

Assessing the Effect of Dawadawa Stored Under Different Temperature Regimes in Cooking

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Abstract: Most Africans in general and Ghanaians to be specific have ignored their healthy and nutritious local meals and additives for foreign ones. These have become a major worry to many health practitioners and nutritionists. The research therefore considers the intricacies of understanding the various storage effects of *Dawadawa* in effective cooking. Exploratory research design was employed in this study to investigate consumer preferences for the different recipes for *Dawadawa*. This allowed the comparison of the dishes which gave additional explanation compared to the analysis based only on individual dishes. Two samples of *Dawadawa*, 25g of each, were used to prepare and cook the *Dafaduka*, a one pot rice dish and Ayoyo Soup in order to ascertain consumers' preference of the flavour and taste of the *Dawadawa* samples. A panel of 30 HCIM students sampled the dishes for aroma, taste and overall acceptability and stated their response on a sensory evaluation form. The comparison of the two *Dawadawa* samples for *Dafaduka* and *Ayoyo* ascertains that whole fresh *Dawadawa* under room temperature is most preferred by consumers when used for *Ayoyo* soup than whole fresh *Dawadawa* refrigerated or room temperature and used for *Dafaduka*. Again, the study establishes that refrigerated *Soyabean Dawadawa* is preferred when used for *Dafaduka* than the refrigerated or room temperature *Soyabean Dawadawa* used for *Ayoyo* soup.

Keywords: *Dawadawa*, Maize, Sorghum, Cassava, Customer

1. Introduction

The clamour with which many Ghanaians have embraced modern eating lifestyle is a source of worry to many health practitioners and nutritionists alike who are to ensure that well balance diets are being taken into our body system [1]. This worry sentiment becomes even more alarming when most Ghanaians have substituted natural and nutritious based locally made condiments or spices such as *Dawadawa*, Aniseed, Cloves and Ginger with additives and food enhancing products with Monosodium glutamate based additives such as Maggi, Onga, Royco cubes and tablets oblivious of its health implications [1]. *Dawadawa* which is produced from Africa Locust beans by natural fermentation under local conditions domestically [2] had previously gained acceptance in Africa, especially Nigeria, Ghana, Sierra Leone, Burkina Faso and Guinea Bissau (Celtnet guide to spices entry for *Dawadawa*), but on a lower key currently.

The African locust beans represent the fermented oily seeds of the *Parkia Biglobosa* tree, a member of the fabaceae

(legume) family of flowering plants (Celtnet guide to spices entry for *Dawadawa*). Although these seeds are mostly used in seasoning food such as African soups and stews [3]; they have other uses with respect to non-foods [4] which are most medicinal, fodder and firewood (Campbell Platt) as quoted by [5]. The popular name of *Pakia Biglobosa* is *Dawadawa*, the Hausa name for this fermented African locust beans, Ghanaians also use the same name; other names are Iru, Ugba, Khinda, Mere, Netestu, Carob and Soubala (celtnet guide to spices entry for *Dawadawa*). *Dawadawa* is mostly used in soups such as *Mia'n Ayoyo*, *Kûûka*, *Bushéshé* and *Denye'n Kubewa* and Palm fruit soup. An example of another dish is *Dafaduka*, a one pot rice dish. *Dawadawa*, a traditional condiment enhances the nutritional value of dishes, as it supplements the large carbohydrate contents of some African dishes with high protein and vitamins; most of these dishes are starchy such as Maize, Sorghum, Cassava and rice [6]. According to the study of [1] in the northern part of Ghana, Tamale, the health benefits of *Dawadawa* cannot be over emphasized as apart from enhancing the taste of local dishes it also prolongs life expectancy rates.

There are several methods of cooking food and the dishes which use the *Dawadawa* condiment are mostly cooked by boiling and stewing methods. According to Practical Cookery [7] boiling is the cooking of prepared foods in liquid at boiling point. In Ghana dishes which use *Dawadawa* condiment cooked by this method includes *Mia'n Ayoyo*, *Kûûka* and *Denyen' Kubewa*. On the other hand stewing, according to Practical Cookery [7] is the slow cooking of food cut into pieces and cooked in a minimum amount of liquid; but in Ghana and other West African countries, the duration used in stewing is not prolonged as that of Europeans or Americans where the stew is further cooked in the oven.

Various states and forms in which *Dawadawa* are preserved and presented are available for sale on the market. These forms include powdered, whole, powdered moulded balls and cakes which could be fresh or dried; the latter is preserved by the dehydration method. Sometimes the various forms of *Dawadawa* are mixed with Soya beans to minimize its pungent smell and to also add to its nutritional value.

