# Acceptability of selected herbs as off-odor remover and flavor enhancer for dried parrot fish

## *Scarus rivulatus*

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**Abstract**
Acceptability of calamansi leaves, guava leaves and lemon grass aqueous extracts as off-odor and off-flavor remover and flavor enhancer to dried Parrot fish *Scarus rivulatus* were evaluated in terms of color, aroma, taste and texture and general acceptability. Students (high school and college) professionals (professors and researcher) pupils and cook served as panelists for the sensory and organoleptic evaluation.
Dried parrot fish treated with guava leaf extract is the most preferred and highly acceptable by the panelists. Analysis of the sensory and organoleptic evaluation also show that dried parrot fish treated with either guava leaf, lemon grass and calamansi leaf extract is highly acceptable based on the different criteria of evaluation. Similarly, the guava leaf extract also masked the off-odor of dried Parrot fish.
Proximate composition analysis of dried parrot fish treated with herbs revealed 80.2% crude protein, 0.065% crude fiber, 037% crude fat, 19.83% moisture and 10.15% ash.

**Keywords:** parrot fish, sensory and organoleptic evaluation, herbs, flavor enhancer, off-odor remover

## 1. Introduction

Parrot fish belongs to the Family Scaridae, which is a distinctive group of labroid fishes. Members of this family can be found on coral reefs and approximately 85 species of parrotfish have been described living in tropical and subtropical coral reefs (Bonaldo, 2006) [4] throughout the world, swim constantly, often found in schools night sleep alone in mucus bubble secreted for protection from predators (Böhlke and Chaplin, 1993) [3]. Members of family Scaridae are critical for maintaining sandy beaches and healthy coral reefs (Win *et al.,* 1959) [21]. They ingest limestone particles and calcareous algae, and then poop sand (Bellwood, 1995) [2]. Parrot fishes imparts muddy off-odor and off-flavor which makes it unacceptable for the consumers. To avoid marketing fish with environment-related off-flavors, fish must be screened for flavor quality. Quantitative chemical analysis is inadequate for flavor quality control because of time constraints, costs involved, and the limited number of odorous compounds that can be detected with available methods. Sensory analysis (taste-testing), which treats trained "tasters" as analytical instruments, is the only applicable method for routine evaluation of fish flavor quality. Sensory analysis can detect odorous compounds at very low levels, and discriminates between types of off-flavors as well as flavor intensity. Variability and bias in sensory analysis can be minimized by proper selection and training of panelists (Ploeg, 1991) [15].

Even though fish and fish products are an important source of nutrients in many countries, and health professionals encourage more fish consumption, research on consumer perception of fish seems to be scant. Many consumers in the Western world feel they should eat more fish and are certain that fish is healthy. Sörensen *et al.* (1996) [17] tried to connect consumers' attitudes to their likelihood of buying and liking fresh fish in connection with some other products. Most consumers perceived the fresh fish to be healthy and promote well-being, but that did not affect their likelihood of buying the fish. Many people also associate fish with "fishy" odors and the smell of TMA and do not like the flavor of fish. Understanding the needs of consumers and preparing easy to make fish dishes is important to increase fish consumption.

Spices are used for flavor, color, aroma and preservation of food or beverages. Spices may be derived from many parts of the plant: bark, buds, flowers, fruits, leaves, rhizomes, roots, seeds, stigmas and styles or the entire plant tops. The term 'herb' is used as a subset of spice and refers to plants with aromatic leaves. Aroma brought about by these herbs are known to remove off-odor and enhance the flavor of a product. Hence, this study generally aims to utilize locally available herbs as off-odor remover and flavor enhancer for dried parrot fish. Specifically, the study sought to evaluate the acceptability of dried parrot fish treated with calamansi (*Citrus microcarpa)* leaves, guava (*Psidium guajava*) leaves and lemon grass (*Cymbopogon citratus*) stalk extract, to different group of panelists. The result of this study may be used by researchers from various academic and research institutions in its quest for natural off-odor remover and flavor enhancer for fish and other fishery products.

## 2. Materials and methods
### 2.1 Experimental fish
Around 15 kg of 250-300 g size parrot fish (Fig. 1) was purchased from the fisherman of Divilacan, Isabela. The fish was washed with clean seawater and immediately transported to the Fish Processing laboratory of the Provincial Institute of Fisheries, Isabela State University, Roxas Isabela.
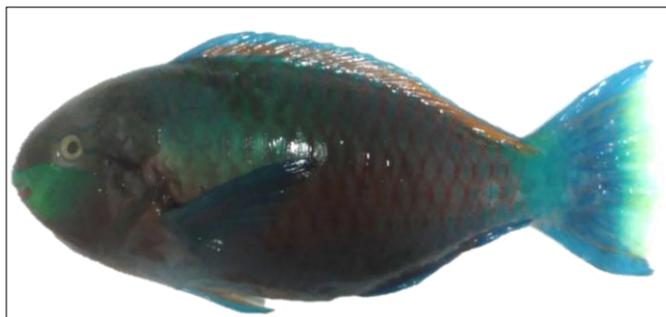
**Fig 1:** Parrot fish *Scarus rivulatus*

## 2.2 Preparation of herbal extracts
The leaves of calamansi and guava and the stalk of lemon grass were collected from the household backyards at Roxas and Aurora, Isabela. The leaves and stalk of each experimental plant were freshly collected and chopped into small pieces using knife and chopping board. The 1kg plant material: 1 l water was boiled in covered pot for 15 min. After boiling, the liquid portion was separated from the plant materials and was filtered using cheese cloth. The filtered herbal extract was kept refrigerated until use. The herbal extracts were added with sodium chloride to make up 7% brine solution. The treatment assignment for this study includes: T1- Brine solution (control group) T2- Calamansi leaves, T3- Guava leaves and T4- Lemon grass. The extract of herbs was used to soak the fish prior to drying.

