

Ethno-nutritional Characteristics, Typology and Conditions of Manufacture and Conservation of Fish Based Dishes in the Locality of Yabassi, Cameroon

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Abstract: The integration of cultural data in a scientific approach constitutes the basis for the development of the culinary industry of traditional preparations. The present study was aimed at inventorying fishes and fish based dishes found in Yabassi locality, and to collect information on the pre-treatment of these fishes, and the preparation process and conservation methods of some fish based dishes. The investigations were carried out in Yabassi locality in two periods, from February to June 2016 and from February to June 2017 and consisted of direct observations and interviews in households, restaurants and in out-of-home vendors. A total of 281 persons were investigated, they were chosen because they were either responsible for family meals or meals seller, or consumers. For each participant, primary information such as gender, age, origin region and occupation were recorded. Moreover, information concerning fishes found in the area, fish based dishes, the ingredients and cooking methods as well as the purpose of dishes were recorded. A total of 281 persons were investigated in Yabassi among which 83% of women and 17% of men. They were mainly aged 30-60 years old (84%), mostly originated from Littoral Region (78%). The survey revealed a total of 15 fish species currently present and consumed in Yabassi. Among them, 07 species represented more than 90%. These are respectively *C. nigrodigitatus* (44.5%), *Oreochromis sp.* (18.3%), *C. carpio* (9.9%), *H. niloticus* (7.3%), *Clarias sp.* (6.9%), *Hydrocynus sp.* (4.2%) and *M. cephalus* (3.6%). A total of 11 fish based dishes in Yabassi locality were listed particularly. The most frequently cooked were 'Mbongo' (41.17%) followed by Pistachio cake (21.03%), Bouillon (13.03%) and 'Mabomba' (6.64%). It was found that various cooking methods are used for these dishes, particularly water cooking, smoothed cooking, oil cooking and stew. Different virtues are attributed to these dishes. These dishes are mostly conserved by drying, heating and refrigeration.

Keywords: Fishes, Local Dishes, Cooking Methods, Conservation, Yabassi

1. Introduction

Malnutrition, including under nutrition, micronutrient deficiency and over nutrition, remains one of the biggest challenges to global development [1-4]. Integration of indigenous and scientific knowledge for conservation of bio-

resources has taken shape by three recent major international conventions [5]. Worldwide, traditional foods suffer from many problems including inadequate intergenerational knowledge transfer, lack of documentation and time-consuming processes [6]. Most traditional foods require a variety of edible plant materials for their preparation. In the eating habits of most ethnic groups in Cameroon, the sources

2.3. Fishes Found in Yabassi

The fish species found in Yabassi or caught in the Nkam-Wouri river were inventoried at local markets and near the docks. The occurrence of each species was then assessed using the identification key at the fishery resources laboratory at the Institute of Fisheries and Aquatic Sciences at Yabassi [14]. Then, information on the pre-treatment and cooking method of these fishes were collected.

2.4. Fish Based Dishes Found in Yabassi

Fish dishes were inventoried in households, restaurants and in out-of-home vendors. The occurrence of cooking of these dishes was evaluated using questions on a survey sheet administered to the owner of the dishes. Information on the form and species of fished used and on the cooking method was also collected for each dish, as well as information on the purpose of the preparation and the virtues attributed by the population for the main dishes. These informations also included preparation process and the main dish preservation methods.

2.5. Data Analysis

The qualitative and quantitative data and information collected were analyzed using mainly simple descriptive statistics especially tabular frequency counts and percentages.

3. Results and Discussion

3.1. Demographic Characteristics of Study Population

As showed in table 1, a total of 281 persons were investigated in Yabassi among which 83% of women and 17% of men. They were mainly aged 30-60 years old (84%), originating from Littoral Region (78%) and had done primary (30%) and secondary (58%) studies and as occupation, 25% were farmers, 23% housewives and 30% traders.

Table 1. Demographic characteristics of study population.

