

# Culinary valorisation of sea cucumbers from the Algerian west coast

Nour-el-Houda Belkacem<sup>1</sup> and Karim Mezali<sup>1\*</sup>

## Abstract

In Algeria, sea cucumbers are not available through sales outlets and are less appreciated by Algerian consumers. The present work aimed to introduce sea cucumbers into the national cuisine. For that, 70 sea cucumbers – comprising the two species *Holothuria tubulosa* and *H. arguinensis* – were collected from the western coastal region of Mostaganem in Algeria. Once the sea cucumbers were dried, we prepared four dishes imitating the recipes of dishes commonly consumed in Algerian cuisine. A tasting session was carried out on a sample of the population of the Mostaganem region in order to have an idea of the quality of each prepared dish.

**Keywords:** sea cucumber-based dishes, tasting, nutritional value, Mostaganem

## Introduction

Nowadays, sea cucumbers are considered to be excellent food and nutritional products. Indeed, they are rich in essential amino acids, have a high protein content (5–12% of fresh body weight) and are considered to be a source of omega-3, omega-6 and other fatty acids (Zhong et al. 2007; Mecheta et al. 2020). They are rarely consumed in the Mediterranean region, and all catches are exported to Asian countries (Aydin 2018; Mezali and Slimane-Tamacha 2020) where they are sold in shops at very high prices. The Chinese consume sea cucumbers on special occasions such as during festive meals (Purcell 2017). The body wall, longitudinal muscles and viscera are the most consumed parts of the sea cucumbers (Conand and Byrne 1993). The most important Mediterranean species are *Holothuria poli*, *H. tubulosa* and *H. arguinensis*. Since 2008, the collection of sea cucumber species in Algeria is allowed but not for commercial purposes (Mezali et al. 2021). The use of sea cucumbers as a food source, however, began in China 1000 years ago (Purcell et al. 2012).

In 2020, a survey conducted by Mezali and Slimane-Tamacha indicated that sea cucumbers are not available through traditional sales outlets and are not really appreciated by Algerian consumers. A survey conducted by Mezali et al. (2021) showed that the most consumed seafood in Algeria are round sardines, sardinella and anchovies (due to their accessibility and affordability), and shrimps, lobsters and mussels when budgets allow. This survey also showed that although sea cucumbers are little known by Algerian consumers, the majority of respondents were willing to introduce them in their culinary dishes. For the present study, we prepared different sea cucumber dishes for a tasting session to assess whether they can be enjoyed by the western Algerian community.

## Methodology

Seventy sea cucumber individuals comprising the two most abundant species – *Holothuria tubulosa* and *H. arguinensis* – were sampled during October 2021 at “Petit-port” station in the municipality of Sidi-Lakhdar, Mostaganem, on the west coast of Algeria (36°12'25.8"N, 0°22'29.9"E). The sampled individuals were processed into the dry product beche-de-mer (Purcell 2017). Four culinary dishes were prepared using the dry product, similar to the most popular recipes in Algeria. A tasting session was held at the Faculty of Natural and Life Sciences at the University of Mostaganem, Algeria. A questionnaire, prepared in two languages (French and Arabic), was distributed to 42 people of different sexes and ages in order to gain their opinions on the quality of each sea cucumber dish according to its similarity with other dishes commonly consumed by the Algerian community (see Box 1).

### *Processing fresh product into beche-de-mer*

The transformation of freshly harvested sea cucumbers into beche-de-mer is based on the simple traditional methods described by Purcell (2017): cleaning, salting, cooking and sun drying. Each individual is dissected and emptied of its digestive tract and viscera (Fig. 1A). The integument is rinsed with tap water and washed of all traces of sediment, then drained and wrapped in absorbent paper (Mezali 1998) and placed in a box filled with coarse salt (1 kg per 3 kg of sea cucumbers) for 2–5 days (Fig. 1B). After that, the animals are placed in a saucepan filled with hot water and boiled until the water reaches 70–90°C, stirring every 5 minutes to avoid damage to the integuments (Fig. 1C). For the first cooking, the integuments are boiled for 10–30 minutes until they have a soft consistency. After that, they are drained into a strainer (Fig. 1D), spread on a cotton towel, and then dried in the open air in a place exposed to

<sup>1</sup> Protection, Valorization of Coastal Marine Resources and Molecular Systematic Laboratory, Department of Marine Science and Aquaculture, Faculty of Natural Sciences and Life, University of Mostaganem Abdelhamid Ibn Badis, PO Box 227, 27000, Mostaganem, Algeria.

\* Author for correspondence: karim.mezali@univ-mosta.dz

the sun for 4–5 days (Fig. 1E). The drying time depends on how cloudy the sky is. The product obtained after drying has a very hard consistency (Fig. 1F).