## 2.3 Protocol for drying fish
The fish was prepared in split-dried form using knife and chopping board, eviscerated and washed with clean freshwater. The fish were assigned to different treatments and soaked in the herbal extracts for 30 min at a ratio of 1kg fish: 1L herbal extract. After soaking / marinating, the fish were arranged in drying trays of the drying chamber. The fish was dried under the heat of the sun for one week. The finished product was kept in plastic containers and stored in a cool dry place until the sensory and organoleptic evaluation.

## 2.4 Sensory and organoleptic evaluation
The dried parrot fish were deep-fried in cooking oil for 15 min and pat dry with paper towel. The fried product were prepared in bite-size form for the sensory and organoleptic evaluation. Panelists for the evaluation of the acceptability of the product includes: students (high school and college), elementary pupils, professionals (professors and researchers) and cook (commercial cook). There were ten (10) respondents per group of panelist. The panelists were asked to observe the color/ appearance, savor the aroma / odor, and taste the product. Each panelist were provided with water after tasting the product and were immediately asked to provide the rating for the treatment group before proceeding to the next. The acceptability of dried parrot fish treated with herbal extracts were evaluated according to color, aroma, taste and texture, using the Likert scale rating system where: 0.1- Unacceptable (UA); 1.1-2.0-Sligthly Acceptable (SA); 2.1-3.0=Acceptable (A); 3.1-4.0=Moderately Acceptable, (MA); 4.1-5.0-Highly acceptable (HA).

## 2.5 Proximate analysis of dried Parrot fish
Dried parrot fish samples were sent to Department of Agriculture (RFO-02) Integrated Laboratory Division, Cagayan Valley Integrated Agricultural Laboratory, Regional Government Center, Carig Sur, Tuguegarao City, for the proximate analysis of crude protein, crude fiber, crude fat, moisture and ash. The proximate analysis followed standard protocol for analysis of proximate composition of products.

## 2.6 Statistical analysis
The rating of each panelist for the different criteria under evaluation of the different treatments were grouped and tabulated. Treatment means per category of panelist and criteria for evaluation were determined and were analyzed by one-way analysis of variance (ANOVA) for windows. A value of $P<0.0.05$ was used to indicate significant differences. Treatment means were compared using the Tukey's test (SPSS, version 21). Descriptive rating was incorporated in each of the treatment means per category of panelist and criteria of evaluation.

## 3. Results
The results of the sensory and organoleptic evaluation of selected herbs as flavor enhancer for dried Parrot fish is presented in in Figures 2 to 14. The specific evaluation results are presented in the following sections: a) preference of the panelists, b). acceptability of herbs as flavor enhancer, c). acceptability based on the criteria of evaluation, d). overall acceptability of herbs as flavor enhancer and e). proximate composition of dried parrot fish.

## 3.1 Preference of the panelists
The result of sensory and organoleptic evaluation of the preference of the panelists on the color, aroma, taste and texture of dried parrot fish treated with herbs as flavor enhancer is shown in Figures 2 to 5.

## 3.1.1 Student panelists
Dried Parrot fish with lemon grass was the most preferred and generally accepted by the student panelists, which it has a rating of 4.08 (HA), followed by the guava leaves, calamansi leaves and brine solution (control) with 3.85 (MA), 3.85 (MA) and 3.65 (MA), respectively. However, all the treatments were not statistically different from each other. Dried Parrot fish with lemon grass also obtained the highest preference in terms of texture, aroma and color.
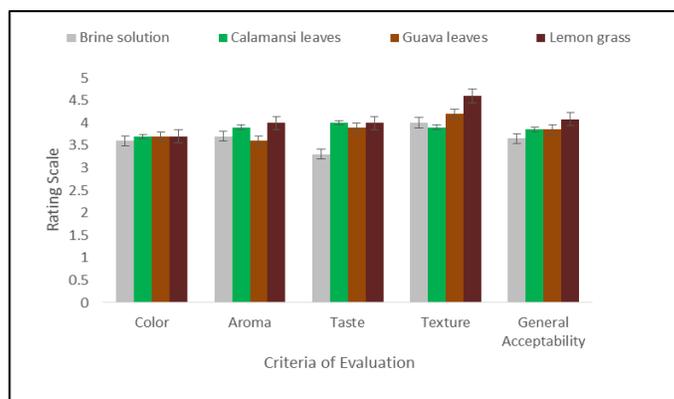


**Fig 2:** Sensory and organoleptic evaluation (mean ± SD) of students (n=10) on the color, aroma, taste and texture of dried Parrot fish *S. rivulatus* treated with herbs as off-odor remover and flavor enhancer.

