Available online at http://www.ifgdg.org

Int. J. Biol. Chem. Sci. 16(5): 2009-2020, October 2022

ISSN 1997-342X (Online), ISSN 1991-8631 (Print)

International Journal of Biological and Chemical Sciences

Original Paper http://ajol.info/index.php/ijbcs http://indexmedicus.afro.who.int

Supply areas of watermelon varieties and marketing practices in the city of Abidjan, Côte d'Ivoire

Désirée Victoire GBRAGUHE[1*], Marc ADOU[1], Yao Désiré ADJOUMAN[1,2] and Fabrice Achille TETCHI[1]

[1]Laboratoire de Biochimie Alimentaire et de Technologies des Produits Tropicaux-STA, UFR Sciences des Sciences et Technologies des Aliments, Université NANGUI ABROGOUA, Abidjan, 02 BP 801 Abidjan 02, Côte d'Ivoire.

[2]Centre Suisse de Recherches Scientifiques en Côte d'Ivoire, CSRS-CI, 01 BP 1303 Abidjan 01, Côte d'Ivoire.

[*]Corresponding author; E-mail: gbraguhedesi@gmail.com ; Tél.: +225 07 49 89 15 66

Received: 21-06-2022 Accepted: 07-10-2022 Published: 31-10-2022

ABSTRACT

The watermelon is a fruit prized throughout the world for its sweet flesh. In Abidjan, the marketing of this fruit is booming. The objective of this study is to identify watermelon supply areas and marketing practices in Abidjan city. To do so, an exhaustive survey using the snowball method was conducted among 614 vendors in Abidjan city. The results show that 95% of the sellers are women and only 5% are men. The varieties of watermelons most sold are round (56%) and red (85%). The towns of Bassam (35.9%), Bonoua (16%) and Jacqueville (15.2%) are the main areas of origin of the watermelons sold. Traders buy watermelons either from producers (19.71%) or from wholesalers (82.29%) and then market the fruit individually (56%) or cut into slices (44%). This study shows that the watermelon fruit marketed in Abidjan City are round, red-fleshed varieties that come mainly from the city of Bassam and whose prices are set mainly according to the scarcity or abundance of the fruit.

Keywords: Watermelon, varieties, origin, marketing, Abidjan city.

INTRODUCTION

Historically, the agricultural sector has been central to the economy and development of Côte d'Ivoire (Ducroquet et al., 2017). Furthermore, according to authors Adaman and N'dri (2016), Côte d'Ivoire's economy is based on agriculture. However, a recurrent problem in this developing country is undernourishment, even though its economy is essentially based on agriculture. This situation results, in part, from a policy choice essentially focused on the promotion of export crops (cocoa, oil palm, rubber, etc.) to the detriment of traditional local food crops (Rasul et al., 2007), including cucurbits such as watermelon (*Citrullus lanatus*) (Irié et al., 2011).

Watermelon is a fruit that is among the five most consumed fruits in the world (Adjoumani et al., 2016) because of its sweet and juicy flesh (Jeffrey, 2001). Its global production is estimated at more than 166 million tons in 2018 according to the data of the Food and Agriculture Organization of the

DOI: https://dx.doi.org/10.4314/ijbcs.v16i5.15

United Nations (FAO, 2020). It accounts for about 9.5% of the total fruit production in the world and nearly 83.7% of its production is in Asia (Davis et al., 2008). Accumulated evidence has established a consensus that watermelon is a concentrated source of natural components with health-promoting properties. Also, work done on this fruit around the world has shown that it contains several bioactive components that play a vital role in performing various metabolic functions (Butt et al., 2009).

Despite the diversity of assets offered by watermelon, in Côte d'Ivoire, few investigations have been carried out on the marketing of simple fruit or products derived from it. However, the poverty reduction strategies developed, emphasize the processing and marketing of raw materials in Côte d'Ivoire (FMI, 2009). Moreover, knowing the health benefits of watermelon as well as the gains that could be made by its commercialization (in simple fruit or derived products) in its economy will allow Côte d'Ivoire to adopt a management policy for this fruit. Therefore, faced with the challenge of valorization of raw materials, this study is interested (or has been interested) in the identification of supply areas and the marketing of watermelon in Abidjan city.

MATERIALS AND METHODS

Study environment

Located in the lagoon region in the south of Côte d'Ivoire, the district of Abidjan comprises 13 municipalities (10 of which make up the city of Abidjan) covering an area of 513 km² (Clos, 2012). The city is generally characterized by a subequatorial climate with four seasons. This climate, also called Atenean, is characterized by a long and short dry season from December to March and from August to September respectively, and also characterized by a long and short rainy season from April to July and from October to November respectively. The annual temperature varies from 26 to 27°C (Kouassi et al., 2022). Abidjan is located in the wettest area of Côte d'Ivoire, which receives an average of 2800 mm of rain per year. The relative humidity is very high, averaging over 80% (Onibokun, 2002). It is located in an area of coastal plain where the relief is flat with low altitude varying from 0 to 50 m (Sehi-Bi, 2001). Geologically, the lithology of the city of Abidjan is made up of clayey sands, medium sands and coarse sands resting on a schistose base (Kouamé et al., 2006).