1.1. Statement of the Problem

The alkaline fermentation of *Dawadawa* results in the production of a tasty condiment but with a strong ammoniac odour which some consumers find too strong, offensive and sometimes complain about though they love it. As a result of this problem, this research was conducted to find out if there would be a change in the pungent and offensive aroma and flavour when freshly whole moulded *Dawadawa* and Soya bean moulded *Dawadawa* are stored under various conditions, so that consumers benefit from their nutritive value.

Hence this research seeks to examine this problem and fill the gap in the literature by considering the following questions:

1. What is the storage effect on *Dawadawa* in cooking under certain conditions for a period of time?
2. What are the means of overcoming this effect?
3. What are the various states of *Dawadawa* and its overall customer acceptability?

1.2. Specific Objectives

Specifically the study seeks to:

1. Investigate different processes from which *Dawadawa* is manufactured.
2. Identify different conditions under which *Dawadawa* is stored.

2. Literature Review

2.1. History of Spices

Spices have always cast a spell on our imaginations. They flatter our senses and sight with their vibrant colours, smell with their enticing fragrances and taste with their distinct flavours. They are the catalysts of some of the greatest adventures in human history, like Christopher Columbus’

voyage. Today, spices empower us as explorers, even if we never journey beyond the kitchen counter. They energize our daily adventures in food and remind us of journeys to exotic places and favourite meals with loved ones [8]. The word "spice" a derivative of the Latin word "*species*," which denoted a wide variety of products, did not appear until the end of 12th century. The use of herbs dates back to early humans and old people wrapped meat in the leaves, accidentally discovering that this enhanced the taste of the meat, as did certain nuts, seeds, berries and even bark. In the olden days, spices and herbs were used to mask the often unpleasant taste and odour of food and later, to keep food fresh.

The reputed excesses of ancient Roman food consumption were apparent in the wide variety of seasonings used in the meals of the rich. Pepper, the Roman spice of choice, was as omnipresent as *garum* (a fish-based sauce) on the Roman tables. Without a doubt, spices had become status symbols. In the biblical story of the Magi, three kings from the exotic reaches of the Orient give gifts of gold, frankincense, and myrrh to the new born Jesus Christ. Frankincense and myrrh were rare, very expensive spices of the time. Again, the Prophet Mohammed from the merchant tribe of the Quoraichites took advantage of the spice trade to spread his messages in the 5th century. People were more inclined to listen to what he had to say, given that he was selling irresistible spices. For centuries wars were waged, new lands discovered, and the earth circled, all in the quest of spices. Currently spices which are basically used in almost dishes costs less and relatively cheap. It is hard to imagine that these fragrant bits of leaves, seeds, and bark were once so coveted and costly [8].

Table 1. Some uses of spices.

Spices	Uses
Dawadawa (Parkia Biglobosa)	Seasoning and cooking to add flavour to food; a healthful substitute for chocolate and chocolate bars, chips and powder. To sweeten foods. Spice for some of the best tasting African stews ever; has some medicinal properties.
Bay leaf (Tez Patta)	Adds specific flavour to food being cooked; has some medicinal properties.
Chilli (Lal Mirch)	Main ingredient used for adding hot flavour to the food.
Cinnamon (Dalchini)	Mainly for seasoning food and preparing Masalas; has a medicinal use too.
Cloves (Laung)	A cooking ingredient mainly for seasoning or preparing Masalas.
Curry leaves (Curry Patta)	A main ingredient for seasoning in some countries. It has many medicinal uses.
Garlic (Lassan)	For cooking as well as for the medicinal purpose.
Ginger (Adrak)	Gives a specific flavour to food and has many medicinal uses.
Nutmeg (Jaiphal)	For garnishing in powdered form and Masala preparation. Used in soaps, perfumes and shampoos and for medicinal purpose.
Pepper (Kaali Mirch)	Extensively used in cooking, especially for garnishing. Has many medicinal uses too.
Aniseed (Chakra Phool)	Cooking and for medicinal purpose

Source: [10], [11], [12]

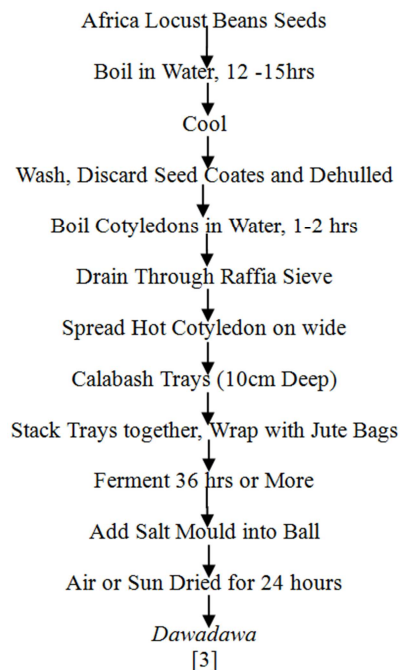
2.2. Uses of Spices

While used primarily as flavouring and seasoning agents in foods, many spices possess significant microbial activity. In all instances, antimicrobial activity is due to specific chemical or essential oils [9].