## 3.1.2 *Professional panelists*
Dried Parrot fish with calamansi leaves was the most preferred and generally accepted by the professionals with a rating of 4.30

(HA), followed by the guava leaves and lemon grass with a value of 4.28 (HA), 4.28 (HA) and 3.98 (MA), respectively. However, all treatments are not statistically different from each other dried Parrot fish treated with lemon grass is obtained the highest preference in terms of color and aroma, on the other hand dried parrot fish with guava leaf extracts obtained the most preferred taste and texture.
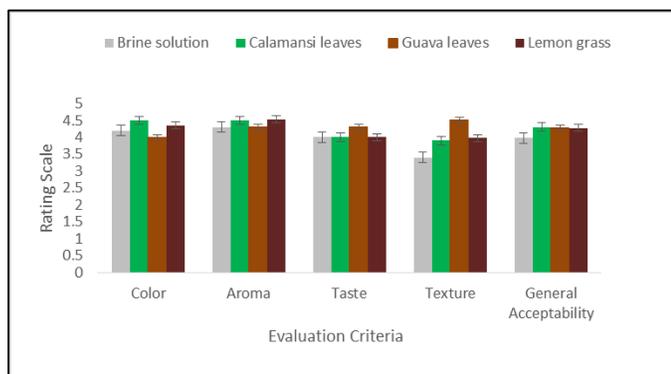


**Fig 3:** Sensory and organoleptic evaluation (mean ± SD) of professionals (n=10) on the color, aroma, taste and texture of dried Parrot fish *S. rivulatus* treated with selected herbs as off-odor remover and flavor enhancer.

### 3.1.3 *Pupil panelists*
Dried Parrot fish with brine solution (control) was the most preferred and generally accepted by the pupils with a rating of 3.97 (MA), followed by the calamansi leaves, lemon grass and guava leaves with a value of 3.87 (MA) 3.85 (MA) and 3.77 (MA), respectively. However, all treatments mean were not statistically different from each other. Dried Parrot fish treated with calamansi leaves obtained the highest preference in terms of color while guava leaves got highest rating in terms of aroma. On the other hand, dried Parrot fish treated with brine solution (control) only obtained the most preferred taste and texture.
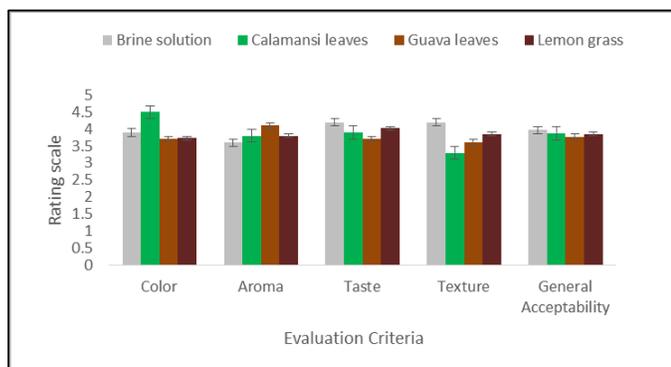


**Fig 4:** Sensory and organoleptic evaluation (mean ± SD) of pupils (n=10) on the color, aroma, texture and taste of dried Parrot fish *S. rivulatus* treated with selected herbs as off-odor remover and flavor enhancer.

### 3.1.4 *Cook panelists*
Dried Parrot fish with lemon grass was the most preferred and generally accepted by the cook panelists, with a rating of 4.55 (HA). This is followed by the calamansi leaves, brine solution (control) and guava leaves with a value of 4.40 (HA), 4.20 (HA) and 4.13 (MA), respectively. However, all treatments were not statistically different from each other. Dried parrot fish with calamansi leaves obtained the highest preference in terms of

color. On the hand which lemon grass treated parrot fish obtained the most preferred aroma taste and texture preference.
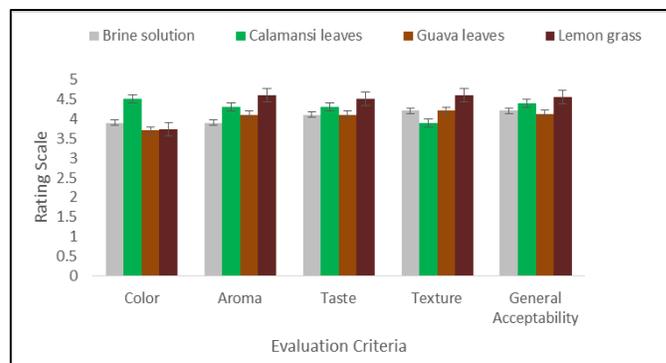


**Fig 5:** Sensory and organoleptic evaluation (mean ± SD) of cook panelists(n=10) on the color, aroma, texture and taste of dried Parrot fish *S. rivulatus* treated with selected herbs as off-odor remover and flavor enhancer.

## 3.2 Acceptability of herbs as flavor enhancer
The result of sensory and organoleptic evaluation on the acceptability of herbs as flavor enhancer in terms of color, aroma, taste and texture of dried Parrot fish treated with selected herbs is shown in Figures 6-9.