Sampling methodology

The collection of information was essentially based on a survey carried out in Abidjan city, which includes only 10 communes of Abidjan, namely: Yopougon, Treichville, Adjamé, Port-Bouët, Attécoubé, Marcory, Plateau, Koumassi, Abobo and Cocody. This survey took place from October 16 to November 20, 2020. It consisted of an exhaustive census of watermelon vendors in the 10 communes using the snowball method described by the author Fokou et al., 2016. It consisted of going through the neighbourhoods of the ten communes to list the marketing sites based on the information provided by the respondents. For this purpose, a questionnaire was administered to each person in charge of marketing at the time of the survey. The questionnaire focused on the socio-demographic characteristics of the respondent (gender and age) and also on the reputation of watermelon among vendors. The questionnaire focused on the color of the pulp and the shape of the fruit, on the cities where the fruit is produced according to the respondents, on the mode of supply and the supply prices per heap (assembly of fruits) and per kg of fruit, on the mode of sale and the sale prices (per slice and whole fruit), on the mode of conservation adopted by the respondents and finally on the conservation time of the fruit.

Statistical analyses

The different information collected on the survey forms was entered into the Epi-data 3.1 software and then transferred to the SPSS

version 20.0 software to constitute the database. The numbers were calculated for the quantitative variables as well as the percentages. Statistical analyses were then performed using XLStat software version 2014.5.03. In addition, the Chi-2 test was used to test the relationships between categorical variables at the 0.05 significance level. When there was a significant difference, the Marascuilo procedure of performing pairwise comparison tests for all pairs of proportions was then employed (Marascuilo, 1988). This allowed the identification of proportions that differed from each other.

RESULTS

Identification of watermelon vendors in Abidjan city

The survey of watermelon vendors in Abidjan City yielded a total of 614 interviews with people involved in watermelon marketing. However, the number varies significantly from one commune to another ($P<0.001$). The communes with the highest number of vendors are: Abobo (18.2%), Yopougon (17.1%) and Port-Bouët (16.9%). Plateau (4.2%) is the commune with the fewest vendors (Table 1).

Socio-demographic characteristics of the survey population

According to Table 2 below, the vast majority (95%) of watermelon traders in Abidjan city are women. Only (5%) of men are involved in this activity. Also, the survey population is divided into several age categories and the proportions of each age group are significantly different from each other ($P<0.001$). The population with the highest proportion represents 38.4% of the respondents. It is in the age range of 31-50 years. In second place comes the population whose age varies from 26-30 years with a proportion of 27.7%. Then the population whose age is between 21-25 years with a proportion of 19.4%, those whose age is between 15-20 years represent 8.8% of the surveyed population and finally the last category are the respondents of more than 50 years who represent only 5.7% of the surveyed population. The socio-demographic characteristics of the respondents in this study show that the actors in watermelon marketing are dominated by women. Also, these actors are made up of young people and adults (21-50 years old) who represent the active population of Abidjan.

Identification of watermelon production sites according to vendors

The survey of watermelon sellers in Abidjan city shows that watermelon is produced in several cities in Côte d'Ivoire (Table 3). However, according to the proportions that are significantly different ($P < 0.001$), Bassam (35.9%) remains the locality with the highest watermelon production according to the watermelon selling population surveyed. Bonoua, Jacqueville, Abidjan and Divo are also major watermelon producing localities with a proportion of 16%, 15.2%, 14% and 6.3% respectively. In addition to the above-mentioned cities, the survey identified other cities such as Bondoukou (0.1%), Bouaké (0.1%), San-Pedro (0.3%), Yamoussoukro (0.4%), Aboisso (0.5%), Tiassalé (0.9%), Adiaké (0.9%), Assini (1%), Dabou (1%), Hiré (1.3%), Korhogo (1.4%), Elibou (1.4%) and Grand-Lahou (3.5%) as watermelon production areas, but in smaller proportions. Several cities of Côte d'Ivoire constitute zones of origin of the watermelon transported to Abidjan city. However, the watermelon comes most from the cities located on the coast of Côte d'Ivoire such as Bassam, Bonoua and Jacqueville.

