

(RESEARCH ARTICLE)



## Assessing healthcare professionals' knowledge of the therapeutic applications of marine products

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### Abstract

This cross-sectional study examines the therapeutic applications of marine products in Algeria and their impact on human health. Based on a survey of healthcare professionals, using a questionnaire validated by experts in pharmacognosy and pharmacology, the study gathered 130 responses in four months, mainly from pharmacists.

The results reveal a good knowledge of marine products among the majority of participants, but underline the need to reinforce expert training, improve education of healthcare professionals, raise public awareness, and put in place strict regulations to guarantee the quality and efficacy of these products in a therapeutic setting.

**Keywords:** Marine products; Applications; Survey; Healthcare professionals; Algeria

### 1. Introduction

The natural environment has always been a major source of biologically active molecules, and 60% of the anticancer drugs currently in use are derived from natural products. Trabectedin and bryostatin-1 demonstrate the importance of marine sources in cancer treatment [1,2].

Compounds extracted from marine organisms are often unique due to their particular chemical composition, influenced by seawater. For example, the halogenated terpenes found in some red algae have no equivalent on land [3].

Research into marine pharmacology only really began in the middle of the 20th century, marked by two major discoveries: cephalosporins, antibiotics isolated from the marine fungus *Cephalosporium acremonium* [3]; and arabinosides, isolated from the Caribbean sponge *Cryptotethya crypta*. Their synthetic analogues are ARA-A and ARA-C, and ARA-C is a powerful anticancer agent [4].

Seaweed has scientifically proven nutritional benefits [5], as it contains many essential compounds, such as dietary fiber, protein (50-70% of its dry weight in spirulina), polyunsaturated fatty acids, vitamins (F, B12, K1, B9, C, provitamin A, etc.), minerals (iodine, manganese, magnesium, calcium, iron, etc.) and antioxidants (polyphenols, carotenoids, etc.). [6].

These include spirulina [7], shark cartilage for osteoarthritis and joint pain [8] and alginate, which is used as a symptomatic treatment for gastro-esophageal reflux disease [9]. These products, rich in nutrients and health benefits, include krill for its rich omega-3 content, with well-documented cardiovascular benefits [10].

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The first investigations into benthic marine algae in Algeria date back to the 18th century. These include the work of Montagne (1838, 1846, 1848, 1856) in the Algiers region, and that of Debray (1893, 1897) and Seurat (1927, 1933) [11,12].

## 2. Materials and methods

This was a cross-sectional survey of a target population, using the following process:

### 2.1. Designing the questionnaire

- Literature search: This stage involved exploring scientific websites and search engines such as Google Scholar, Researchgate, PubMed, Vidal, ERIC, Microsoft Academic, Community Lib Guides, and Ref-Seek. Keywords used included: spirulina, nutritional value of algae, marine products, chlorella, algae toxicity, antioxidant and anti-inflammatory properties of algae, marine collagen, and sponge [13,14,15,16,17,18,19,20].
- Selection of publications: Relevant publications and scientific literature were selected, then a targeted questionnaire was drawn up and validated by a supervisor, a pharmacist specializing in pharmacognosy at the “Laboratoire de Matière Médicale”, Faculty of Pharmacy, University of Algiers-1.

### 2.2. Distribution of the questionnaire

The questionnaire was distributed in two ways: In hard copy, hand-delivered in the Algiers region.

Digital version via Google Forms, shared on social networks with the following link: <https://forms.gle/sPDj8BaWBwMB68bB6>.



### 2.3. Data processing

The data collected was initially processed and analyzed using Microsoft Excel (2019). A more in-depth statistical study will be considered depending on the quality and quantity of the data.