### 3.2.1 *Brine solution (control)*
Dried Parrot fish with brine solution (control) was the most preferred and generally accepted by the cook panelists, with a rating of 4.20 (HA). This was followed by the professionals, pupils and students with a general acceptability value of 3.98 (MA), 3.98 (MA) and 3.65 (MA), respectively. However, the entire mean were not statistically different from each other. Parrot fish with brine solution (control) obtained the highest preference in terms of taste, professional obtained highest aroma preference and pupils has obtained highest texture preference. On the other hand, pupils professional and cook evaluated dried Parrot fish with brine solution (control) obtained the most preferred color.
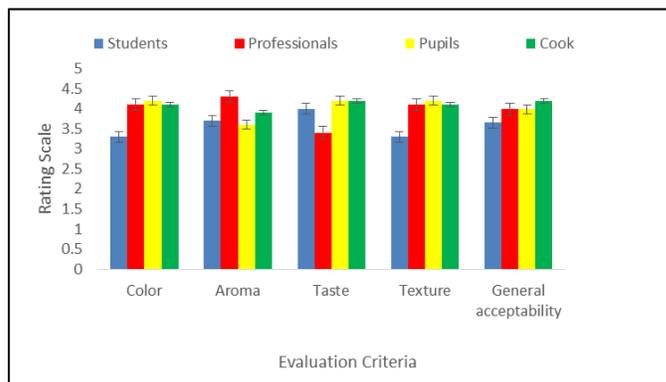


**Fig 6:** Sensory and organoleptic evaluation on the acceptability of dried Parrot fish *S. rivulatus* treated with brine solution (control)

### 3.2.2 *Calamansi leaves*
Dried Parrot fish with calamansi leaves as flavor enhancer was the most preferred and generally accepted by the cook panelists, with a rating of 4.28 (HA). This is followed by the professionals, students and pupils with a general acceptability value of 4.30 (HA), 3.85 (MA) and 3.65 (MA), respectively. However all

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treatments were not statistically different from each other. Also cook panelists obtained the highest preference in terms of color, in the dried parrot fish treated with calamansi leaves while professionals obtained highest aroma preference. On the other hand pupils and cook obtained the most preferred texture.
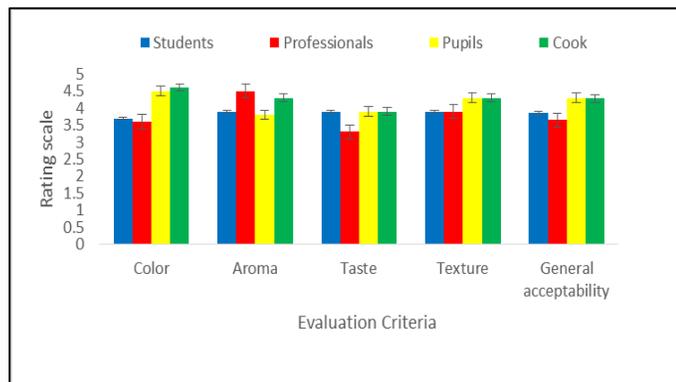


**Fig 7:** Sensory and organoleptic evaluation on the acceptability of dried Parrot fish *S. rivulatus* treated with calamansi leaf extract as off-odor remover and flavor enhancer

### 3.2.3 *Guava leaves*
Dried Parrot fish with guava leaves as flavor enhancer was the most preferred and generally accepted by the professionals which have a rating of 4.28 (HA). This is followed by the cook, students and pupils, with 4.13 (HA) 3.85 (MA) and 3.78 (MA), respectively. However, all panelists were not statistically different from each other. In addition professional panelists obtained the highest preference in terms of color, aroma and taste of guava leaves treated dried parrot fish while cook obtained the highest texture.
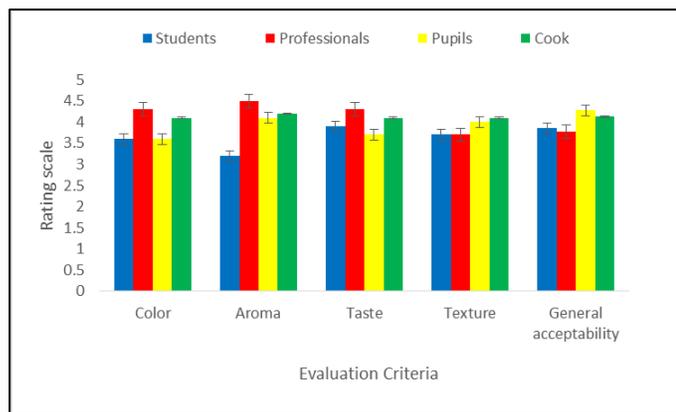


**Fig 8:** Sensory and organoleptic evaluation on the acceptability of dried Parrot fish *S. rivulatus,* treated with guava leaf extract as off-odor remover and flavor enhancer.