Characterization of the fruit according to the shape and color of the pulp

Figure 1 shows the different shapes of watermelons sold by traders. Two shapes are sold by the traders. According to the proportions ($P<0.001$), round-shaped watermelons (56.09%) are the most sold in contrast to oval-shaped watermelons

(43.91%). As for the color of the pulp (Figure 2), the survey data show four different colors of watermelon pulp sold in the market. These include red, yellow, white and pink flesh watermelons in significantly different proportions ($P < 0.001$). However, red-fleshed watermelons are the most sold by the respondents with a proportion of 85.3%. They are followed in decreasing order by white-fleshed watermelons (5.9%), pink (5.7%) and yellow (3.1%). These results show that on the Abidjan market, watermelons with a round shape and red pulp are the most sold.

Supply and cost per kg and per heap

From production to consumption, actors such as wholesalers and retailers are involved in the distribution of watermelon within the city as shown in Photograph 1. And according to Figure 3, only 19.71% of the actors surveyed obtain their watermelons from growers. In terms of numbers, more than 80% of the respondents purchase watermelons from wholesalers. This survey revealed that wholesalers are the most important group of actors in contrast to growers.

Investigations into the marketing of watermelon showed that respondents obtain their watermelons in two ways. Either by buying the fruit per Kg or by buying the fruit per heap (Table 4). Statistical analysis of the data showed a significant difference between the two ways of procurement ($P<0.001$). Prices per kg of fruit vary from 75 to 300 CFA francs. However, the respondents generally buy the Kg (FCFA) at 200 (36.8%), 175 (17.1%), 150 (12.6%) or 250 (11.1%). They may also have Kg (FCFA) at 75 (1%), 100 (5.2%), 125 (4.7%), 225 (6.2%) and 300 (5.4%). According to the respondents, the prices of fruit placed in lots or piles are fixed according to the size and number of fruits and vary from 500 to 5000 FCFA. However, the most purchased lots are lots of 3 to 4 fruits at a price of 1000 FCFA (42%), lots of 3 to 6 fruits at a price of 5000 FCFA (21.4%) or lots of 3 to 5 fruits at a price of 2000 FCFA (19.7%). Lots of 3 to 4 fruits costing 500 FCFA (3%) are the least purchased by the respondents. It appears that watermelon sellers in Abidjan city, get watermelon in two ways that are the purchase by heap and by Kg of fruit.

Marketing mode and price of watermelon fixed by retailers

According to Figure 4, watermelons are sold by vendors whole or sliced as shown in Photograph 2. However, the sale of sliced fruit (56%), according to the respondents, is the method that allows them to sell their goods quickly.

Figure 5 shows that the sellers surveyed sell watermelon slices at prices (FCFA) set at 100 (69%), 200 (22%), 50 or 500 (4%) and 300 or 1000 (1%). And according to Figure 6, the prices (FCFA) of fruit sold whole are mostly set at 500 (21%), 1000 (26%), 1500 (23%) and 2000 (16%). All results of this analysis have significantly different proportions ($P < 0.001$). The various investigations highlight two marketing methods used by watermelon sellers in Abidjan City. These are the sale of whole fruits at prices ranging from 500 to 5000 (FCFA) and the sale of cut fruits at prices ranging from 50 to 1000.

Method and duration of watermelon storage among vendors

According to Figure 7, 87% of respondents store watermelons in the open air in bulk, 8% store in crates, 3% in bags and 2% in refrigerators. These proportions are significantly different from each other ($P<0.001$). The storage practices adopted by the respondents, in significantly different proportions ($P < 0.001$), allow for a storage period of watermelons ranging from 1 to 2 weeks (30%), 1 week (29%), 2 to 3 weeks (19%), 1 month (14%), 3 to 5 days (6%) and 2 to 3 days (2%) as shown in Figure 8. In sum, the storage method (fruit exposed to the air, at room temperature and dry) used by the respondents allows a shelf life of watermelons ranging from one to three weeks.

Table 1: Number of vendors surveyed in Abidjan city.

Municipalities	Vendors	
	Workforce	**Proportion %**
Yopougon	105	17,2 [C]
Treichville	41	6,7 [ab]
Adjamé	39	6,4 [ab]
Port-Bouët	104	16,9 [C]
Attécoubé	42	6,8 [ab]
Marcory	29	4,7 [a]
Plateau	26	4,2[a]
Koumassi	68	11,1[bc]
Abobo	112	18,2[C]
Cocody	48	7,8[ab]
Total	**614**	**100,0**

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

Table 2: Distribution of watermelon traders by gender and age.

Observation	Social demographic characteristics	Workforce	Proportion (%)
Gender	Female	583	95
	Male	31	5
Age	15-20	54	8,8[a]
	21-25	119	19,4[b]
	26-30	170	27,7[c]
	31-50	236	38,4[d]
	51 and more	35	5,7[a]

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

Table 3: Cities of origin of watermelon to Abidjan city according to traders.