- Study period: December 19, 2023 to April 19, 2024 (4 months).
- Inclusion criteria: Healthcare professionals residing and practicing in Algeria, including pharmacists, physicians, nurses and traditional practitioners.
- Non-inclusion criteria: Any person not meeting the above-mentioned inclusion criteria.
- Exclusion criteria: Incomplete or incorrectly filled-in forms.
- Study biases: Biases can be summarized in two points:
  - The lack of a scientifically validated local bibliography on the same theme.
  - The almost total absence of experts in this field to act as reference points.

## 3. Results

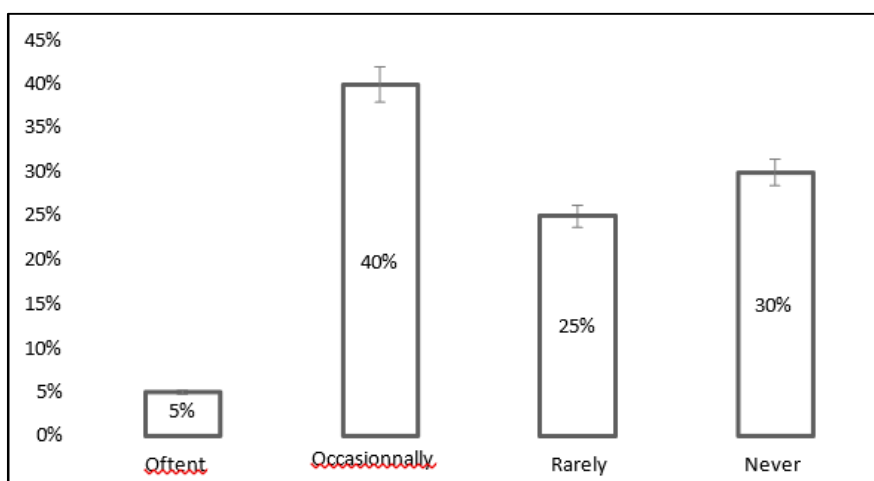
We collected 130 responses over a period of 120 days, i.e. a ratio of  $\approx 1.08$  responses/day.

**Table 1** Essential data on the profession and familiarity of healthcare professionals with marine products for therapeutic or human use

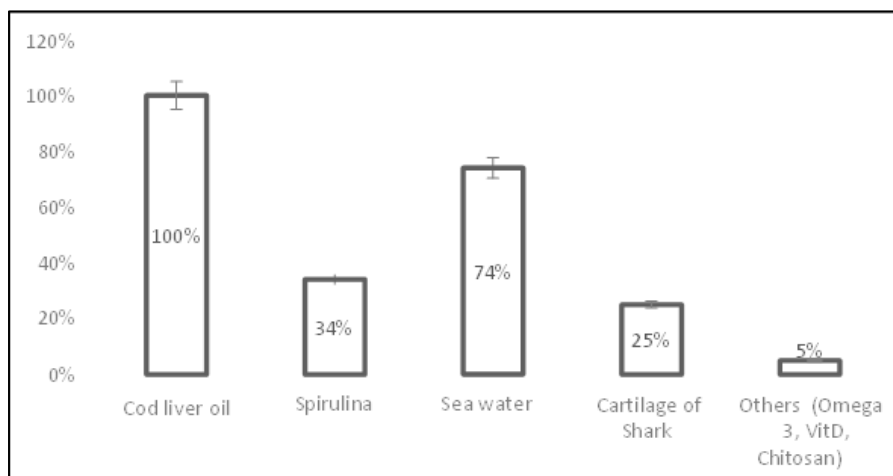
Healthcare Professionals (HP)	Number of Responses	
Pharmacist	90	69%
Doctors	18	14%
Other	22	17%

Professional experience	-	
< 5 years	106	82%
5 to 10 years	13	10%
> 10 years	11	8%
Familiarity with marine products for human use	-	
Yes	103	79%
No	27	21%
Awareness of the therapeutic applications of marine Products	-	