2.3. Production and Preservation of Dawadawa

In Africa, as in other parts of the world, fermented foods form an important part of the diet; a host of such foods exists in Africa [13]. Grainy products which are fermented range from the *Kenkey* of Ghana to *Gari* of West Africa as well as *Ensete* and *Injera* in Ethiopia, *Ting* in Botswana [13]. One of such fermented food or spice widely used is *Dawadawa*, a condiment for flavour enhancing in soups and stew in the countries stated above. Fermentation according to [14], results in preservation of an amount of food through lactic acid, alcohol, acetic acid and alkaline fermentation. The diet enriched through development of the diversity of flavours, aroma and texture in food substrates. The food substrates are then biologically enriched with protein, essential amino acids, essential fatty acids and vitamins. During food fermentation processing detoxification takes places and a decrease in cooking times and energy requirement [14].

The bean is boiled for 24 hours and the seed coats are removed and de-hulled [14]. Beans are placed inside leaves or cloth covering; mucilage forms, and after several periods of production, no inculum is necessary as production area walls and seeds equipment are heavily imbued with it. Fermentation either takes 36 hours at 35C or 48 hours at 40C [14]; the fermented seeds are gathered and formed into balls the size of golf balls or flattened into small cakes like additives for stews and soups. However other commentators appear with traditional production of *Dawadawa* as follows was:



2.4. The Effects of Spices in Cooking

The old saying that “variety is the spice of life” holds true in every aspect of life, including diet. Health experts recommend everyone to eat a variety of foods with many colours and flavour a part of a healthy lifestyle [15]. The benefits of cooking with herbs spices and condiments go far beyond adding colour and flavour to dishes. Not only are herbs spices and condiments used to add variety and replace extra fat, sugar and salt in meals, but they also provide powerful antioxidants while adding virtually no calories [16].

2.5. General Rules for Storing Herbs and Spices

Moisture, sun, light, heat and air can cause dried herbs and spiced to lose their flavour, colour and aroma therefore, they should be stored in air-tight containers, away from the above stated conditions such as. A cupboard or drawer is ideal. Heat producing appliances like the refrigerator or dish washer. Some general guidelines for storing some herbs and spices are one (1) year for ground herbs and spices and two (2) years for whole herbs and spices. A smaller container or a bulk supply should be purchased until one knows how fast certain herbs and spices are used. If an herb or spice smells and tastes flavourful, it is probably still potent and good for use. Label the date of purchase on the container with a permanent pen to know when it was purchased.

2.6. Recipes Which Use Dawadawa Locally and Internationally

2.6.1. TuoZaafi and Ayoyo Soup (from Ghana) Ayoyo Soup and Stew Ingredients

- *Ayoyo* leaves - 1 bunch
- Salt Petre – ¼ teaspoon
- Powdered Fish
- Powdered Okro (dry)
- *Dawadawa*
- Pepper (dried/powdered)
- 4 Medium Onions
- Any spice or seasoning you prefer

Palm oil Tomato Stew

- Meat 400g
- Palm oil
- medium Tomatoes 4
- Tuna 1 tin
- *Dawadawa*
- Pepper ½ teaspoon
- Medium Onions 3

TuoZaafi (Carbohydrate)

- Corn flour - one and half cup - 300g
- Cassava flour - half cup - 100g

Method: Ayoyo Soup

1. Chop the *Ayoyo* leaves into smaller sizes.
2. Put water on fire and when it becomes hot, add chopped onion, powdered fish, fresh okro and *Dawadawa*.
3. When the water and the added ingredients start boiling, add the chopped *Ayoyo* and the saltpetre.
4. While the soup boils, it is going to come up like

Champaign you shook before popping the cork. Beat the soup with a ladle so as not to boil over into the fire. When the soup does not rise again, it means it is cooked.

5. Add salt, seasonings and Maggi cubes to taste plus a little water simmer for 5 minutes and serve.

Palm oil Tomato Stew

1. Wash all the ingredients, cut meat into pieces and chop the onions.
2. Place into a saucepan, add salt and steam for 20 minutes.
3. Fry the meat in palm oil, add onion, pepper and later tomatoes; simmer till the meat is tender stirring regularly.
4. When almost cooked, add fish simmer for about 10 minutes and serve.

TuoZaafi

1. Put water on fire to boil based on the portions of *TuoZaafi* required.
2. Take some of the corn flour, mix with cold water and add to the boiling water while stirring to avoid a lumpy porridge (*Taligii*); boil till well cooked.
3. Take about 1/3 of the *Taligii* and put it aside; gradually add the corn flour to the one on fire whilst mixing the soft dough till a smooth soft paste is obtained. The *Taligii* placed aside may be added to the *TuoZaafi* when the need arise for a softer consistency.
4. Mould and place in serving bowls.