In order to improve product quality and to give the sea cucumber a straight shape, a second cooking is carried out after 2–3 days of sun drying (Purcell 2017). In order to rid the integuments of their calcareous deposits, each integument is placed for 24 h in water mixed with white vinegar (one part vinegar to three parts water). After that, each integument is scrubbed using a stiff brush. This operation removes all of the calcareous deposits from the integument. At this stage, the product is ready to be used in various dishes.

### Preparation of sea cucumber-based dishes

Four dishes were prepared for the tasting survey (Fig. 2).

#### Sea cucumber with white sauce (Fig. 2A)

To prepare the white sauce, in a pan, 3 tablespoons of vegetable oil are mixed with well-fried green onion, garlic, mushrooms, spices and afterward fresh cream. Cut the sea cucumber into small pieces, add to the sauce, and cook and stir over a low heat for 5 minutes until softened.

#### Marinated sea cucumber salad (Fig. 2B)

Cut sea cucumber into very small pieces and add a half a teaspoon of salt, and a dash of black pepper to 45 ml of lemon juice, 3 tablespoons of vegetable oil, finely chopped parsley, small diced carrots, mustard, mushrooms, olives (cut into small pieces), leafy thyme, two cloves of minced garlic and red pepper. After mixing everything, store the marinated sea cucumber salad in the refrigerator (at 5°C).

#### Sea cucumber bourek (Fig. 2C)

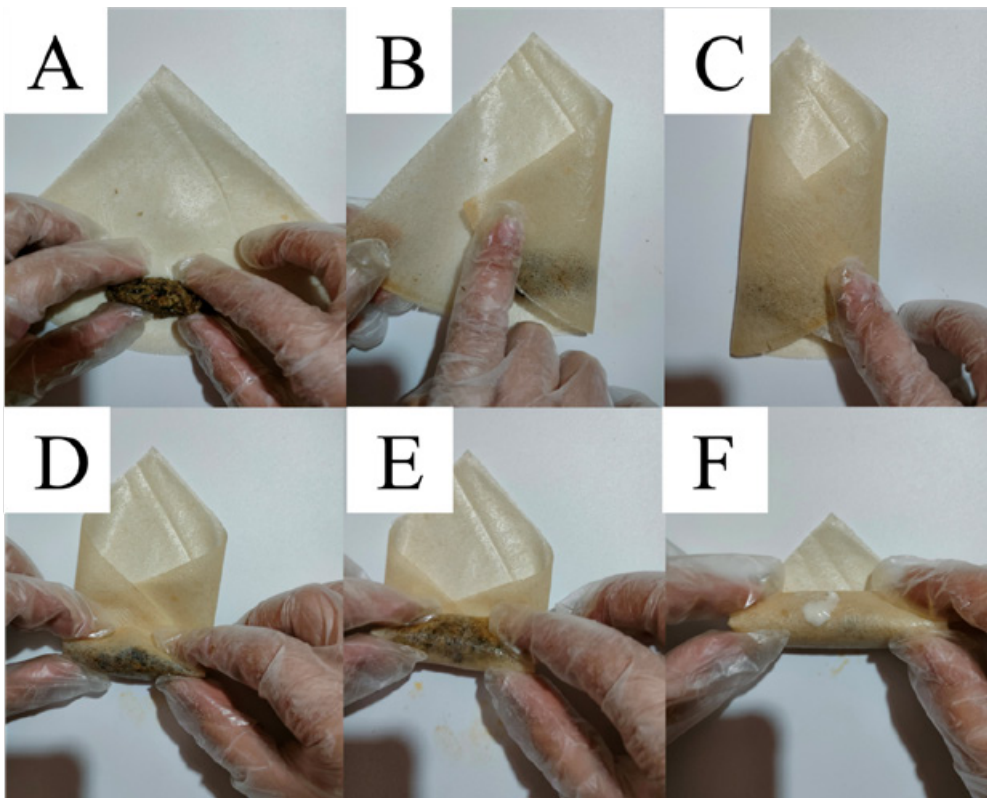
Bourek is a delicious Algerian festive meal starter served during the holy fasting month (Ramadhan) to accompany traditional chorba (soup). The name is Turkish and this starter is the signature dish in Algiers. It is usually prepared from the leaves of “dioule” or “brick” (very fine paste composed of wheat flour, cornstarch, water and salt) filled with minced meat, tuna, eggs, chicken or cheese. Our bourek replaced minced meat with chopped sea cucumber. A grated onion is cooked over low heat with a little vegetable oil. Once cooked, an egg with grated cheese is added. In the meantime, the integuments of sea cucumbers are cut into small pieces (3–4 cm), and then chopped using an electric chopper, adding spices (half a teaspoon of salt and black pepper, cumin, paprika and finely chopped parsley). After mixing



**Figure 1.** Steps to transform fresh sea cucumbers into dried product. A) cutting and cleaning; B) salting; C) cooking; D) integuments drained in a strainer; E) sun drying; F) final dried product beche-de-mer.