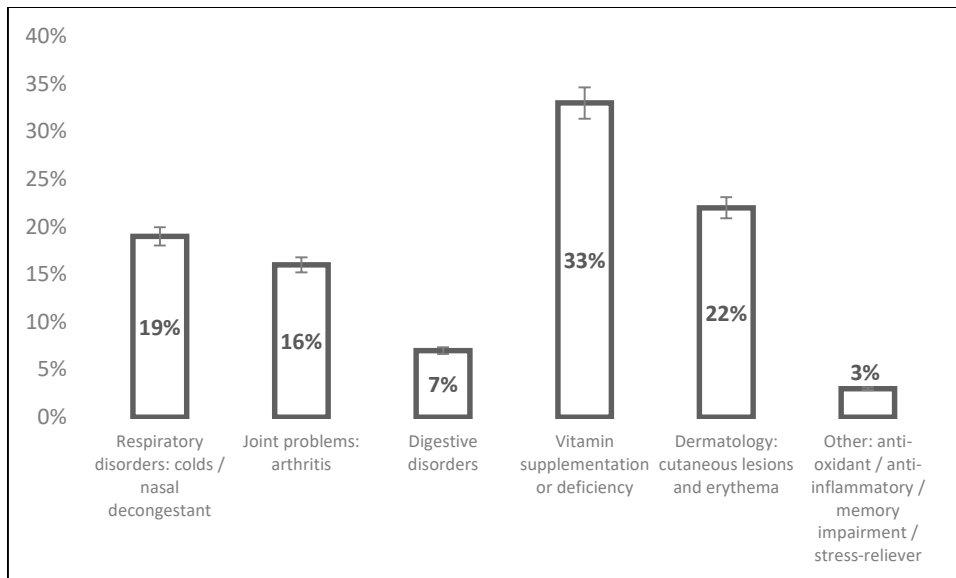
Other results are shown in the histogram above:



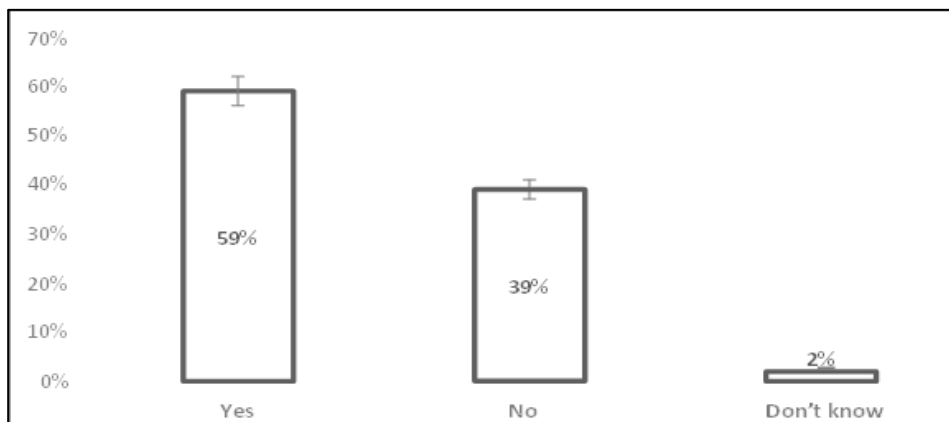
**Figure 1** Frequency with which HPs prescribe marine products