2.6.2. Ewedu (from Nigeria) Ingredients

Young <i>Ewedu</i> (Jute) leaves	400g
Iru (<i>Dawadawa</i>) carob	1 table spoon
Potash	1 tablespoon

Method:

1. Strip the *ewedu* leaves from their stem, wash and shred.
2. Add 250ml water and bring to a boil.
3. Add the shredded *ewedu* along the *iru* (*Dawadawa*) and the potash or baking soda.
4. Cover and allow to boil for 10 minutes.
5. Season to taste and continue cooking for further 5 minutes.
6. Portion size four (4)

2.6.3. Soumbala Chicken Sauce with Rice, Warm Pot (from Mali) Ingredients

Chicken (whole)	800g approx
<i>Soumbala</i>	300g
<i>Curie</i>	1 tablespoon
Okra (dried, powder)	1 tablespoon
Tomatoes (fresh)	2 med. size
Garlic	2 cloves

Method:

1. Cut the chicken into pieces and then put in a pot for 5 minutes on a burner then add the onion, tomatoes, garlic and salt.

2. After another 5 minutes, add the *soumbala* and some water.
3. Cover the pot allows it to boil for at least 20 minutes.
4. Add the black pepper and okra powder and let it boil for another 15 minutes.
5. Add the *Curie* and then let it boil for another 10 minutes. The *Soumbala* sauce is then ready.

2.6.4. Carob Cake (from Egypt) Ingredients

Oatmeal Flour	1 ½ cups
Baking Soda	2 teaspoon
Salt	½ teaspoon.
<i>Carob</i> Powder	½ cup (1 teaspoon instant coffee, optional)
Eggs or Egg Beaters	2 l g
Sugar	1 ¼ cup
Olive oil	2/3cup
Sour Milk or Buttermilk	1 cup
Vanilla	1 teaspoon
Walnuts (Chopped)	½ cup.

Method:

1. Before measuring pour 3 or 4 tablespoons of Arrowroot or corn starch in cup and fill with oatmeal that has been in blender or food processor.
2. Heat oven to 350 degrees. Use 8 x 8 x 12 pans. Spray and line with waxed paper.
3. In large bowl thoroughly stir together oatmeal flour, baking soda, salt, and carob powder. Add nut meats. In separate bowl beat eggs until foamy and light in colour. Gradually beat in sugar.
4. To flour mixture add oil, milk, and vanilla; beat until smooth. Beat in egg mixture until blended. Batter will be thin. Pour into prepared pan. Bake 35-40 minutes or until cake tester comes out clean. [17].

3. Methodology

3.1. Profile of the Study Area

The study area is Accra Polytechnic which is located in the city centre of the city along the Barnes Road in Tudu where most of the city's businesses are located. Accra Polytechnic is the premier polytechnic in Ghana and it provides adequate work force for the country's middle man power. The Hotel Catering and Institutional Management Department of the school of Applied Science and Arts as food production students would be available to give credible responses pertaining to the flavour and taste of the dishes.

3.2. Study Design

The study employed an exploratory survey design, a scientific method which involves observing and describing the behaviour of a subject without influencing it in anyway [18]. In the view of [9], exploratory design is used to obtain information concerning the current status of a phenomenon to describe what exists with respect to variables or conditions in

a situation. The design is used to observe natural behaviour such as *Dawadawa* without affecting it in anyway.

Thus, an exploratory study was undertaken in order to ascertain and describe the characteristics of the variables of interest in a situation. This was done through the use of strategies and procedures to describe clarify and interpret existing variables which constitute a phenomenon. A major demerit of the exploratory survey is the difficulty of ensuring that the questions to be a swill bed in exploratory survey are clear and not misleading. This is so because survey reports can vary significantly because of the exact wording of questions [20].

3.3. Storage

Dawadawa samples were stored at room temperature and in the refrigerator in airtight containers for one month in order to monitor the change in presentation of products when used in cooking. In each state, the *Dawadawa* spice was weighed to carry out the cooking of the dishes. This study was conducted at the Small Scale Production Kitchen at the Hotel Catering and Institutional Management Department of Accra Polytechnic.

3.4. Sensory Evaluation

Cooking of *Dafaduka*, Jollof with *Dawadawa* and *Ayoyo* Soup was conducted at the Small Scale Production unit at the (HCIM) Department on campus. The dishes were served to a number of panellists to effectively carry out the sensory evaluation.

Preparation and cooking of dishes

Two samples of *Dawadawa* were used in preparation and cooking of *Dafaduka* (a one pot rice dish) and *Ayoyo* Soup in order to find out consumers' preference of the flavour and taste of these *Dawadawa* samples.