### 3.3.4 *Lemon grass*
Dried Parrot fish with lemon grass was the most preferred and generally accepted by the pupils, which has a rating of 4.28 (HA), This was followed by the cook, students and professionals with a general acceptability value of 4.25 (HA), 4.08 (HA) and 3.87 (MA), respectively. However, all mean were not statistically different from each other. In dried Parrot fish treated with lemon grass, cook obtained the highest preference in terms

of color and aroma preference. Students and cook obtained the highest taste preference. On the other hand, cook panelists they most preferred texture.
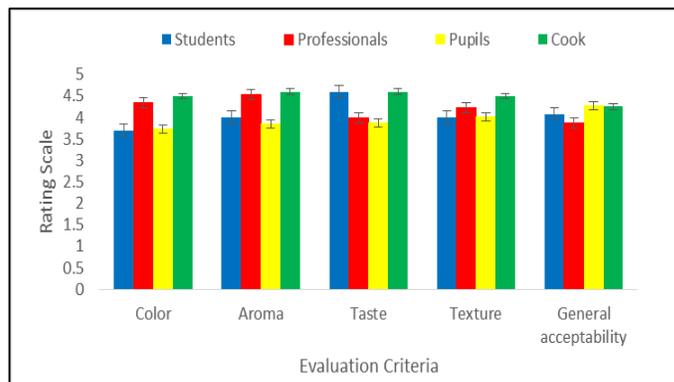


**Fig 9:** Sensory and organoleptic evaluation on the acceptability of dried Parrot *S. rivulatus,* treated with lemon grass as off-odor remover and flavor enhancer

### 3.3 Acceptability based on criteria of evaluation
The acceptability of dried parrot fish treated with herbs as flavor enhancer based on the color, aroma, taste and texture is shown in Figures 10-13.

### 3.3.1 Color
Among treatments, the most preferred and highly acceptable by the different panelist in terms of color preference is the fish treated with brine solution (control) which has a rating of 4.17 (HA) followed by fish treated with lemon grass (4.07, HA) and calamansi leaf (4.01, HA) extracts. Fish treated with guava leaf extract is moderately acceptable by the panelists due to the darker coloration it imparted.
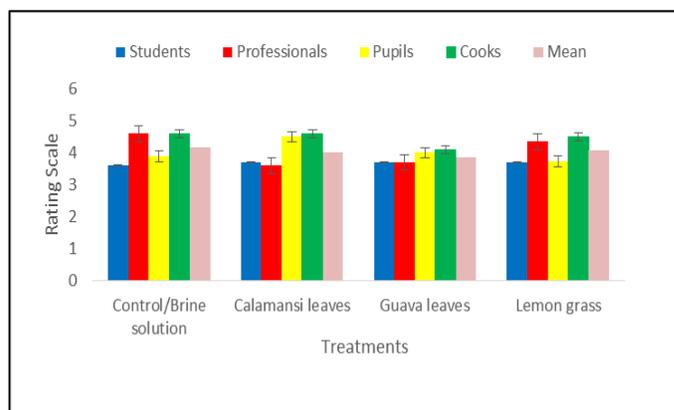


**Fig 10:** Evaluation on the color of dried Parrot fish *S. rivulatus* treated with different herbal extracts as off-odor remover and flavor enhancer.

### 3.3.2 Aroma
In all treatments, the most preferred and highly acceptable by the different panelists in terms of aroma was the fish treated with lemon grass which has a rating of 4.24 (HA) followed by calamansi leaf extract (4.12, HA). Aroma of fish treated with these two herbal extract is highly acceptable by the panelist because it was able to mask the off-odor of the parrot fish.
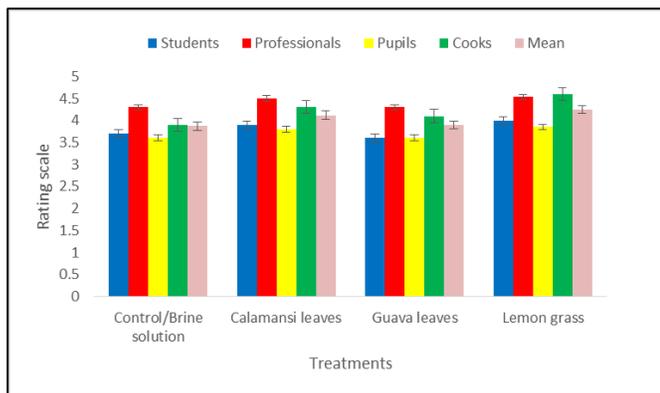
**Fig 11:** Evaluation on the aroma of dried Parrot fish *S. rivulatus* treated with herbal extracts as off-odor remover and flavor enhancer.
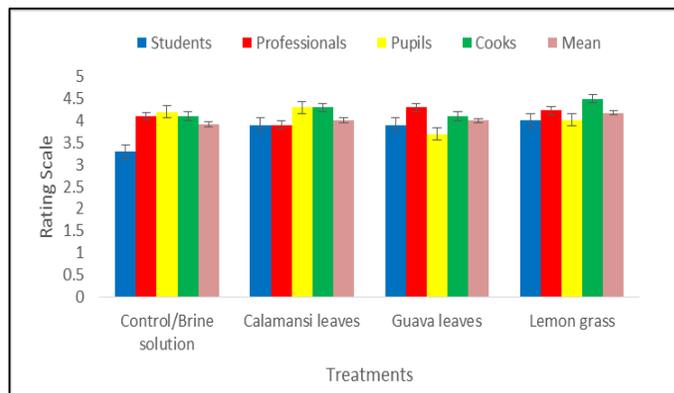
### 3.3.3 Taste