	Number	Relative frequency (%)
Gender		
Women	233	83
Men	48	17
Age (years)		
]20; 30]	31	11
]30; 40]	115	41
]40; 50]	68	24
]50; 60]	53	19
>60	14	5
Origin Region		
Centre	15	5
Far North	2	1
Littoral	219	78
North	3	1
South	4	1
South-West	3	1
West	35	12
Studies level		
None	18	6
Primary studies	84	30
Secondary studies	162	58

	Number	Relative frequency (%)
Higher studies	17	6
Occupation		
Dressmakers	3	1
Farmers	67	25
Fishmen	19	7
Housewives	63	23
Hunters	3	1
Nurses	2	1
Penitentiaries	3	1
Ranchers	3	1
Secretaries	4	1
Students	10	4
Traders	82	30
Teachers	17	6
Technicians	5	2

3.2. Fishes Found in Yabassi Locality

The survey revealed a total of 15 species currently present and consumed in Yabassi (Table 2). These include *Chrysichthys nigrodigitatus* (commonly named Machoiron), *Clarias sp* (commonly named catfish), *Cyprinus carpio* (commonly named Carpe), *Heterotis niloticus* (locally named Kanga), *Hydrocynus sp.* (commonly named tiger fish) *Liza falcipinnis* (locally named Mulet gris or Mbo'o), *Mugil cephalus* (commonly named Mulet), *Malapterurus electricus* (commonly named Electric catfish), *Oreochromis sp.* (commonly named Tilapia), *Ctenopoma petherici* (locally named Mayepe), *Hydrocynus forskalli* (commonly named poisson chien, locally named Mbassa), *Dasyatis sp* (commonly named raie and locally named Douba), *Lates niloticus* (commonly named capita inland locally named mbi), *Mormyrus sp* (commonly named *longue bouche* and locally named Ngouma). These results are in agreement with the data present by FAO [15] who presented the fishery profile of Cameroon. It shows that the species found in Yabassi are mostly fished in continental waters. In fact, the species are mostly sought in Nkam River. Based on 524 fishes observed, 07 species represented more than 90%. These are respectively *C. nigrodigitatus* (44.5%), *Oreochromis sp.* (18.3%), *C. carpio* (9.9%), *H. niloticus* (7.3%), *Clarias sp.* (6.9%), *Hydrocynus sp.* (4.2%) and *M. cephalus* (3.6%). These species are among the most fished in Nkam River [10, 11].

The results also showed that at Yabassi, fishes are usually delivered at home or procured directly in river and in landing sites ('Titina'), or in markets ('Banya'), and in fish shops ('Carefour 8', 'Longtoka', 'Ndogbele', 'Mangnongo', 'Bodiman'...). Fishes are procured live (20%), fresh (65%), frozen (3%) or smoked (12%). Moreover, about 10% of fishes procured fresh or smoked are sometimes altered. When procured fresh or live, the fishes undergo pre-treatments before use or storage. The time between procurement and pre-treatment vary from 0 to about 3 hours according to the place and the home of client. Pre-treatments methods used by Yabassi population included washing (with cool or lukewarm water associated or not with citron, vinegar or salt), salting associated with citron or vinegar, treatment with citron or vinegar, and refrigeration (Table 2). The water used for pre-treatment are from drillings (34%), springs (24%), backwater (16%), wells (13%) and rivers (12%) and CDE which are national

company of water distribution (1%). Because of its perishability, fresh fish is particularly difficult to preserve in tropical countries due to deficiency of adequate equipment, climatic and environmental conditions which contribute to fish spoilage within few hours. To limit post-capture loss, various preservation

methods among which those listed at Yabassi are used individually or in association [16, 10]. These methods aim to inactivate micro-organisms and endogenous enzymes which are involved in the spoilage mechanism [16].

Table 2. Occurrence and pre-treatment of fishes' species found in Yabassi.

	OCCURRENCE (%)	PRE- TREATMENT
Chrysichthys nigrodigitatus (Machoiron)	44.5	Washing with water (36%), with lukewarm water + citron (13%), with lukewarm water (8%) or with lukewarm water + salt (1%) Smoke (20%) Treatment with citron (11%), with salt (5%), with salt + citron (1%) or with vinegar (4%) Refrigeration (1%)
Oreochromis sp. (Tilapia)	18.3	Washing with water (62%) Smoke (25%) Treatment with citron (13%)
Cyprinus carpio (Carpe)	9.9	Washing with water (38%), with lukewarm water + citron (3%), with lukewarm water (3%) or with lukewarm water + salt (3%) Smoke (18%) Treatment with citron (17%) salt (5%), with salt (17%)
Heterotis niloticus (Kanga)	7.3	Washing with water (73%) Smoke (27%)
Clarias sp.	6.9	Washing with water (43%), with lukewarm water (28%), with lukewarm water + citron (7%) Smoke (25%) Treatment with citron (7%)
Hydrocynus sp.	4.2	Not provided
Mugil cephalus (Mulet)	3.6	Not provided
Ctenopoma petherici (Mayepe)	1.7	Not provided
Mormyrus sp.	1.0	Not provided
Hydrocynus forskalli (Mbassa)	1.0	Not provided
Dasyatis sp (Douba)	0.8	Not provided
Malapterurus electricus (Electric catfish)	0.4	Not provided
Mormirus sp (Ngouma)	0.2	Not provided
Liza falcipinnis	0.2	Not provided

