon grades identified for marketing purposes in the study area namely; grades (1, 2, & 3). Accordingly, five watermelon fruits each were bought from the different grades and from different retailers. The fruits were measured separately using a weighing balance. The average weight determined for each grade was used as the weight (Kg) of the watermelon fruit for that grade respectively.

3.3.2 Colour of watermelon flesh

Generally, the color of the ripe watermelon flesh of all the varieties produced in the area ranges from red to pink. Earlier studies (Saleh, 2012) revealed that the taste of the fruit directly relates to intensity of the red colour of the flesh. This often informs the decision of most marketers to cut open some watermelon fruits, exposing their inner

flesh and display them as samples to prospective consumers. For this reason, different samples of Watermelon of the three main varieties Kaolack, Rothmans and Sugar baby ((figures 3, 4 and 5) were purchased. The fruits were sliced open to expose the flesh colour. The colour of the flesh was determined by consumers and the enumerators with the aid of a colour chart.

3.3.3 Watermelon taste
Samples of the different watermelon varieties were purchased and sliced open and shared among some respondents who tasted the samples and then later they were asked to identify tastes of their own choices as Sweet, moderately sweet and not sweet as the case may be.

3.3.4 Determination of the watermelon size
Watermelon fruit size was determined using a measuring tape. The circumference of five watermelon fruits from each of the different grades and from different retailers was measured. The average size determined for each grade was used as the size (cm^2) of the watermelon fruit for that grade.

3.4. Analytical Techniques
To achieve the objectives of this study, Consumer Preference Ranking Index (PRI) analytical techniques was employed: Following Florencia, (2016), Lynn et al, (2012) and Thornton (2013) preference ranking index (PRI$_i$) model was developed by A. Suleiman, (2018) serving as a tool for analyzing the consumer preferences of a particular commodity exhibiting different attributes that influences consumer choice and eventual consumption of that commodity in order to maximize utility. The index aimed at ranking the preferences of the consumer based on commodity attributes selected and ranked by the consumers.

Preference ranking index model is mathematically represented as:

$$PRI_i = \sum X_i \text{---} (1)$$

Where:

$$X_i = \frac{f_i}{cf} \text{--} (2)$$

$$\sum X_i = X_{1} + X_{2} + X_{3}$$

$$= \frac{f_1}{cf} + \frac{f_2}{cf} + \frac{f_3}{cf} \text{--} (3)$$

f_i = Number of consumers that indicates first preference to the watermelon attributes (variety, weight, size, taste, fruit skin colour, flesh colour)

f_2 = Number of consumers that indicates second preference to the watermelon attribute (variety, weight, size, taste, fruit skin colour, fruit flesh colour)

f_3 = Number of consumers that indicates third preference to the watermelon attributes (variety, weight, size, taste, fruit skin colour, fruit flesh colour)

cf = Number of consumers participating in ranking the variety (cumulative frequency).

Index Estimation Error (IEE) = 1 - $\sum PRI_i$ -------------------------------- (4)

Errors could arise due to inability of a consumer to provide opinion on a particular commodity attributes.

To redistribute the IEE, an Average Index Estimation Error (AIEE) is computed:

$$AIEE = \frac{IEE}{No.of\ PRIi} \text{---} (5)$$

If the AIEE is negative subtract the AIEE from each of the PRI$_i$ otherwise add it on each of the PRI$_i$

Accordingly, the watermelon attributes and their unit of measurement considered by the model is represented as follows:

V= Variety {Kaolack, Rothmans, Sugar baby}

W = Fruit weight (Large (7kg), Medium (5.3kg), Small (4.4kg)

S = Fruit size Big (73.6cm), Medium (68.2cm), Small (62.8cm)

T = Taste {sweet, moderately sweet, not sweet}

C= Colour of the flesh {red, pink.}

F= Freshness of skin {fresh and glossy, not fresh}

4. CONSUMER PREFERENCES OF THE WATERMELON ATTRIBUTES

The preferences of a consumer are defined as the subjective or individual tastes of the consumer as measured by utility, of various bundle of goods. This definition enables the consumers to rank these bundles of goods according to the levels of utility obtained. It is in line with this that this study mainly centered around attributes or characteristics of watermelon (i.e., attributes and cues) with a view of determining those prevailing characteristics mostly preferred by the consumers in order to serve as guide for breeders, producers and marketers across the study area. The highest obtainable preference index value is 1 and the least is 0.