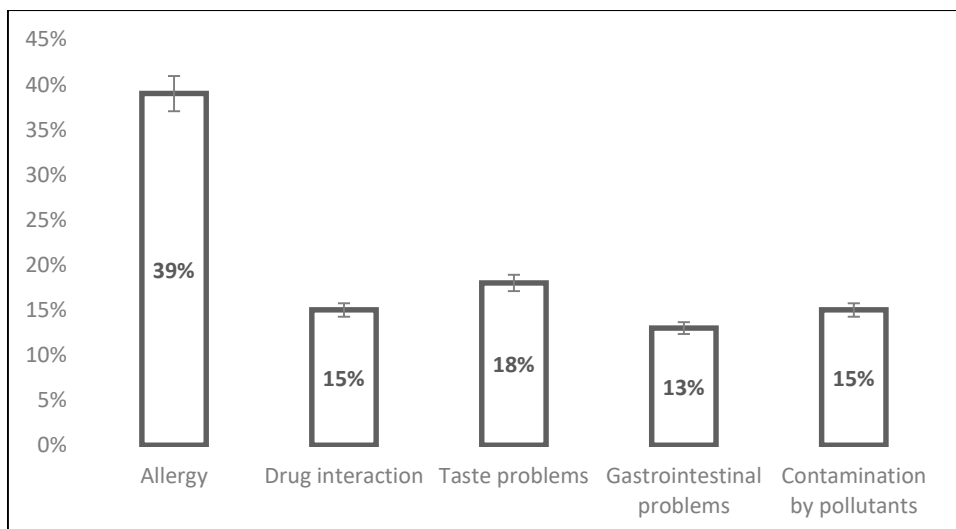
**Figure 2** Marine products prescribed or recommended by HPs



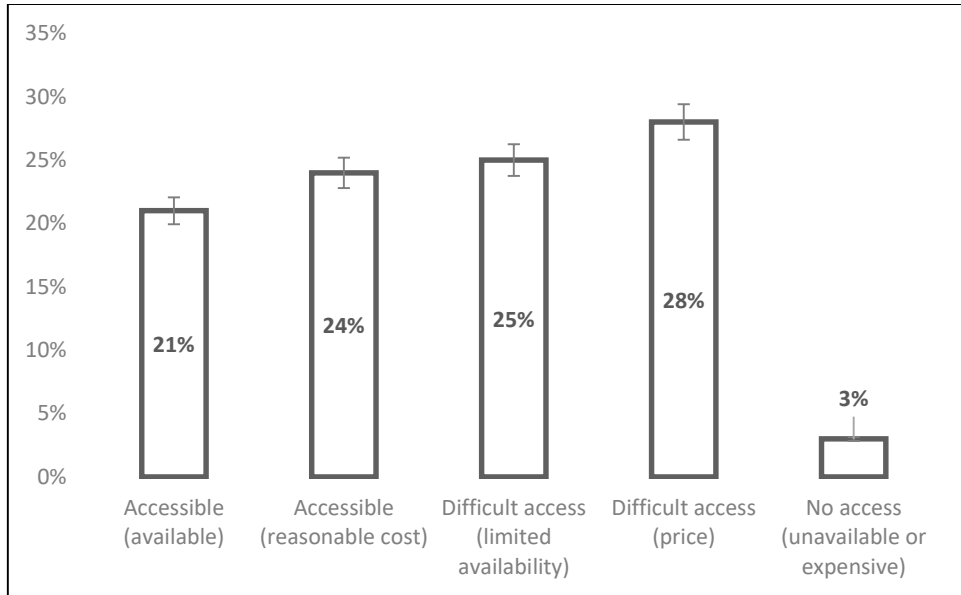
**Figure 3** Indications justifying prescriptions



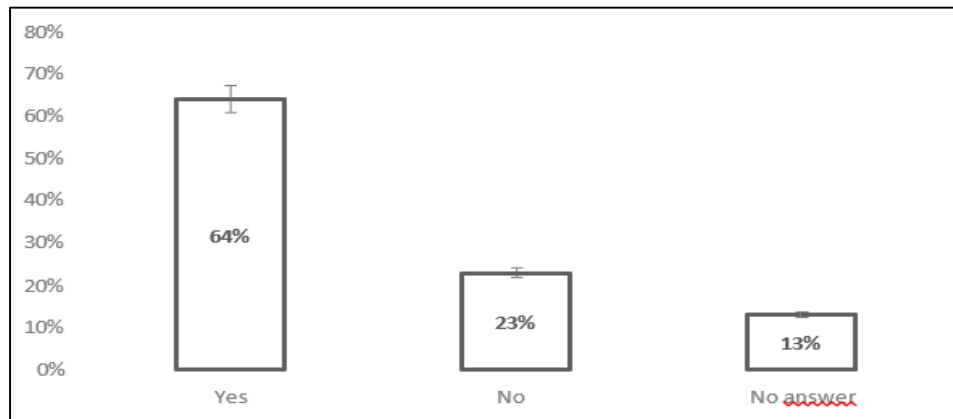
**Figure 4** Improvements seen in patients following the use of marine products