Dafaduka (Jollof with *Dawadawa*) Ingredients

- Brown Rice 800g (2 margarine tins)
- Tomatoes (Fresh) 850g (10 big sizes)
- Tomato Puree 300g
- Pepper (fresh, ground) 75g
- Shea butter oil 1/4 litre
- Onion 300 (3 big sizes)
- *Dawadawa* 25g of each state
- Herrings (dried, pounded) 100g (1/4 margarine tin)
- Shrimps (dried, pounded) 75g
- Salt 1 teaspoon

Ayoyo Soup Ingredients

- *Ayoyo* leaves 800g
- Pounded dried fish and shrimps 100g
- Salt 1 teaspoon
- *Dawadawa* 25g of each state

The above stated ingredients were divided into four; each sample and 200g of brown rice was used for the cooking of *Dafaduka*. A 30 panel of students made up of both full time and part time HCIM students from the first to the third years were used to sample the food for aroma, taste and overall acceptability. Each student was given one food sensory form

for their response after tasting the food.

3.5. Sampling Frame

The target population comprised of HCIM students of Accra Polytechnic within the 2014/2015 academic year as at January, 2015. The students were made up of full and part time Students who have specialized in Food production in order to consent to participate in the sensory evaluation.

Table 2. Sample of Students.

Year	Full Time	Part Time	Total
1	130	65	195
2	120	53	173
3	92	55	147
Total	342	173	515

3.6. Sample Procedure

Random sampling was employed to select 30 Food Production students in HCIM.

3.7. Data Analysis

Two Samples of *Dawadawa* comprising Soya bean *Dawadawa* which consist of 30% Soya bean and 70% *Dawadawa* and raw *Dawadawa* were bought from the market. These were subjected to room temperature and refrigeration conditions for one month. The raw *Dawadawa* was used as control over the Soya bean *Dawadawa*.

4. Results and Discussion

4.1. Socio-demographic Characteristics of the Respondents

The study sought to describe the demographic characteristics of the sampled respondents used for the study. The result of this analysis is shown in table 3 below.

Table 3. Socio-demographic characteristics of the respondents.

Socio-demographic	Frequency	Percentage
Gender		
Male	3	10
Female	27	90
Total	30	100
Age		
21-25	14	47
26-30	11	37
31-35	1	3
36-40	3	10
41-45	-	-
46-50	1	3
Total	30	100
Marital status		
Single	27	90
Married	3	10
Total	30	100
Employment		
Employed	19	63.3
Unemployed	11	36.7
Total	30	100

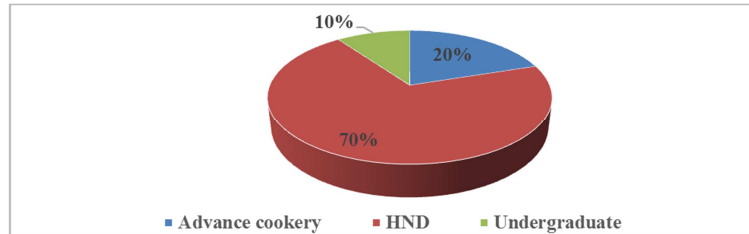
Source: survey data, 2015.

Table 3 presents the results of the demographic characteristics of the respondents. Regarding the age of the respondents, greater proportion (47%) of them fell into young bracket (20-25) years followed by the age (25-30) years representing (37%). It also revealed that ages (30-35) representing (3%), while ages (35-40), (40-45), and (45-50) represent 10%, 3%, 0% and 10% respectively. The study also revealed that the interviewed population contained more Females than Males. Majority (63%) of the respondents are

employed whilst the least (37%) are unemployed. Finally, the study showed that a 90% majority of the respondents sampled for the study are single only 10% are married with none of them divorced.

Educational Qualification of the Respondents

The study also sought to describe the distribution of the educational qualification of the respondents for the study. Findings of the distribution are shown in Figure: 1



Source: Survey data, 2015

Figure 1. Educational Qualification of Respondents.

From Figure 1, the educational levels of the respondents appear to be at the highest level since the survey data has shown that majority (70%) these respondents have attained HND qualification, whilst 10% and 20% of them had attained undergraduate and a Non tertiary Advance cookery qualifications respectively.

4.2. Desirability of Dafaduka with Dawadawa Samples

This section presents the results of Tasting *Dafaduka*. It shows the respondents' view on various *Dawadawa* samples used to prepare the *Dafaduka*. These samples are Soya beans *Dawadawa* moulded and processed under room temperature and refrigeration respectively, and whole fresh moulded *Dawadawa* processed under refrigeration and room temperature respectively.

4.2.1. Refrigeration Temperature

Table 4. *Dafaduka* under Refrigeration Temperature.