3.3. Dishes Based on Fishes Found in Yabassi Locality

Table 3 shows dishes based on fishes recorded in Yabassi locality, their cooking frequency, the species, the form of fishes used and their cooking method. A total of 11 dishes were listed particularly Bouillon, Frying, Groundnut sauce, 'Mabomba',

'Mbongo', 'Ndole' Sauce, Okra sauce, 'Pépé soup', Pistachio cake, Stew fish and Tomato sauce. The most frequently cooked were 'Mbongo' (41.17%) followed by Pistachio cake (21.03%), Bouillon (13.03%) and 'Mabomba' (6.64%). These dishes are among those presented and most eaten in Cameroon and particularly people living near waterways [17].

Table 3. Dishes based on fished found in Yabassi.

	DISHES												
	'Mbongo'	Pistachio cake	Bouillon	'Mabomba'	Stew fish	Pistachio soup	Groundnut soup	Frying	Tomato soup	Okra soup	'Ndole' soup	'Pépé soup'	
COOKING OCCURRENCE (%)	43.17%	21.03%	13.03%	6.64%	4.43%	2.95%	2.21%	2.21%	1.48%	1.11%	1.11%	0.63%	
FORM OF FISHES USED	Fresh (%)	100	36.59	100	100	100	36	30	100	4	43	16	100
	Smokes (%)	-	63.41	-	-	-	64	70	-	96	57	84	
	All fishes	-	-	-	-	100	100	100	-	-	100	100	100
SPECIES OF FISHES USED (%)	<i>Chrysichthys nigrodigitatus</i>	80	53.17	55	83	-	-	-	-	-	-	-	-
	<i>Cyprinus carpio</i>	7	6.47	29	-	-	-	75	-	-	-	-	-
	<i>Oreochromis sp.</i>	6	6.18	10	17	-	-	-	25	-	-	-	-
	<i>Clarias sp.</i>	4	8.61	6	-	-	-	-	-	-	-	-	-
	<i>Mugil cephalus</i>	2	2.15	-	-	-	-	-	-	-	-	-	-
	<i>Heterotis niloticus</i>	1	15.81	-	-	-	-	-	-	-	-	-	-
	<i>Ctenopoma petherici</i>		7.61	-	-	-	-	-	-	-	-	-	-
COOKING MODE (%)	Water cooking	80		91	89	-	-	100		100	100	100	100
	Smothered cooking	20	100	9	11	-	-	-	-	-	-	-	-
	Stew	-	-	-	-	100	-	-	-	-	-	-	-
	Oil cooking	-	-	-	-	-	-	-	100	-	-	-	-

Depending on foods, different fishes are used, both fresh and smoked. In fact, for 'Mbongo', fishes are used only fresh and the most use are *C. nigrodigitatus* (80%). For Pistachio cake, fishes are used both fresh (36.59%) and smoked (63.41%) and the most used are *C. nigrodigitatus* (53.17%), *H. niloticus* (15.81%) and *Clarias sp.* (8.61%). Concerning Bouillon, fishes are used only fresh and the most use are *C. nigrodigitatus* (55%), *C. carpio* (29%) and *Oreochromis sp.* (10%). For 'Mabomba', fishes are used fresh only and the species uses are *C. nigrodigitatus* (83%) and *Oreochromis sp.* (17%). Concerning Stew fish, Frying fish and 'Pépé soup', fishes are used fresh only and all the fishes are used for Stew fish and 'Pépé soup', while only *C. carpio* (75%) and *Oreochromis sp.* (25%) are used for Frying. For different sauces, fishes are used both fresh and smoked and all the species are used. The form and species of fishes used strongly depended on the occurrence of fishes found in Yabassi, on dish and particularly on food habit [18, 19, 10, 11].

It was found that various cooking methods are used for dishes based on fishes in Yabassi locality, particularly water cooking, smoothed cooking, oil cooking and stew. Stew is used for Stew fish; frying for Frying fish; water cooking for different soups, 'pépé soup' and smoothed cooking for pistachio cake. 'Mbongo' and Bouillon are usually prepared by water cooking (81 and 91% respectively) and sometimes by smoothed cooking (19 and 9% respectively); while 'Mabomba' is usually prepared by smoothed cooking (89%) and sometimes by water cooking (11%). These cooking methods [8, 10, 11].