4.1 Preference for watermelon varieties among consumers

Globally, different watermelon varieties are grown. However, the study shows that the predominantly grown and consumed varieties across the state were found to be Kaolack, Sugar-baby and Rothmans, respectively. Generally, the varietal indices from the results revealed that consumers across the state ranked Kaolack first as their most preferred variety; it was then followed by Sugar baby and then Rothmans, respectively (Table 2). Consumers showed higher preference for Kaolack with an index value of 0.479. It was then followed by Sugar baby (0.277) and then Rothmans (0.243). The results further implied that while Kaolack stand out on its own by virtue of its higher index value, Sugar baby and Rothmans have close preferences. This means that consumers of Sugar baby may settle for Rothmans as an alternative for each other and vice versa. However, consumers of Kaolack are not likely to exchange their preferences for Kaolack with that of either Sugar-baby or Rothmans. For Sugar-baby preference to rise up to that of Kaolack, it has to increase by 20%. Reasons for these consumer preferences were evaluated on the basis of, taste/sweetness and physical appearance weight, and sizes. The results show that availability was not an important parameter in the choice of variety for consumption. This seems to be true considering the fact that the varieties were commonly available across the states. Despite these, field observations (at the time of survey) revealed that Kaolack was more commonly available which according to producers was mainly as a result of its adaptability to the environment and it was also found to be less perishable. This in agreement with the findings of Jain *et al.* (2013) in a study performed in India which revealed availability and variety of products are the most important factors for consumers.

Table 2: Consumer Preference Ranking Indices for Watermelon Attributes

Preference Indices of Watermelon varieties in Kano State Variety and Varietal Characteristics	Kaolack	Sugar Baby	Rothmans
Variety	**0.4790**	**0.2773**	**0.2437**
Size: (Large(62.8cm2); Medium(62.9- 68.2 cm2); Small (68.3-73.6 cm2 and above)	0.4792	0.4688	0.0520
Fruit Weight: (Heavy (5.31-7.00kg and above); Medium(4.41-5.30kg); Light (4.41Kg)	0.4792	0.3542	0.1666
Taste: (Sweet; Moderately Sweet)	0.3120	0.5630	0.1250
Skin Colour/Freshness (Glossy and Shinning; Dull)	0.3333	0.3333	0.3333
Flesh Colour: (Red flesh; Pink flesh)	0.5265	0.3797	0.0938

Source: Field survey, 2025

4.2 Preference for watermelon sizes among consumers

Size of the watermelon fruit is an important characteristic feature being considered by the consumers in their choice for selection in the Market. Generally, Table 2 shows that consumers across the study area have higher preference for large watermelon fruit. The fruit size index for Kaolack was 0.479 and then closely followed by Sugar baby (0.468) and lastly Rothmans (0.052). The higher index scores for Kaolack across the State connote higher preference for the variety, and it implies that on the average the variety produces larger fruit sizes than Sugar baby and Rothmans, respectively. The result further implies that, Rothmans with its relatively small fruit size, which constitute a considerable portion of the farmers yield, have low market in the State. Several reasons were advanced by the consumers as for their preferences in terms of sizes. Respondents for example believed that size has a direct relationship with ripeness and sweetness while others related size with the watermelon flesh while others simply believed that the larger the fruit, the more ripe it becomes.

4.3 Preference for watermelon weights among consumers

Another important feature of great consideration by the watermelon consumers in the area was its weight. According the results, Kaolack had the highest index value of 0.479 followed by Sugar baby (0.354) and then Rothmans with the least index value (0.166). Consumer preferences with respect to watermelon weight therefore were in favour of heavy, medium and then light. The high index value for Kaolack with respect to its weight means that the variety had a competitive advantage over Sugar baby and Rothmans and, therefore, most preferred. This closely agrees with the results obtained with regards to size, since weight is a function of size. In addition, according some key informants, the weight of a given watermelon is also a function of the juice it contains and therefore most preferred.