In terms of taste, the most preferred and highly acceptable by the panelist is the fish treated with guava leaf extract which obtained a rating of 4.26 (HA), followed by fish treated with lemon grass extract (4.00, HA). These two treatments were able to mask the off-flavor and enhanced the taste of the fish as evidenced by the highly acceptable ratings of panelists. Fish treated with calamansi leaf extract obtained the lowest rating of 3.75, which is moderately acceptable. The calamansi leaf extract somehow imparted a sour flavor to the fish.
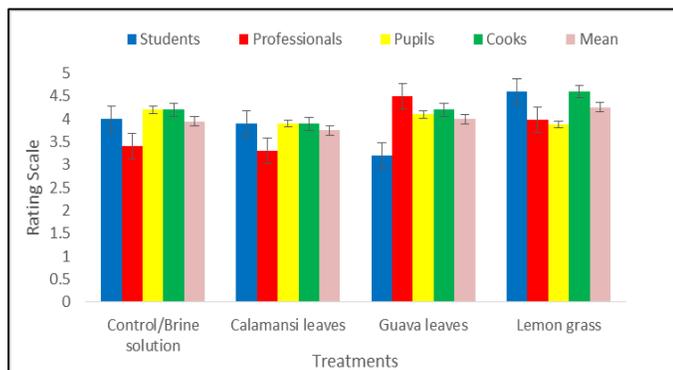


**Fig 12:** Evaluation on the taste of dried Parrot fish *S. rivulatus* treated with herbal extracts as off-odor remover and flavor enhancer.

### 3.3.4 Texture

Fish treated with lemon grass extract obtained the highest acceptability of the panelists in terms of texture. It has a rating of 4. 18 (HA). Fish treated with calamansi leaf and guava leaf extracts are also highly acceptable to panelists with ratings of 4.01, and 4.0, respectively. Fish in brine solution is moderately acceptable by the panelists.



**Fig 13:** Evaluation on the texture of dried Parrot fish *S. rivulatus,* treated with herbal extracts as off-odor remover and flavor enhancer

### 3.4 General Acceptability of herbs as flavor enhancer for dried Parrot fish

Dried Parrot fish treated with lemon grass extract is the most preferred and generally accepted by the panelists (Fig. 14). It has a rating of 4.19, which is highly acceptable. Fish treated with calamansi leaf extract and guava leaf extracts are also highly acceptable to the panelists with ratings of 4.02 and 4.01, respectively. Fish treated with brine solution (control) is moderately acceptable to the panelists, Even though the use of herbal extract is highly acceptable to the panelists, statistical analysis revealed that the treatment means are not significantly different from each other.
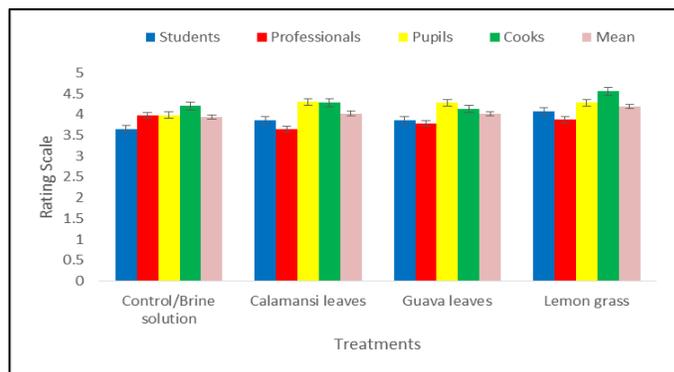


**Fig 14**: General acceptability of the plant extracts as off-odor remover and flavor enhancer for dried Parrot fish *S. rivulatus*.

### 3.5 Proximate composition of dried Parrot fish

The result of the proximate composition of dried parrot fish treated with herbal extracts is shown in Table 1. Dried parrot fish contains about 80.2 % protein.

**Table 1:** Proximate analysis of dried Parrot fish.

| Sample | Crude protein (%) | Crude fiber (%) | Crude fat (%) | Moisture (%) | Ash (%) |
|---|---|---|---|---|---|
| Dried Parrot fish treated with guava leaf extract | 80.2 | 0.065 | 0.37 | 19.83 | 10.15 |

### 4. Discussions

Effectiveness of the extracts of calamansi leaves, guava leaves and lemon grass as off-odor and off-flavor remover and flavor enhancer were evaluated by the different groups of panelists in terms of color, aroma, taste and general acceptability. Difference in the preference of panelists based on these criteria of evaluation is the result of individual differences and personal preference on the likeness of a particular product.

It is clear that flavor perception begins with the eyesight, as soon as food is seen. Sending a message to the brain, the eyes tell whether a food looks palatable and should be tasted. Touch will usually come next, either with the hands or with some utensil,

such as a fork or a spoon. The touch gives an idea about the texture, if the food is hard or soft, course or fine, etc. Sniffing follows and the aroma will give a hint of the flavor. Taking a bite starts many simultaneous processes, taste buds tell if the food is bitter, sweet, salty, or sour or perhaps some combination, tongue and teeth assess the texture, and aroma is perceived through the retronasal route, all determining the flavor of the food. Based upon that determination a decision whether to take another bite is made. Taste and aroma are generally the most important contributors to flavor. Their interactions can stem from physical, physiological, cognitive, or psychological effects. Taste and aroma perception, like many other physical processes, begin at a chemical level, with compounds reacting with certain receptors to elicit a neurological response. This physiological response along with the chemical reactions can be referred to as the sense level of perception (Högnadóttir, 2000)[10]. Color and appearance attracts the consumer to a product and can help in impulse purchases. At the point of purchase, the consumer uses appearance factors to provide an indication of freshness and flavor quality (Barrett *et al*, 2010)[1]. In our study, the carcass of dried parrot fish immersed in the herbal extracts were distinguishable from controls, since it imparted a darker coloration. Majority of the panelists prefer a light coloration on the dried fish like those of the fish immersed in brine solution. Consumers have different perception when they looked at the color of the product. Other consumers may conclude that the darker the coloration of the product, the stronger is the aroma and flavor, hence they are not sure whether to buy or not the product with strong coloration.