Table 4 presents the purpose of preparation of the main dishes ('Mbongo', Pistachio cake, Bouillon and 'Mabomba') and virtues attributed to them by population. It can be observed that these dishes are usually for sale or for many

occasions particularly family consumption, celebration of traditional wedding, health problems or travel. Also, diverse virtues are attributed to these dishes by Yabassi population. In fact, 2.5% of population use to prepare bouillon for family consumption, 30% for celebration, 2.5% for health problems, 50% for all the previous listed occasions while 15% use to prepare it for sale only. Different virtues are attributed to it particularly fight against malaria and flu or used as degreaser and digestive facilitator. As for 'Mabomba', 53.30% of population prepare it for celebration, 3.30% for the above listed occasions while 43.40% prepare for sale only. It is used for treatment of mystical diseases. Concerning 'Mbongo', 4.59% of population prepared it for family consumption, 33.03% for celebration, 1.83% for health problems, 0.92% for travel, 44.95% for all the occasions and 14.68% for sale only. The virtues attributed to 'Mbongo' are that it is a source of vitamins, can fight against nightmares and navel sickness. For Pistachio cake, 1.54% of population prepared is for family consumption, 47.69% for celebration, 1.54% for traditional wedding, 4.62% for travel, 23.08% for all the early listed occasions and 21.54% for sale only. Pistachio cake has many virtues particularly fight against prostatitis and hypertension, it is also used for weaning and as source of vitamins or digestive facilitator. These results confirm that food is fundamental to human survival, in more than just one way [20, 19]. First, food is basic for averting hunger and maintaining health for every human being. Secondly, food satisfies our palate and makes us happy and emotionally and socially content. Third, food constitutes a form of cultural expression. Otherwise it has been shown in a study done among the Bakwele of South-eastern Cameroon that fishes have numerous cultural and medicinal virtues as those noted with Yabassi people in the present work [7].

Table 4. Purpose of preparation of the main dishes and virtues attributed by population.

	Bouillon	'Mabomba'	'Mbongo'	Pistachio cake
Purpose of preparation				
Family consumption	2.50%	-	4.59%	1.54%
Celebration	30.00%	53.30%	33.03%	47.69%
Traditional wedding	-	-	-	1.54%
Health problems	2.50%	-	1.83%	-
Travel	-	-	0.92%	4.62%
All the above occasions	50.00%	3.30%	44.95%	23.08%
Sale	15.00%	43.40%	14.68%	21.54%
Virtues attributed by the population	1) Antimalarial, 2) Against flu, 3) Degreaser, 4) - Digestive facilitator	Treatment of mystical diseases	a) Source of vitamins, b) Against nightmares, c) Against navel sickness	a) Against prostatitis, b) Source of vitamins, c) Digestive facilitator, d) Antihypertensive, e) Used for weaning

3.4. Empiric Preparation and Conservation Methods of Pistachio Cake and 'Mabomba'

Preparation process

Information on preparation process of Pistachio cake and 'Mabomba' was obtained from housewives and sellers during surveys. This information was confirmed nearest some sellers who accepted to be accompanied during preparation. Table 5 presents the main ingredients and materials used for

preparation of Pistachio cake and 'Mabomba'. These ingredients and materials are subjected to some treatments before use. One notes that these two dishes are prepared with numerous spices.

For preparation of 'Mabomba', spices are pre-treated as shown in Table 5. Before addition to cleaned and cut fish, some spices are burnt, others grilled to make their flavor feel more. Pre-treated fresh fish is macerated with the spice mixture. This mixture of crushed spices consisted for 500 g

of fish to 20 g of *Ricinodendron heudelotii*, 74 g of 'mbongo', 20 g of calcined *Scorodophleus zenkeri* bark, 20 g of onion, 25 g of red chilli, a clove of garlic, 15 g of white pepper, 30 g of *Olox subscorpoïdera*, 15 g of *Piper guineense*, 30 g of *Ocimum gratissimum*, 26 g of *Monodora myristica* and 200 ml of water. The whole is seasoned with 5

g of salt and 02 'Maggi' cubes. The macerated spiced fish is wrapped in clean banana leaves and steam cooked (98–105°C) for 30 minutes. This preparation process is in agreement with those presented in previous studies [17] who made a review on composition of Cameroonian traditional dishes.