4.4 Preference for watermelon tastes among consumers

Watermelon taste is certainly the most important characteristic feature being considered by the consumers across the area. The result further shows that Sugar baby with the highest index value of 0.563 was the most preferred variety with respect to taste. It was then followed by Kaolack (0.312) and lastly Rothmans with the least index value 0.12.

This result portrays Sugar baby as the variety with the most desirable taste across the State. This attribute gives it a competitive advantage over Kaolack which in turn had competitive advantage with respect to size and weight. This agrees with findings of Oladele (2015) and that of Iyabo and Olubunmi (2012) In which 89% of the consumers were found to show higher preference for sweet watermelon. Results also revealed that the reasons given by the consumers for their preferences includes the

sweetness itself (65%), 8% for stimulating food intake and the remaining 5% for health benefits in Kano state. In the same vein, 57%, 16% were recorded for sweetness, and stimulating food intake respectively.

4.5 Preference for watermelon skin-colour among consumers

The watermelon skin colour is another important physical characteristic feature being considered by the consumers in their preferences for the purchase and consumption of the commodity in the area as attested to by most of the consumers who attributed it to freshness and therefore taste of the watermelon. The results revealed that all the consumers across the state preferred watermelon whose skin was fresh, shiny and glossy. All the varieties across the state therefore had the same index value of 0.333 as shown by Table 2. This agrees with Iyabo and Olubunmi (2012) In addition key informants further revealed that fresh and glossy watermelon skin indicates ripeness and fresh fibre content.

4.6 Preference for Watermelon flesh colour among consumers

According to key informants, the colour of the watermelon flesh is a recipe for its taste which is probably why watermelon retailers in the study area have over the years succumbed to the request of most of the prospecting consumers for slightly opening up the watermelon balls to expose its flesh colour even before purchase is concluded. Notable flesh colours for a ripe and presumably sweet Watermelon were either red or at worst pink. The results revealed that Kaolack with an index value of 0.526 was the most preferred variety with respect to its well pronounced red and spongy flesh (locally referred to as *"mai yashi"* across the States.). It was then followed by Sugar baby (0.379) and lastly Rothmans with a pinkish flesh and hence having the least index value of 0.093 was least preferred. This implied that on the average, a ripe Kaolack watermelon fruit is more reddish and spongy than either that of Sugar baby or Rothmans. The higher index value score for Kaolack with respect to colour of the flesh further implied that the variety has yet another competitive advantage (in addition to fruit size and weight) over the other varieties. Key informant interview also suggests that, the red colour of the watermelon fruit categorically signifies ripeness and by extension sweetness of the fruit. This agrees with Muhammad (2014) and Iyabo (2012) in their separate studies on watermelon in Kano and Oyo States respectively.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The overall results shown in Table 2 further revealed that consumers of watermelon in the State indicated higher preference for Kaolack because of its competitive advantage over other varieties with respect to fruit size, weight and colour of the flesh. It was closely followed by Sugar baby that had a competitive advantage over even Kaolack with respect to sweetness. However, Rothmans was the least preferred variety considering all the indices considered by this work having a comparatively lower index values than other varieties.

5.2 Recommendations

Watermelon producers should adopt the participatory irrigation management (PIM) stratagies developed under the NAERLS/ABU Zaria, CIRAD and HJRBDA collaborative projects which will greatly improve the services of the Irrigation Facilities

and hence the well being of the Producers.In addition, Scientists/Breeders should take advantage of the competitive advantage of the Kaolack variety in the Market and work towards its development in order to meet the sweet taste of sugar baby in order to increase demand and subsequent consumption of the fruit as a way of avoiding Glut and low prices of the commodity.