Cities of origin of the watermelon	Workforce	Proportion (%)
Abidjan	217	14,0[d]
Aboisso	8	0,5[a]
Adiaké	14	0,9[ab]
Assini	15	1,0[ab]
Bassam	558	35,9[e]
bondoukou	1	0,1[a]
Bonoua	247	16,0[d]
Bouaké	2	0,1[a]
Dabou	16	1,0[ab]
Divo	98	6,3[c]
Elibou	21	1,4[ab]
Grand-Lahou	59	3,5[bc]
Hiré	20	1,3[ab]
Jacqueville	236	15,2[d]
Korhogo	21	1,4[ab]
San-Pedro	4	0,3[a]
Tiassalé	14	0,9[ab]
Yamoussoukro	6	0,4[a]

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

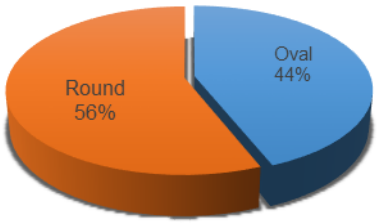


Figure 1: Characterization of fruits sold in Abidjan city according to the shape.

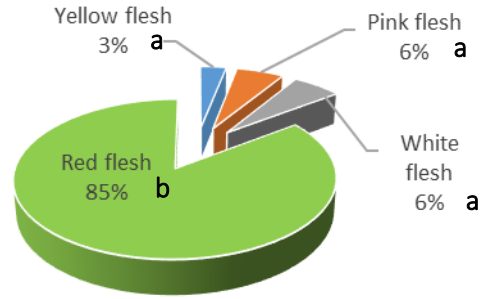


Figure 2: Color distribution of watermelon Pulp sold in Abidjan city.

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

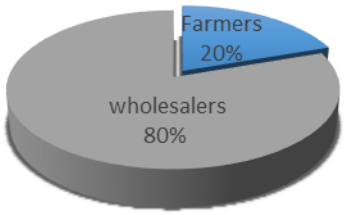


Figure 3: Different modes of watermelon supply used by vendors in Abidjan city.

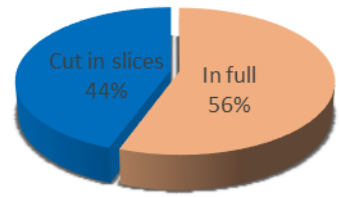
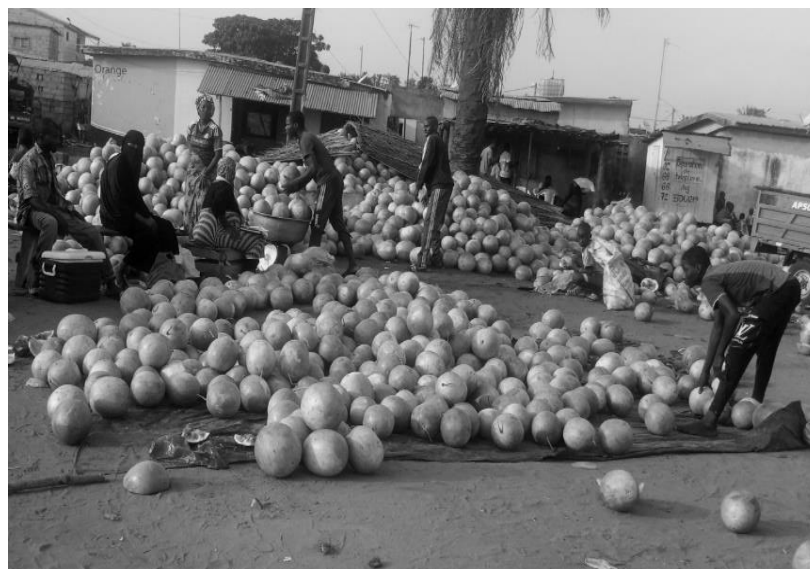


Figure 4: Proportion of the different ways of selling watermelon used by the vendors.



Photograph 1: Watermelon wholesaler sitting near the weighing area talking to a retailer during her supply.

Table 4: Determination of watermelon procurement costs.

Cost of watermelon supply					
Per kg			**Per heap**		
Price (FCFA)	**Workforce**	**Proportions (%)**	**Price (FCFA)**	**Workforce**	**Proportions (%)**
75	9	1^{a}	3 or 4 à 500	20	3^{bc}
100	48	$5,2^{b}$	1 à 700	2	$0,3^{ab}$
125	44	$4,7^{b}$	3 or 4 at 1000	281	42^{e}
150	159	$12,6^{d}$	1 at 1200	1	$0,1^{a}$
175	117	$17,1^{d}$	3 or 2 basins at 1500	2	$0,3^{ab}$
200	343	$36,8^{e}$	3, 4 or 5 at 2000	132	$19,7^{e}$
225	58	$6,2^{bc}$	3, 4 or 5 at 2500	63	$9,4^{d}$
250	103	$11,1^{cd}$	3, 4, 5 or 6 at 5000	143	$21,4^{e}$
300	50	$5,4^{b}$	I take roughly	25	$3,7^{c}$
Total	**931**	**100**	**Total**	**669**	**100,0**

** Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).*

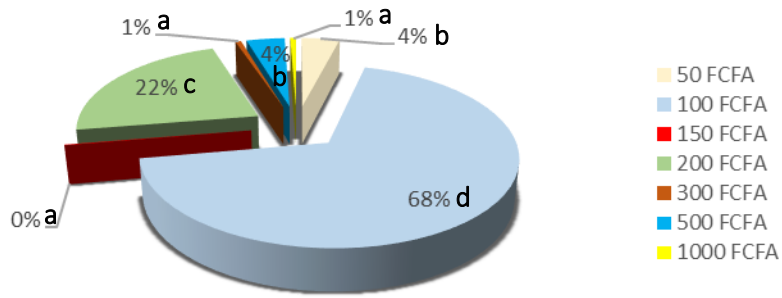


Figure 5: Distribution of sales costs by fruit size.

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

Photograph 2: Fruit vendor's table showing watermelon sold whole and cut up.

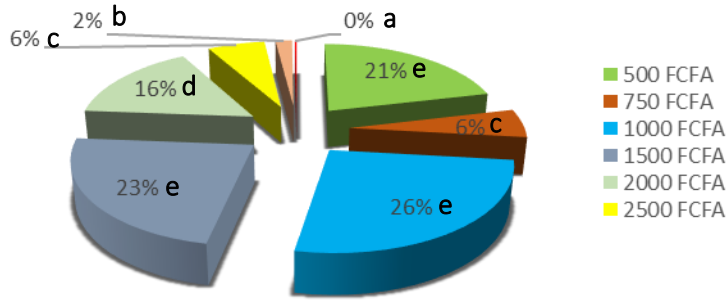


Figure 6: Distribution of costs per fruit unit.

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

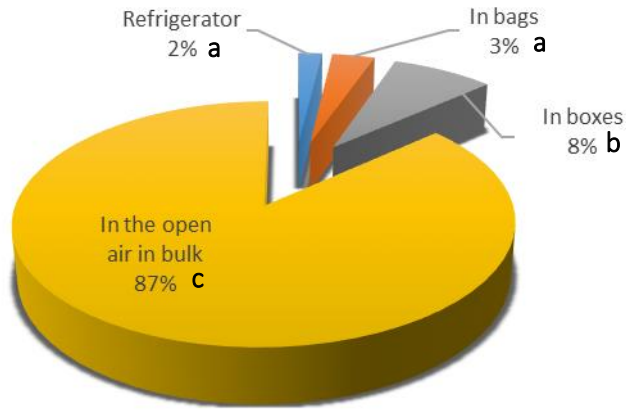


Figure 7: Method of storing watermelon according to the respondents.

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

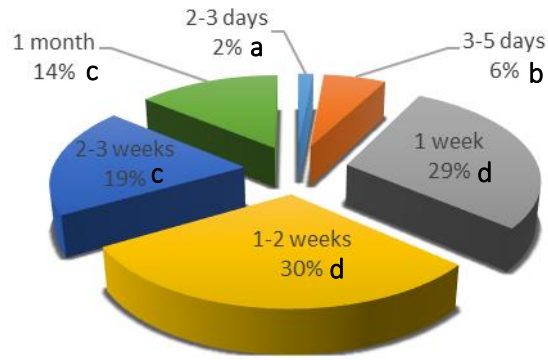


Figure 8: Shelf life.

* Les données n'ayant pas la même lettre signifient qu'il y a une différence significative (P<0,001).

DISCUSSION

This study aimed of identifying the supply areas and varieties of watermelon sold in the city of Abidjan. The results of the survey reveal that Abidjan city has several actors involved in watermelon marketing. The socio-demographic characteristics of the respondents show that the actors involved in watermelon marketing are dominated by women. This finding could be explained by the fact that in Africa, everything related to cooking or eating is the responsibility of women (Aka-Gbezo et al., 2017). Also, the occupations in which Abidjanese women engage in the streets are almost all related to trade, specifically the sale of foodstuffs such as fruit, etc (Simao, 2017). The results of this study are consistent with those of Onyemauwa (2010) whose study focused on the marketing margin and efficiency of watermelon marketing in the Niger Delta region of Nigeria. These results also compare favorably with those of Ebiowei (2013) whose work focused on marketing margin and determinants of net returns from watermelon marketing in Yenagoametropolis of Bayelsa State, Nigeria. They also compare with the results of the work of Oseni (2015) on the evaluation of the structure and conduct of watermelon marketing in Akure metropolis, Ondo State, Nigeria. And with those of Chogou et al. (2019) who worked on the structure and performance of the watermelon (*Citrullus lanatus*) market in Benin and finally with those of Yanogo et al. (2021) whose work focused on watermelon (*Citrullus lanatus*), an opportunity for marketing actors in the city of Koudougou (Burkina Faso). Indeed, in the various studies conducted by these authors, more than 70% of watermelon marketing actors are dominated by women.