**Figure 2.** The dishes presented for the tasting survey: A) sea cucumber with white sauce and mushrooms; B) sea cucumber bourek; C) marinated sea cucumber salad; D) minced sea cucumber meatballs; and E) tasting plate of the four sea cucumber dishes and the questionnaire.



**Figure 3.** Preparation of sea cucumber bourek. A) Placing the stuffing on a leaf of dioule; B) closing the first side; C) closing the second side; D) rolling up the bourek; E) squeezing the bourek tightly; F) adding a small dip of cheese to glue the leaf of dioule.

the chopped sea cucumbers with the other ingredients, the stuffing was put inside the leaves of dioule (Fig. 3A) by squeezing well on both sides of the bourek (Fig. 3B and C) wound or into any desired shape (triangle, rolled) (Fig. 3D, E and F).

#### *Minced sea cucumber meatballs (Fig. 2D)*

Cut a sea cucumber into small pieces (about 3–4 cm), then chop finer using an electric chopper. A teaspoon of salt, black pepper, cumin, paprika and finely chopped parsley are added. The “meatballs” are then made in the palm of the hand. To prepare the tomato sauce, pour 3 tablespoons of vegetable oil in a pan and add a well-fried green onion. To this, add 2 cloves of pressed garlic and concentrated tomato paste with a grated tomato. The sauce is then stirred over low heat until thickened.

### *Tasting survey*

The tasting session was accompanied by a questionnaire that included: 1) information about the people who participated in the survey (e.g. their gender, age, origin, preferred seafood and whether they suffer from chronic diseases); 2) a visual assessment of the meal presented (i.e. appearance and similarity to other commonly consumed dishes, such as red or white meat or fish meals); 3) an assessment of each dish's smell; and 4) an assessment of each dish's taste and texture.

Another questionnaire was distributed, which included information about the four sea cucumber dishes, and the nutritional benefits of sea cucumbers in general. This questionnaire included: 1) a description of the four dishes; 2) a question about participants' willingness to introduce sea cucumber dishes into their eating habits; and 3) the type of product they would like to find in outlets (fresh animals or dried beche-de-mer).

## Results and discussion

Our survey was conducted on 42 people from three age groups under 18 years (5%), 18–35 years (62%) and over 35 years (33%) (Fig. 4A). A high percentage of respondents were women (74%) (Fig. 4A). The predominance of women is explained by the fact that they have the curiosity to discover, prepare and test new food products. Some 69% of respondents came from coastal municipalities, while the others (31%) came from inland areas (Fig. 4A). See Box 1 for the list of questions that were asked of participants.

Algerian gastronomy is very rich thanks to the different culinary cultures of its regions. Like pasta or rice, which are staple foods for Italians or Chinese, couscous is a symbol

of food identity for the peoples of the Maghreb countries and especially for the Algerians who prepare it according to different recipes, depending on the region (Chemache et al. 2018). Our results show that most respondents like seafood (93%) (Fig. 4A), but each person had their own particular preferences. Depending on their financial means, some people prefer mussels, others prefer cephalopods, shellfish and even fresh sea urchin gonads. Regarding the visual test, the prepared dishes looked very good to most (88%), 5% were uncertain and 7% said that the dish was not pleasant, especially for the first dish, which is soft in consistency (Fig. 4B and Fig. 2A). The smell of the dishes was considered to be quite pleasant by 69% of respondents but only moderately pleasant by others (31%) (Fig. 4B). The preferred dish was the sea cucumber bourek (32% of respondents; Fig. 2B), closely followed by the minced sea cucumber meatballs with tomato sauce (31% of respondents; Fig. 2D). People who chose those dishes were attracted by their presentation, which was comparable to dishes prepared with chicken or other minced meat. Other respondents thought it was a seafood blend. Generally, the sea cucumber bourek and the minced sea cucumber meatballs with tomato sauce were appetizing and easy to eat (39%), with a smooth texture (19%) (Fig. 4C).