Statement	SD Moulded		Whole Fresh	
	Frequency	Percentage	Frequency	Percentage
Aroma				
Undesirable	6	20	11	37
Mod. desirable	21	70	13	43
Most desirable	3	10	6	20
Total	30	100	30	100
Taste				
Undesirable	0	0	8	27
Mod. desirable	14	47	13	43
Most desirable	16	53	9	30
Total	30	100	30	100
Overall acceptability				
Undesirable	7	23	6	20
Mod. desirable	18	60	14	47
Most desirable	5	17	10	33
Total	30	100	30	100

Source: Survey data, 2015. Note: SD and WF denotes Soya bean *Dawadawa* and Whole Fresh Samples respectively.

This section presents the results on the comparison between various Soyabeans and / or fresh *Dawadawa* samples processed under refrigeration temperature regime.

As indicated in Table 4 respondents were first asked to taste of various Soya bean *Dawadawa* moulded processed under refrigeration temperature. On the aroma of Soya bean *Dawadawa* as seen from the table above, 20% respondents said taste was undesirable, 70% suggest that aroma was moderately desirable and 10% consider the aroma most desirable. The finding, as shown in Table 4 also revealed that majority of the respondents 53% suggest that taste was most desirable, whilst 47% and 0% consider taste moderately desirable and undesirable respectively.

On the whole, 23% responded that Soya bean moulded *Dawadawa* (SD Moulded) is very undesirable, 60% responded that it is moderately desirable and 17% responded that the Soya bean *Dawadawa* Moulded sample is most desirable. The Table 4 also presents the findings on the taste, aroma and overall preference of whole fresh moulded *Dawadawa* processed under refrigeration temperature. On the aroma as seen from the Table 4 above, 37% of the respondents said the aroma was undesirable, 43% responded that aroma was moderately desirable, 20% considered the aroma as most desirable.

The findings further suggest that as far as the taste is concerned, 27% responded it is undesirable whilst 43% and 30% considered it moderately and most desirable respectively. On overall description, 20% responded that it is undesirable, 47% responded it is moderately desirable and 33% asserted it is most desirable. Comparing the two samples processed under refrigeration, the study suggests that whole fresh moulded *Dawadawa* under refrigeration temperature is most desirable to consumers with an overall percentage scores of 33% than the Soya bean moulded processed under the same temperature which is the less desired choice for consumers. Therefore, it is established by this study that consumers have high preference for whole

fresh moulded *Dawadawa* under refrigeration temperature than Soya bean moulded *Dawadawa* processed under the same temperature regime.

4.2.2. Room Temperature

This section presents the results on the comparison between various Soya beans *Dawadawa* samples processed under room temperature regime. The results in Table 4, depict respondents' views on aroma, taste and overall desirability indicators of Soya bean *Dawadawa* processed under room temperature. With respect to the aroma of Soya bean Moulded *Dawadawa* processed under room temperature, the results indicate that, 50% of the respondents said aroma was undesirable whilst 33% and 17% of them asserted that the aroma for this sample was moderately desirable and most desirable respectively.

Table 5. *Dafaduka with room Temperature* *Dawadawa*.

Statement	SD Moulded		Whole Fresh	
	Frequency	Percentage	Frequency	Percentage
Aroma				
Undesirable	15	50	8	27
Mod. desirable	10	33	16	53
Most Desirable	5	17	6	20
Total	30	100	30	100
Taste				
Undesirable	8	27	4	13
Mod. desirable	16	53	20	67
Most Desirable	6	20	6	20
Total	30	100	30	100
Overall acceptability				
Undesirable	4	13	5	14
Mod. desirable	19	63	20	69
Most Desirable	7	24	5	17
Total	30	100	30	100

Source: Survey data, 2015. Note: SD and WF denotes Soya bean *Dawadawa* and Whole Fresh Samples respectively.

Table 5. The findings also showed that majority (53%) of the respondents implied that taste was moderately desirable, whilst 27% and 20% of them considered the taste for the Soya bean Moulded *Dawadawa* processed under room temperature is undesirable and most desirable respectively. On overall desirability of the sample, the results revealed that only 13% of the respondent considered the sample as totally undesirable whilst 63% responded that the sample is moderately desirable. However, the study established that 23% of the respondents considered the Soya bean Moulded *Dawadawa* sample as totally being most desirable. The Table 5. Further presented the views of the respondents on the aroma, taste and overall desirability of the whole fresh moulded *Dawadawa* prepared under room temperature. With regards to the aroma of the sample, 27% of the respondents confirmed that the aroma was undesirable, 53% responded that aroma was moderately desirable whilst 20% said the aroma was most desirable. The finding, as illustrated indicated that 13% responded that the taste for the sample is undesirable, 67% which is the majority of the respondent

considered the taste for the sample to be moderately desirable and 20% of the sample established that the taste of the sample is most desirable. On overall, 14% of them responded that this is undesirable whilst 67% and 17% responded is moderately desirable and most desirable respectively.