REFERENCES

1. Abba, A. (2009). Framework for Agricultural Market Analysis: Theories and Applications. Ahmadu Bello University Press Limited, Zaria Kaduna State, Nigeria www.abupressltd.com

2. Agwu, N. M. (2011). Patterns and Determinants of Fruits and Vegetables Consumption in Urban and Rural Enugu State Nigeria (An Unpublished Ph.D Thesis) Submitted to the department of agricultural Economics, university of Nigeria, Nsukka

3. Ahmed, B.S. A, Saleh, (2018) Socio-Economic Characteristics of the Irrigated Tomato Farmers under Kano River Irrigation Project, Phase I, Kano State, Nigeria. *Proceedings of the 3th Annual Conference of the Horticultural Society of Nigeria (HORTSON) Lafia 2018, Ta,al conference Hotel, Lafia, Nassarawa State, Nigeria. (23rd-2th October, 2016).* Pp 274-280.

4. Balogun, O. S., Akinyemi, O., Simoyan, J. B. and Olowoluwa, I. J. (2006): Profitability Analysis and Resource Use Efficiency of Yam/Millet Crop Mixtures in Gwagwalada Kuje Area Councils, Abuja, Nigeria. In: Haruna, U. et al. (Eds). Consolidation of Growth and Development of Agricultural Sector. Proceedings of the 9th Annual National Conference of Nigerian Association of Agricultural Economists held at the Abubakar Tafawa Balewa University, Bauchi. pp 15-18

5. Clay, W, Galvex-Nogales, E and Wall G (2005): consumers' needs and preferences for fruit and vegetables Food and Agricultural Organization of the united nations, Rome, 2005.

6. De Lannoy, (2001). Crop Production in Tropical Africa. Romain H.R (Ed). Published by Directorate General for International Cooperation (DGIC), Brussels, Belgium. Pp.236238 7. FAO, (2011).

7. FAO (2011) Agricultural statistics for 2011. Food and Agriculture Organization of the United Nations, http://apps.fao.org/page/collections?subset=agriculture retrieved 18.08.2014

8. FAOSTAT (2011) Food and agriculture organization of the United Nations. (Crop Database). http://faostat.fao.org/site/567/default.aspx#ancor. Retrieve 22.6 2017

9. Federal Republic of Nigeria (2007) *Official gazette*. No24 volume 94 Published by the Federal Government Printer Lagos, Nigeria

10. Food and Agriculture Organization of the United Nations. (2012). FAOSTAT Database. Rome, Italy: FAO. Retrieved March 1st, 2016 from http://faostat3.fao.org/home/E

11. FAO (2017) Agricultural statistics for 2011. Food and Agriculture Organization of the United Nations, http://apps.fao.org/page/collections?subset=agriculture retrieved 18.08.2014

12. FAO. (2018) Food and Agriculture Organization of the United Nations. Food price index. Retrieved from http://www.fao.org/worldfoodsituation/foodpri-cesindex/es/

13. Florencia C.(2016) Consumer preferences for retail channel and beef steak attributes: Experimental evidence from Argentinean consumers: (*A THESIS Submitted to Michigan State University in partial fulfillment of the requirements for the degree of Agricultural, Food and Resource Economics - Master of Science*)

14. Grunert, K. G., Bech-Larsen, T., & Bredahl, L. (2000). Three issues in consumer quality perception and acceptance of dairy products. International Dairy Journal, 10(8), 575-584.

15. Grunert, K.G., Bredahl, L. & Brunso, K. (2004) Consumer perception of meat quality and implications for product development in the meat sector-a review. Meat Science (66): 259-272.

16. Huh, Y. C., I. Solmaz and N. Sari (2008) Morphological characterization of Korean and Turkish watermelon germplasm I. Cucurbitaceae. *2008 Proceedings of the 9th EUCARPIA meeting on genetics and breeding of Cucurbitaceae* (Pitrat M. Ed.), INRA, Avignon, France. May 21-24

17. JARDA, (1995).Jigawa State agricultural and Rural Development Authority (JARDA). Mid-term Review Report of National Fadama Development project, Jigawa component Pp27-38.