Flavor is typically described by aroma (odor) and taste. Aroma compounds are volatile-they are perceived primarily with the nose, while taste receptors exist in the mouth and are impacted when the food is chewed (Tournier *et al*, 2007)[19]. Aroma is one of the parameters that determine a person's level of satisfaction on the quality of the product. The aroma of dried parrot fish treated with either lemon grass or calamansi leaf extract is the most highly acceptable aroma of the panelists. The strong fresh grassy lemon scent of lemon grass and lemony-like scent of calamansi leaves effectively masked the muddy off-odor of the parrot fish. The aroma of food in many ways determine whether or not the food is tasty. With one's sense of smell can recognize whether or not tasty food from a distance without tasting it directly. Even the food industry thought it very important to test the aroma of a product, because it can quickly provide the results of an assessment of whether a product can be favored or not by the consumer.

While color and appearance may be the initial quality attributes that attract us to a particular product, the flavor may have the largest impact on acceptability and desire to consume it again. In our study, dried parrot fish treated with either guava leaf or lemon grass extract imparted a highly acceptable taste to the panelists. The impact of olfactory stimuli on taste perception is interpreted in terms of taste enhancement (the so-called odor-induced taste enhancement) appeared when taste intensity of the mixture was higher than taste intensity of the compound alone (Tournier *et al*, 2007)[19]. It can be noted that both the aroma and taste of the fish treated with either lemon grass and guava leaf extract is highly acceptable to the panelists. Therefore, these two herbal extracts can enhance the flavor of dried parrot fish.

Texture is a sensory and functional manifestation of the structural, mechanical and surfaces properties of foods detected through the senses of vision, hearing, touch and kinaesthetic

(Szczesniak, 2002)[18]. In our study, fish treated with lemon grass extract showed highest acceptability in terms of texture. This preference is still related to the taste and aroma of the product. Oral texture is the perception that arises when food interacts with teeth, saliva and tactile receptors in the oral cavity. During mastication, the texture of the food changes, the palatability of the food is assessed and the food converted to a form suitable for swallowing (Mishellany *et al*, 2006)[13]. The process of mastication varies among people and this affects the food breakdown and subsequently texture and flavor of the food (Brown and Wilson, 1997)[5].

Fish flavor is a complex mixture of several aroma compounds and varies between species and changes during processing of fish aroma, texture and taste, when it appears flavor of any food stuff is the sum of all aromas, taste and intensity sensations experienced by consumers that indeed every bite generally invokes an entire suite of aromas and tastes which can be broad. Thus while brome phenols are not entirely responsible for the particular flavors of a flavors not should be confused with fishy odors or off tastes which result of microbial spoilage, as well as processing plant to prevent this unique flavors ocean like natural flavors from being masked by spoilage flavors and odors habits develop through repeated behaviors and can be seen as automatic acts since individuals rarely think consciously about them (Franchi, 2012)[8]. Description of off-flavors is often difficult because of some factors; there are many chemical compounds responsible for off- flavors, the same chemical compound can licit different flavor descriptions from different people as certain flavors may be produced by more than one chemical compound and variation in the concentration of an odorant may cause changes in the flavor characteristics rather than in flavor intensity (Ploeg, 1991)[15].

On the other hand, study of relationship between food preference and food choice, consumers' response to food products are determined by four different components. One consumer perceives the sensory characteristics of a product. Second, the consumer has a general response to a product, which is an affective component. Third, the consumer applies a cognitive component which is related to the information the consumer has about the product and to the consumers' attitudes and beliefs. Fourth, the response is affected by a behavioral component which involves the persons' intentions or actions for future interactions (Costell *et al*., 2010)[6].

Few studies of flavor, as the relationship between food preferences and food choice, learn that some flavor perception has some factors to affect food. Some people like a variety of foods while others do not or picky eaters. On the one hand, preference in the context of food can indicate a consumers' choice of one food product over another. Liking, on the other hand, reflects the assessment of quality of a product (Franchi, 2012)[8]. What is interesting, however, is what causes these differences and particularly why they occur. We already know that there are some biological differences in how we perceive the basic tastes (Tuorila, 2007)[20]. Apart from the previously mentioned biological factors, most of our food preferences are learned through experiences and there are several ways of learning about food (Nestle *et al*., 1998)[14]. Learned behavior might be conscious or unconscious. Food preferences are a typical example of learned behavior that occurs unconsciously. In contrast to intentional learning, this type of learning does not deteriorate with age (Köster, 2009)[8]. However, De Graaf *et al*. (1996)[7] found that age affects flavor perception. A group of

elderly people needed a higher concentration of some foodstuffs to report the same flavor intensity as a group of young people and the elderly also had a higher concentration for optimal preferred perceived intensity that is the concentration where they liked the flavor best. Studies have shown that elderly people prefer foods with stronger flavor, while young subjects preferred lower flavored versions of the same foods. Odor perception is known to diminish with age and it is theorized that by adding flavorants and/or odorants to foods, elderly people will eat more of them because of higher preference, diminishing the likelihood of malnutrition (Griep *et al*., 1997) [9]. These might be the reason why there is a difference in the preference of pupils, students and the cook and professionals in terms of taste and aroma of the dried parrot fish treated with herbal extracts. Flavor is usually more important in determining consumer acceptance of foods than appearance or texture.