Comparing the sample under this temperature regime, the study establishes that Soya bean Moulded is preferred more by consumers than the whole fresh moulded *Dawadawa* processed under the same temperature regime.

Comparing the two temperature regimes, refrigeration temperature and room temperature regimes, the study establishes that the whole fresh moulded *Dawadawa* processed under refrigeration temperature is most preferred or desirable by consumers than whole fresh moulded *Dawadawa* processed under room temperature. Furthermore, the Soya bean *Dawadawa* moulded processed under room temperature is most desirable overall, to consumers than the Soya bean *Dawadawa* moulded processed under refrigeration temperature. Comparing the two samples under both temperature regimes, the study establishes that whole fresh moulded *Dawadawa* is more desirable than the Soya bean *Dawadawa* moulded.

4.3. Desirability of Samples for Ayoyo Soup with *Dawadawa*

4.3.1. Detailed of Procedure

This section presents the results of tasting *Ayoyo* Soup made of different *Dawadawa* samples. It provides the respondents view on various *Dawadawa* samples use to prepare *Ayoyo* soup. These samples are whole fresh moulded *Dawadawa* samples processed under refrigeration and room temperatures respectively and Soya bean *Dawadawa* moulded samples processed refrigeration and room temperatures respectively. The Desirability analysis was based on three main desirability variable indicators including aroma, taste and overall. Under each variable indicates three major description categories such as undesirable, moderately desirable and most desirable. Respondents were asked to indicate whether the aroma, taste or overall features of a particular sample is undesirable, moderately desirable or most desirable findings of this analysis is presented in Table 4 and Table 5 respectively.

4.3.2. Refrigeration Temperature

This section presents the results on the comparison between various *Dawadawa* samples processed under refrigeration temperature regime used for *Ayoyo* Soup.

Table 6. *Ayoyo Soup with Dawadawa under Refrigeration Temperature*.

Statement	SD Moulded		Whole Fresh	
	Frequency	Percentage	Frequency	Percentage
Aroma				
Undesirable	17	57	12	40
Mod. desirable	9	30	16	53
Most desirable	4	13	2	7
Total	30	100	30	100
Taste				
Undesirable	14	47	10	33

Statement	SD Moulded		Whole Fresh	
	Frequency	Percentage	Frequency	Percentage
Mod. desirable	12	40	17	57
Most Desirable	4	13	3	10
Total	30	100	30	100
Overall acceptability				
Undesirable	13	43	8	27
Mod. desirable	12	40	17	57
Most desirable	5	17	5	16
Total	30	100	30	100

Source: Survey data, 2015. Note: SD denotes Soya bean *Dawadawa*.

Table 6 provides the view of respondents view on the aroma, taste and overall desirable indicators of the whole fresh moulded *Dawadawa* processed under refrigeration temperature for *Ayoyo* soup. On the aroma findings from Table 4, indicate that, 40% of the respondents said that its aroma was undesirable, 53% asserted that its aroma was moderately desirable and 7% considered its aroma most desirable. The findings further establishes that on taste of this sample, 33% responded that its taste is undesirable whilst 57% suggested that the taste is moderately desirable and 10% alluded that the taste is most desirable. Concerning the overall the study affirms that 27% of the respondents indicated that it is undesirable whilst 57% and 17% considered the sample of whole fresh moulded *Dawadawa* is moderately desirable and most desirable respectively.

Table 6 also presents the views of respondents on the aroma, taste and overall on Soya bean *Dawadawa* moulded processed under refrigeration for *Ayoyo* soup. With regards to the aroma, 57% of the respondents said its aroma was undesirable, 30% responded that its aroma was moderately desirable and 13% said the aroma was most desirable. The finding also indicates that concerning taste 47% of the respondents affirmed that the taste is undesirable with 40% and 13% suggesting that the taste was moderately desirable and most desirable respectively. With respect to the overall acceptability, 43% responded that it is totally undesirable with 40% and 17% of the respondents considering the sample of Moulded processed Soya bean *Dawadawa* under refrigeration temperature to be moderately desirable and most desirable respectively. Considering the overall desirability, the study establishes that both the whole fresh moulded and the Soya bean moulded *Dawadawa* processed under refrigeration temperature regime are equally most desirable to consumers.

5. Conclusion

The exploratory research design was proposed and applied in this study to investigate consumer preference for the different recipes for *Dawadawa* products. The methodology proposed allows for the comparison between dishes prepared with different recipes of *Dawadawa*. The methodology employed in this study supports the view that the comparisons for the different dishes gives additional explanation compared to the analysis based only on

individual dishes.