18. JGSG (2005). Jigawa state Government Official Diary, Directorate of information, Dutse, Nigeria.Pp194-197.

19. Kim, B. (2008). Watermelon nutrition: How to get the most nutritional value out of watermelon. Health and beyond: http://www.chetday.com/index.html

20. KNSG (2006). Kano state Government, National Population commission censors reports pp.30-35

21. Koutsoyionnis, A. (2003). Theory of econometrics. Macmillan press limited London. 3rd edition pp. 231-238

22. Lancaster, K. J. (1966). A New Approach to Consumer Theory. Journal of Political Economy, *74 (2), 132–157.*

23. Lauren M. (2021) Consuer preferences and Associated price premium for Agricultural traits in Maine Markets. *An Unpublished Thesis submitted to the School of Economics, the University of Maine, in Partial fulfilments of the requirement for the degree of Master of Science in resource economics policy.* University of Maine,Lauren.r.miller@maine.edu

24. Koutsoyionnis, A. (2003). Theory of econometrics. Macmillan press limited London. 3rd edition pp. 231-238

25. Lynn M .W, Ramses B. T, Richard V. T, and Lydia S.(2012) : Colour preference and morphological variation in Citrullus lanatus in Namibia. *Genetic. Resources and Crop Evolution research journal. 47: 385-393.*

26. Muhammad B. A.(2014) Economic Analysis Of Watermelon (Citrillus Lanatus) Production in selected Local Government Areas Of Kano State, Nigeria: (A Thesis Submitted To The School Of Postgraduate Studies, Ahmadu Bello University, Zaria, In Partial Fulfillment Of The Requirement For The Award Of Master Of Science In Agricultural Economics Department Of Agricultural Economics And Rural Sociology, Faculty Of Agriculture, Ahmadu Bello University, Zaria, Nigeria).

27. NPC (2006). National Population Commission, Estimated Human population Figure of 2006 Census, Federal Republic of Nigeria.

28. Olofin. A. and Tanko, A.I. (2002). Laboratory and Arial Differentiation metropolitan Kano in Geographic perspective, *Department of Geography Field studies series 1, Bayero University, Kano, Nigeria. Pp.10-45*

29. Robinson RW, Decker-Walters DS (1997). Cucurbits. CAB International, Wallingford, UK, p. 226.

30. Saleh, A. (2012) Value Chain analysis of Watermelon in the Kano River Irrigation project (KRIP) Kano State, Nigeria. (An unpublished thesis submitted to the Department of Agricultural Economics and extension, Faculty of Agriculture, Bayero University, Kano, Nigeria.)

31. Saleh, A. (2021) Comparative Analysis of the Wet and Dry Season Watermelon Production in Kano and Jigawa States, Nigeria. An Unpublished Ph.D Thesis Submitted to the Department of Agricultural Economics and Extension, Faculty of Agriculture, Bayero University, Kano.

32. Thorntorn W. A (2012) A validation of the colour: *Journal of the illuminating engineering society.* V 4 issue 1.pp 48 52 downloaded 23/10 2019 22: 09

33. Usman, S. (2009).Analysis of Farm Plan and Resource -use Efficiency of Sesame Production in Jigawa State, Nigeria. *Unpublished M.Sc. Thesis submitted to the Department of Agricultural Economics and Rural Sociology*, Ahmadu Bello University, Zaria.

34. Vander Vossen HAM, Denton OA, El Tahir, IM (2004). Citrullus lanatus (Thunb.) Plant Resources of Tropical Africa 2. Vegetables. PROTA

35. Wasylikowa K, van der Veen M (2004). An archaeobotanical contribution to the history of watermelon, Citrullus lanatus (Thunb.)Matsum. & Nakai (syn. C. vulgaris Schrad.). Vegetable. History Archaeobot journal. 13: 213-217.

36. Wehner T C (2008). Watermelon. In Prohens, J, Nuez F (eds) Vegetables I. Asteraceae, Brassicaceae, Chenopodicaceae, and Cucurbitaceae. Springer Science Business Media, New York, pp. 381-418.

37. Yekinov S. I.I Sokolu, L. Iarova, N. Chupryna and M.Akulushyna(2021) *Satisfaction of consumers for consumers of Agricultural Products.* IOP Conference series; Earth and Environmental Sciences(240th ECS meeting Orlando, F.L Orange county convention center U.S.A October,10th- 14th 2021.