In Abidjan city, the actors who are most involved in this activity are young people and adults (21-50 years old) who represent the active population of Abidjan. This information also corroborates the work of Ebiowei (2013) and Chogou et al. (2019), where young people represent 50% of the 21-30 age group in South Ijaw and 41% in Yenagoametropolis in the Niger Delta, and 75% in Benin, respectively. However, the work of Balogun et al. (2018) that focused on the economic analysis of watermelon marketing in Lagos State, Nigeria, notes that the actors are more male and less young. In fact, in this state, the proportion of men in watermelon marketing is over 50% and the age range of the actors is between 30 and 40 years. In Enugu State, Nigeria with the work of Ukwuaba et al. (2018, 2019) on the socio-economic and institutional determinants of watermelon marketing and respectively on the performance of watermelon marketing, young people represent only 1.88% of the stakeholders while stakeholders whose age is between 41-50 years represent 44.38%. From Figure 2, it appears, according to the actors, that several cities of Côte d'Ivoire constitute zones of origin of the watermelon transported to Abidjan city. This result shows that watermelon cultivation is practiced in many regions of Côte d'Ivoire. However, the cities located on the coast of Côte d'Ivoire such as Bassam, Bonoua and Jacqueville record higher proportions in terms of watermelon provenance designation.

Consequently, they are subject to a strong practice of this activity. This result is attested to by the work of USAID (2006) carried out in Guinea on the watermelon sector, which states that in its normal environment, watermelon (*Citrullus lanatus*) generally grows along rivers. The cities located on the littoral would thus be favorable to the culture of the watermelon. Indeed, the experiments carried out on the production of watermelon by authors such as Hamza (2014) in Algeria, Kakpovi (2017) in Benin in the commune of Ouidah and Korichi (2020) in the region of Tizi-Ouzou, were all carried out in zones located on the littoral taking into account the very favorable ground for the market garden culture.

Several factors determine the qualities of watermelon sold on the markets in Abidjan city. Indeed, the sale of watermelon by traders is based on criteria such as: the shape of the fruit, the price, the color of the pulp, etc. In this survey, the results reveal that on the market, watermelons with round shape and red pulp are the most sold. Indeed, watermelons with these two characteristics are

the most cultivated by Ivorian producers, and are therefore more marketed by sellers because they are more available. This result is attested by Kuvare (2005) whose work focused on greenhouse watermelon production in South Africa, Chogou et al. (2019) whose work focused on the market structure and performance of watermelon in Benin, and the work of Yanogo et al. (2021). All of them state that the quality of the fruits is an important attribute in the production for a specific market and that in general the market prefers red pulp rather than fruits of other pulp colors, mainly due to the lack of cultivars with high quality fruits and to the resistance of the consumers.

This survey also revealed that retailers are the most important group of actors (82.29%) as opposed to wholesalers (19.71%). The same observations were made by Oseni (2015) and Yanogo et al. (2021). Indeed, according to the latter, more than 60% of the actors involved in watermelon marketing are retailers. Watermelon marketing depends on these actors whose roles are different but complementary.

In Abidjan city, watermelon is sold in two ways: by the heap and by kg. The sale prices of watermelon are set according to the shortage or abundance of the fruit and according to the volume or the place of sale. The surveys carried out by the author Oseni (2015) do indeed confirm that watermelon prices vary according to the season, compared to the month. This same variation was also observed in the Cameroonian state where the authors Jiotsa et al. (2015) whose work focused on cooperative movements in the western mountains of Cameroon, were able to highlight the low prices of watermelon on the market. Studies conducted by Kakpovi (2017) also revealed that fruit prices are between 157.73 FCFA and 220.82 FCFA per kg. Prices in urban markets vary from 252.37 FCFA to 378.55 FCFA during the rainy season to 504.73 FCFA to more than 630.91 FCFA per kg in the off season. In addition, according to (Balogun et al., 2018) there is considerable variability in watermelon prices throughout the year mainly due to seasonal changes in production volume.

The mode of conservation (fruits exposed to the open air, at room temperature and in a dry place) used by the respondents allows watermelons to be stored for one to three weeks. These results were also noted in the works of Kakpovi (2017) thus indicating a storage duration of watermelon ranging from 2 to 3 weeks. Indeed the fruits are not suitable for long-term storage. Normally, the upper limit for proper storage is about three weeks. However, this will vary from variety to variety.