The marinated sea cucumber salad was preferred by only 20% of respondents (Fig. 2C), while the sea cucumber with white sauce and mushrooms dish was even less popular at 17% (Fig. 2A) because they had a grainy (15%) or elastic (22%) texture, or were considered difficult to chew (4%) (Fig. 4C). About 93% of respondents found sea cucumbers easy to eat (chew), according to the results of the tasting. In addition, 43% of people recognised the ingredients of our four dishes but guessed that the seafood was crab, mollusc or squid. Indeed, according to an Italian chef, Mauro Colagreco<sup>2</sup>, the taste of sea cucumbers is close to that of squid (Gouillet de Rugy 2020). Most respondents (69%) said they would likely buy beche-de-mer if it was sold at the market (Fig. 4C). Perhaps because of the information provided about the health benefits of eating sea cucumbers, 83% of respondents reported being interested in our prepared meals (Fig. 4C).

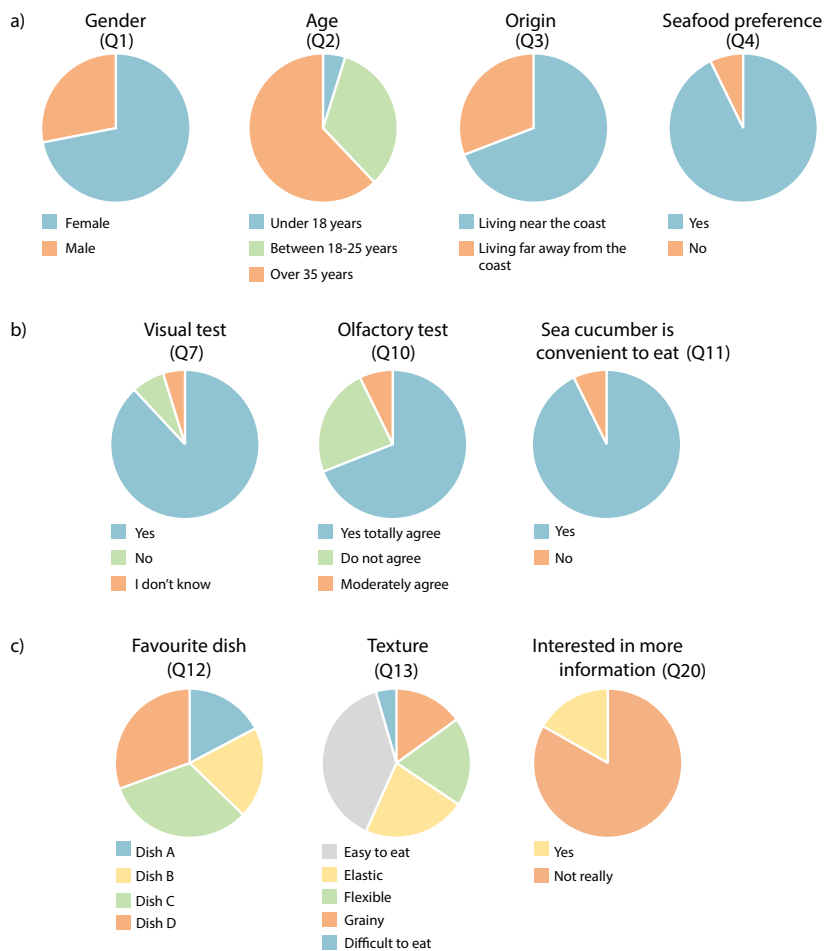
## Conclusion

The majority of people who attended the tasting survey liked seafood and claimed that our four sea cucumber-based dishes were very good (in appearance, smell and taste). The favourite dishes were the sea cucumber bourek and the minced sea cucumber meatballs with tomato sauce. Sea cucumbers in our dishes had a texture comparable to this of squid. The majority said they would be willing to buy beche-de-mer and include it in their meals.

<sup>2</sup> In 2019, Mauro Colagreco's restaurant Mirazur was elected “best restaurant in the world” by the World's 50 Best Restaurants (<https://www.theworlds-50best.com/>).

**BOX 1. Tasting questionnaire**

1. Are you: A man? A woman?
2. How old are you?
3. Where do you live?
4. Do you like seafood and seafood products?
5. What products do you usually eat?
6. Do you have a chronic disease? If yes which one(s)
7. Does this dish look good to you? (Visual test)
8. Do you recognise the ingredients?
9. What do you think it looks like?
10. Is the smell of the dish pleasant? (Olfactory test)
11. Did you find this dish convenient to eat?
12. Which is your favorite dish?
13. What do you think about the texture?
14. Did you recognise the ingredients?
15. Can you name them?
16. What do you like or dislike about these dishes?
17. Does this dish require the addition or removal of any ingredients?
18. If you found the product in the market; would you be willing to buy it?
19. Did you know that these dishes were sea cucumber dishes?
20. Would you be interested to know more about these sea cucumber recipes?
21. Would you be interested in another workshop?



**Figure 4.** Results of the tasting session questionnaire.

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