Two samples of *Dawadawa* were used in preparation and cooking of *Dafaduka* (a one pot rice dish) and *Ayoyo* Soup in order to find out consumers prefer ability of the flavour and taste of these *Dawadawa* samples. An amount of 25g of each sample was used in the preparation and cooking. The above stated ingredients were divided into four samples and 200g of brown rice was used for the cooking of *Dafaduka*. A 30 panel of students made up of both full time and part time HCIM students from the first to the third years were used to sample the food for aroma, taste and overall acceptability. Each student was given one food sensory form for their response after tasting the food.

A sensory evaluation form was given to each of the 30 students to state or identify the preferred of the two samples presented for the study. Two samples of *Dawadawa* comprising Soya bean *Dawadawa* which consists of 30% Soya bean and 70% *Dawadawa* and raw *Dawadawa* were obtained from the market. These were subjected to room temperature and refrigeration conditions temperatures for one month. The raw *Dawadawa* was used as control over the Soya bean *Dawadawa*. The study comprised both primary data and secondary information. The primary sources were Food Production Students of the HCIM of Accra Polytechnic. Secondary information was obtained from published and unpublished literature such as books, journals and relevant articles on the internet. The units of analysis were the HCIM Students.

5.1. *Dafaduka* Food Sample

The study after employing the exploratory research to investigate the comparison for consumer prefer ability between the Soya bean *Dawadawa* Moulded and Whole Fresh Moulded samples processed under refrigeration temperature, established that that whole fresh moulded *Dawadawa* under refrigeration temperature is most preferable to consumers with an overall percentage scores of 33% than the Soya bean moulded processed under the same temperature which is the less desired choice for consumers. Therefore, it is concluded by this study that consumers have high preference for whole fresh moulded *Dawadawa* under refrigeration temperature than Soya bean moulded *Dawadawa* processed under the same temperature regime.

Comparing the Soya bean *Dawadawa* Moulded and Whole Fresh Moulded samples under room temperature regime, the study establishes that Soya bean Moulded is preferred most by consumers than the whole fresh moulded *Dawadawa* processed.

Comparing the two temperature regimes of refrigeration temperature and room temperature regimes, the study establishes that the whole fresh moulded *Dawadawa* processed under refrigeration temperature is most preferred or desirable by consumers than whole fresh moulded *Dawadawa* processed under room temperature. Furthermore, the Soya bean *Dawadawa* moulded processed under room temperature is most desirable overall to consumers than the

Soya bean *Dawadawa* moulded processed under refrigeration temperature. Comparing the two samples under both temperature regimes, the study establishes that whole fresh moulded *Dawadawa* is more desirable than the Soya bean *Dawadawa* moulded.

5.2. Ayoyo Soup Sample

Considering the comparison between various *Dawadawa* samples processed under refrigeration temperature regime used for *Ayoyo* Soup. The study established that both the whole fresh moulded and the Soya bean moulded *Dawadawa* processed under refrigeration temperature regime are equally most desirable to consumers.

With regards to overall consumer prefer ability for Soya bean *Dawadawa* moulded and whole fresh *Dawadawa* processed under room temperature, the study establishes that the Soya bean *Dawadawa* moulded is more preferable to consumers than the whole fresh moulded *Dawadawa* for *Ayoyo* soup. Matching the two temperature regimes of refrigeration temperature and room temperature regimes), the study establishes that the Soya bean *Dawadawa* moulded is most preferred or desirable overall by consumers than the whole fresh moulded *Dawadawa* for *Ayoyo* soup.

5.3. Comparison Between *Dafaduka* and *Ayoyo* Soup Samples

Comparing the use of the two *Dawadawa* samples for the *Dafaduka* and the *Ayoyosoup* under both temperature regimes of refrigeration and room temperatures, the study therefore establishes that whole fresh *Dawadawa* moulded processed under room temperature is most preferred by consumers when it used for *Ayoyosoup* than the whole fresh *Dawadawa* moulded processed under either refrigeration or room temperature when used for *Dafaduka* food. Furthermore, it is also established by the study that Soya bean *Dawadawa* moulded processed under refrigeration temperature is more preferred by consumers when it is used for *Dafaduka* food than the Soya bean *Dawadawa* moulded processed under either refrigeration or room temperature when used for *Ayoyosoup*, but there was an overall acceptance of taste aroma and the health benefit of *Dawadawa* and in the preparation of Ghanaian dishes.

5.4. Recommendation

From the summary of findings and conclusions above, the study makes the following recommendations: First, health benefit is an important factor in influencing consumers' decision to use *Dawadawa* recipe for food preparation. As such, the study recommends that the nutritionists and policy makers need to keenly educate the public about the health benefits of *Dawadawa* in the diet of Ghanaians. The study also recommends that innovative technologies that could help reduce or totally eliminate the odour associated with *Dawadawa* products must be developed to process *Dawadawa* in order to make it more appealing for consumers.

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