Conclusion

This study revealed that Abidjan city, constitutes a center of marketing of watermelon which comes mainly from certain cities of Côte d'Ivoire that are Bassam, Bonoua and Jacqueville. The marketing of this round berry with a red pulp and a shelf life that can reach one month if it is exposed to the open air, at room temperature and in the dry, is mainly carried out by women aged between 21 and 50 years. The study also revealed that the majority of respondents purchase watermelon from wholesalers who transport them from the production areas to Abidjan City. Once in Abidjan, the fruit is sold to retailers either by the bunch or by the kilogram. The retailers ensure the distribution of the fruit by marketing them throughout the city at costs that are fixed according to the scarcity or abundance of the fruit.

COMPETING INTERESTS

The authors declare that they have no competing interests

AUTHORS' CONTRIBUTIONS

DVG: developed the survey questionnaire, conducted the survey at the indicated sites, analysed the survey data and wrote the article. YDA: contributed to the development of the questionnaire, provided guidance for the analyses of the survey data, read and edited the article. MA: contributed to the funding for the survey, provided guidance for the writing of the article, read and edited the article. FAT: Being the supervisor of the research work, he provided guidance for the successful completion of the work.

ACKNOWLEDGEMENTS

We would like to thank all the people who assisted in the collection of the survey data.

REFERENCES

Adaman S, N'dri KA. 2016. Impacts socio-économiques de la culture de l'anacarde dans la sous-préfecture d'Odienne (Côte d'Ivoire). *Eur. Sci. J.*, **12**(32): 1857-7881. DOI: 10.19044/esj. 2016.v12n32p369

Adjoumani S, Bony SB, koffi GK, Kouonon LC, Brou FK, Sié R. 2016. Genetic evaluation of seed traits from intraspecific crossing of genetically distinct watermelon varieties. *Afr. Crop Sci. J.*, **24**(2): 143 – 154. DOI: http://dx.doi.org/10.4314/acsj.v24i2.3

Aka-Gbezo S, Konan AG, N'Cho M, Achi P, Koffi-Nevry R, Koussemon-Camara M, Bonfoh B. 2017. Screening of antimicrobial activity of lactic acid bacteria isolated from *Anango baca* slurry, a spontaneously fermented maize product used in Côte d'Ivoire. *Int. J. Biol. Chem. Sci*., **11**(6): 2616-2629. DOI: http://dx.doi.org/10.4314/ijbcs.v11i6.6

Balogun O, Olatomide A, Oladele TA, Emeka EO. 2018. An economic analysis of watermelon marketing. *Int. J. Veg. Sci*., **25**(13): 1-7. DOI: http://dx.doi.org/10.1080/19315260.2018 .1519625

Butt MS, Sultan MT, Iqbal J. 2009. Garlic: Nature's protection against physiological threats. *Crit Rev Food Sci Nutr*., **49**(6): 538-551. DOI: http://dx.doi.org/10.1080/104083908021 45344

Chogou SK, Assogba R, Degbey H, Abokini E, Achigan-dako EG. 2019. Market structure and performance of watermelon (*Citrullus lanatus*) in Benin. *Sci. Afr*., **3**(48): 1-9. DOI: http://dx.doi.org/10.1016/j.sciaf.2019.e0 0048

Clos J. 2012. Ivory Coast: urban profile of Abidjan, United Nations Human Settlements Programme. Final report UNHSP, Ivory Coast, 36 p.

Davis AR, Perkins-Veazie P, Hassell R, Levi A, King SR, Zhang X. 2008. Effects of grafting on vegetable quality. *HortScience*, **43**(6): 1670-1672. DOI: http://dx.doi.org/10.21273/HORTSCI.43. 6.1670

Ducroquet H, Tillie P, Louhichi K, Gomez-Y-Paloma SL. 2017. Agriculture de la Côte d'Ivoire à la loupe: Etats des lieux des filières de production végétales et animales et revue des politiques agricoles. Rapport Technique, Côte d'Ivoire, 244 p. DOI: 10.2760/126254.

Ebiowei KP. 2013. Marketing margin and determinants of net return of watermelon marketing in yenagoametropolis of bayelsa state, Nigeria. *J. Exp. Biol. Agric. Sci*., **1**(4): 241-247. http://www.jebas.org/wp-content/uploads/2014/09/Kainga-Prince-Ebiowei-JEBAS.pdf

FAO. 2020. Statistical database. Food and Agriculture. FAO, Suisse. http://www.fao.org/faostat/en/#data/QC

FMI. 2009. Côte d'Ivoire : Stratégie de Réduction de la Pauvreté. Rapport du Fonds Monétaire International, Suisse, 199 p.

Fokou G, Doumbia M, Aka S, Ahoussi JMS, Yapo AE, Dje MK, Bonfoh B. 2016. Identification et caractérisation des sites de production du tchapalo à Abidjan. *Inter. J. Inno. A. pplied Studies*, **18**(4): 1167-1176. http://www.ijias.issr-journals.org/abstract.php?article=IJIAS-16-237-02

Hamza N. 2014. Application of arbuscular mycorrhizae in market gardening, case of watermelon (*Citrullus lanatus*). Master Memory, Ferhat Abbas Sétif 1 University, Algeria, 83 p.