Table 5. Summary of ingredients, materials and their treatment.

Common or usual name (Scientific name)		Treatment
Fishes species	Presented in Table 3	1) When used fresh: basic pre-treatment, washing 2) When used smoked: basic pre-treatment, washing, drying and smoke, washing
Pistachio seeds	Pistachio (<i>Cucumeropsis mannii</i>) 1) Onions (<i>Allium cepa</i>), garlic (<i>Allium sativum</i>) 2) Almond of <i>Ricinodendron heudelotii</i> commonly named 'djangsang' 3) Black peppery (<i>Piper guineense</i>) 4) White peppery (<i>Piper nigrum</i>) 5) 'Pèpèe' (<i>Monodora myristica</i>) 6) 'Rondelles' (<i>Olox subscorpoïdera</i>)	Shelling, sorting, sun drying, grinding
Spices	7) Bark of 'loum' (<i>Scorodophleus zenkeri</i>) 8) 'Essesse' (<i>Tetrapleura tetraptera</i>) commonly named 'quatre côtés' 9) Red pepper chili (<i>Capsicum frutescens</i>) 10) Fruits of <i>Aframomum citratum</i> ('Mbongo') 11) Leaves of <i>Ocimum gratissimum</i> commonly named 'Masepe' or 'Bakweri' 12) Salt 13) 'Cubes'	According to spice, shelling, cutting, sorting, roasting, grinding and soaking
Wrapping	Banana (<i>Musa sp</i>) or 'djonc'/'Dikongo' leaves (<i>Megaphrynium macrostachyum</i>)	Washing and slight warming

As for preparation of Pistachio cake, to 500 g of crushed pistachio seeds, 10 g of red *Capsicum frutescens* and 10 g of *Piper guineense* both previously ground, 15 g of salt and 450 mL of water are added. The mixture is homogenized and 500 g of smoked fishes previously cleaned and soaked in warm water are added. Then, 25 ml of refined oil is used to anoint the side of the banana leaf which is into contact with the preparation. The packages are then steam cooked for 2 hours at 98–105°C. This preparation process is in agreement with other [17, 21] who worked on production system, physicochemical, sensory and microbiological properties of different formulations of pistachio cake.

3.5. Conservation Methods

Local dishes stewed in green leaves are kept in their packaging until consumption. Unfortunately, the packaging does not protect them from deterioration and degradation over time to which it was noted 66% of losses after conservation. To avoid this, dishes underwent the application of the various conservation techniques particularly heating (in the evening and/or in the morning), refrigeration and drying. About 57% of people conserve these dishes by heating, 33% by refrigeration or by heating, 5% by refrigeration only and 5% by drying only. These results could be explained by the fact that in Yabassi, very few people have refrigerators, in addition electric energy is not always available.

For heating, dishes are subjected to heat in aluminium and stewed for 30 minutes for water boiling. The rest of the water is removed from the pot and the dishes are placed on the trays for cooling. This operation is done in the evening, in the

morning or both in the evening and in the morning. For this last, after heating in the evening, the dishes spent overnight in the pot and in the morning after heating they are placed on the trays for cooling.

Concerning refrigeration, dishes are placed in a plastic bowl and placed in the refrigerator (4°C). After removing from the refrigerator, these dishes undergo the heating process as described above. As for charcoal drying, dishes are placed on racks at a distance of about 20 cm from the charcoal embers and be returned every 5 minutes for 30 minutes. Usually, those dishes are left on the racks for the whole night.

4. Conclusion

This study revealed a total of 15 fishes species currently present and consumed in Yabassi among them 07 species represented more than 90% especially *C. nigrodigitatus*, *Oreochromis sp.*, *C. carpio*, *H. niloticus*, *Clarias sp.*, *Hydrocynus sp.* and *M. cephalus*. A total of 11 dishes based on fishes in Yabassi locality were particularly listed and the most frequently cooked were 'Mbongo', pistachio cake, Bouillon and 'Mabomba'. It was found that various cooking methods are used for these dishes, particularly water cooking, smoothed cooking, oil cooking and stew. Numerous virtues are attributed to these dishes. They are mostly conserved by drying, heating and refrigeration. Future work is planned to assess the nutritional and microbiological quality of these recipes by applying the various preservation techniques listed. likewise to set up a technological itinerary with a view to its safeguard and for a space-temporary availability.

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