## 5. Conclusions
Dried Parrot fish treated with either calamansi leaf extract, guava leaf extract and lemon grass is highly acceptable based on the color, aroma, taste and texture. Among the treatments, dried Parrot fish immersed in guava leaf extract is the most preferred by the panelists.
The herbal extract that masked the off-odor of parrot fish is the guava leaf extract and lemon grass extract based on the aroma and taste criteria of evaluation determined by the panelists.
Proximate composition of dried Parrot fish treated with guava leaf extract revealed %protein, %ash, %Moisture, %crude fiber, %crude fat.

## 6. References

1. Barrett DM, Beaulieu JC, Shewfelt R. Color, Flavor, Texture, and Nutritional Quality of Fresh-cut Fruits and Vegetables: Desirable Levels, Instrumental and Sensory Measurement, and Effects of processing. Critical Review in Food Science and Nutrition, 2010; 50:369-389.
2. Bellwood DR. Direct estimate of bioerosion by two parrot fish species, *Chlorurus gibbus* and *C. sordidus*, on the Great Barrier Reef, Australia. Marine Biology. 1995; 121:419-429.
3. Böhlke JE, Chaplin CCG. Fishes of the Bahamas and adjacent waters, Second Edition. University of Texas Press, Austin. 1993, 15-12.
4. Bonaldo R. Foraging activity and resource use by three parrotfish species at Fernando de Noronha Archipelago, tropical West Atlantic. Marine Biology, 2006; 149:423-433.
5. Brown WE, Wilson C. Influence of mastication on flavor perception. *In:* European communities (ed) Interaction of Food Matrix with Small Ligands Influencing Flavour and Texture, Valencia, Spain, 1997, 72-77.
6. Costell E, Tárrega A, Bayarri S. Food Acceptance: The Role of Consumer Perception and Attitudes. Chemosensory Perception, 2010; 3(1):42-50.
7. De Graaf C, van Staveren W, Burema J. Psychophysical and psychohedonic functions of four common food flavours in elderly subjects. Chem. Senses, 1996; 21:293-302.
8. Franchi M. Food choice: beyond the chemical content. International Journal of Food Sciences and Nutrition. 2012; 63(S1):17-28.
9. Griep MI, Mets TF, Massart DL. Different effects of flavor amplification of nutrient dense foods on preference and consumption in young and elderly subjects. Food Quality and Pref. 1997; 8(2):151-6.
10. Högnadóttir Á. Flavor Perception and Volatile Compounds in Fish. Icelandic Fisheries Laboratories. Department of Food Science. University of Iceland. 2000, 2-22
11. Kannat SR, Chawla SP, Sharma A. Antioxidant and radio-protective activities of lemon grass and star anise extracts, Food Technology Division, Bhabha Atomic Research Centre, Trombay, Mumbai 400 085, India, 2014, 624-30.
12. Köster EP. Diversity in the determinants of food choice: A psychological perspective. Food Quality and Preference, 2009; 20:70-82.
13. Mishellany A, Woda A, Labas R, Peyron MA. The challenge of mastication: preparing a bolus suitable for deglutition. *Dyspahia.* 2006; 21:87-94.
14. Nestle M, Wing R, Birch L, Disorga L, Drewnowski A, Middleton S *et al*. Behavioral and Social Influences on Food Choice. Nutrition Reviews, 1998; 56:50-74.
15. Ploeg VD. Testing flavor quality of preharvest channel catfish) Delta Research and Extension Center, Missisipi State University, 1991, 431.
16. Smith DV, Margolskee RF. Making sense of taste. Scientific American, 2001; 284:32-39.
17. Sörensen E, Grunert KG, Nielsen NA. The impact of product experience, product involvement and verbal processing style on consumers' cognitive structures with regard to fresh fish, The Aarhus school of business, center for market surveillance, research and strategy for the food sector, MAPP working, 1996, 42.
18. Szezesniak AS. Texture is a sensory property. Food Quality and Preference. 2002; 13:215-225.
19. Tournier C, Sulmont-Rosse C, Guichard E. Flavour perception: Aroma, taste and texture interactions. Food 2007; 1(2):246-257.
20. Tuorila H. Sensory perception as a basis for food acceptance and consumption, Mac Fie, H. (ed.): Consumer led food product development Cambridge, UK: Wood head Publishing Limited, 2007.
21. Winn HE, Bardach JE. Differential food selection by moray eels and a possible role of the mucous envelope of parrot fishes in reduction of predation. Ecology. 1959; 40:296-298.