Irié R, Dje Bi, Kouamé K, Koffi, Baudoin JP, Irié A, Zoro Bi. 2011. Effet de la saison de culture et de la densité des plants sur les adventices et la production de la cucurbite oléagineuse *Citrullus lanatus* (Thunberg) Matsum. and Nakai (Cucurbitaceae). *Sci. Nat*., **8**(1): 85 – 93. DOI: http://dx.doi.org/10.25518/1780-4507.13772

Jeffrey C. 2001. Cucurbitaceae. In *Mansfeld's Encyclopedia of Agricultural and Horticultural Crops*, Hanelt P, IPG, CPR (eds). Springer: Berlin; 1510-1557.

Jiotsa A, Okia TM, Yambene H. 2015. Cooperative Movements in the Western Highlands of Cameroon. *Rev. Geogr Alp*., **103**(1): 1–15. DOI: 10.4000/rga.2764

Kakpovi F. 2017. Technical and socio-cultural constraints related to the production of watermelon *Citrullus lanatus* (thunb) in Benin: case of the commune of Ouidah. State training end report, University of Abomey-Calavi (UAC), Abomey-Calavi, 48 p.

Korichi Y. 2020. Diversity, foraging activity and impact of Apoid (Hymenoptera: Apoidea) pollination on cultivated plants in the Tizi-Ouzou region. Doctoral Thesis, University Mouloud Mammeri Tizi-Ouzou, Algeria, 135 p.

Kouamé KL, Gone DL, Savane I, Kouassi EA, Koffi K, Goula BT, Diallo M. 2006. Relative mobility of ETM from the Akouédo landfill and risk of contamination of the Continental Terminal groundwater (Abidjan-Côte d'Ivoire). *Afr. Stud. Rev*., **2**(1): 39-56. DOI: 10.4314/afsci.v2i1.61133

Kouassi AM, Kouao JM, Kouakou KE. 2022. Caractérisation intra-annuelle de la variabilité climatique en Côte d'Ivoire. *OpenEdition Journals*, **99**(2): 289-306. DOI : https://doi.org/10.4000/bagf.9534.

Kuvare USK. 2005. Greenhouse production of watermelons (*Citrullus lanatus*). Master's Thesis, University of Stellenbosch, South Africa, 300 p.

Marascuilo. 1988. *Statistical Methods for the Social and Behavioural Sciences*. LA-Serlin RC: New York.

Onibokun AG. 2002. *Urban Waste Management, Solutions for Africa* (22-24th éd.). CRDI-KARTHALA: Paris.

Onyemauwa CS. 2010. Marketing Margin and Efficiency of Watermelon Marketing in Niger Delta Area of Nigeria. *AgriculturaTropica and Subtropica*, **43**(3): 196-201.

Oseni JO. 2015. An appraisal of the structure and conduct of watermelon marketing in Akure Metropolis, Ondo State, Nigeria. *Sky. J. Agric. Rés*., **4**(4): 80-89.

Rasul MG, Hiramatsu M, Okubo H. 2007. Genetic relatedness (diversity) and cultivar identification by randomly amplified polymorphic DNA (RAPD) makers in teastle gourd (*Momordica dioica* Roxb.). *Sci. Hortic*., **111**(3): 271–279. DOI: 10.3329/jsr.v1i3.1968

Sehe Bi TH. 2001. Contribution to the Cocody Bay: critical analysis of the current situation and compliance of sanitation systems. En of study dissertation, University of Cocody Bay, Côte d'Ivoire, 168 p.

Simao J. 2017. Genre et marchés : Autonomiser les femmes sur les marchés alimentaires. Étude de cas : la cuisine de rue à Abidjan, Côte d'Ivoire, Abidjan, 82 p.

Ukwuaba IC, Agbo FU, Adeosun KP. 2018. Socio-economic and Institutional Determinants of Watermelon Marketing in Enugu State Nigeria. *J. Agric. Ext*., **22**(3): 161-173. DOI: Http://dx.doi.org/10.4314/jae.v22i3.16

Ukwuaba IC, Agbo FU, Ihemezie EJP. 2019. Performance of Watermelon Marketing in Enugu State, Nigeria. *J Mark Cons Res*., **62**: 54-67. DOI: http ://dx.doi.org/10.7176/JMCR/62-07

USAID. 2006. The watermelon sector in Guinea: current situation and prospects for export development. Final Report Chemonics International Inc, Task Order, USA.

Yanogo PI, Sanogo S, Yaméogo J. 2021. Watermelon (*Citrullus lanatus*), an opportunity for marketing actors in the city of Koudougou (Burkina Faso). *Revue Ivoirienne de Géographie des Savanes*, **2021**: 24.