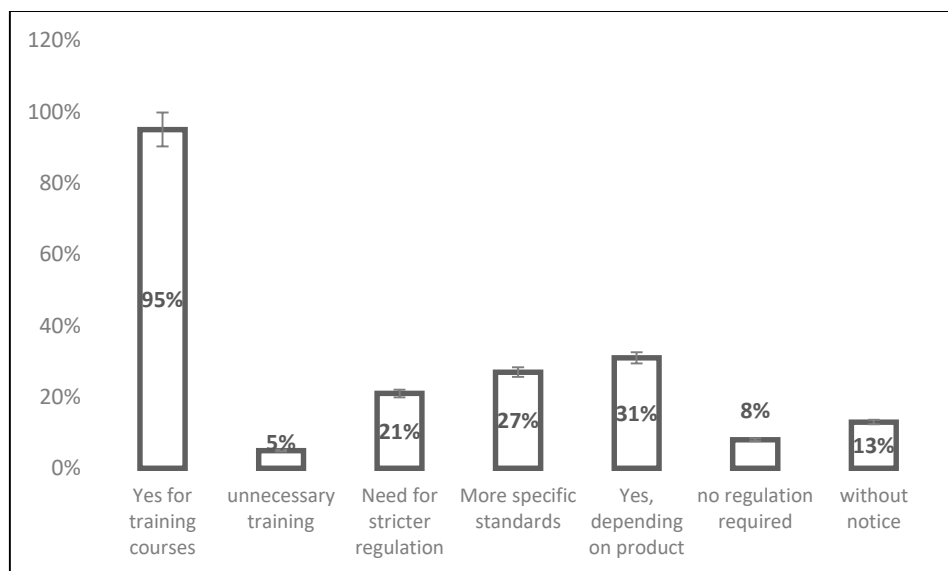
**Figure 5** Possible adverse effects of marine products cited by HPs



**Figure 6** Access to products based on availability – price



**Figure 7** Medical delegate visits (medical information)



**Figure 8** The need for training and regulations on these products

#### 4. Discussion

Medicines and dietary supplements based on marine products are attracting growing interest due to their potential health benefits. Despite this worldwide interest, it is crucial to assess their relevance, availability and acceptability in clinical practice in Algeria. In this survey, the majority of participants were pharmacists (69%), reflecting their role as primary interlocutors in this field. Although we sought to diversify our sample by including physicians and other healthcare professionals, the low participation of these groups raises questions about perceived differences in interest or familiarity with these products between different healthcare professions [21].

Some 82% of respondents have been practicing for less than 5 years, indicating a strong presence of young professionals in this practice. Participants' high level of familiarity with marine products, with 79% claiming to know them, testifies to a growing interest and recognition of these products in the health field. Among the products mentioned, spirulina, seawater, cod liver oil, alginate and shark cartilage were the most frequently mentioned, all of them being dietary supplements. On the other hand, very few respondents mentioned specific drugs, notably anti-cancer drugs such as vidarabine and cytarabine, derived from marine sponges [22].

Regarding the recommendation of these products for therapeutic use, a notable proportion of pharmacists (40%) recommend them occasionally, suggesting that they recognize their benefits while not routinely prescribing them. However, 30% of participants never recommended these products, which could be due to a lack of confidence in their efficacy, a lack of solid scientific evidence, or concerns about their safety and drug interactions. Only 5% of respondents recommend them frequently, indicating that a small minority are convinced of their therapeutic efficacy.

The most common indications for using these products are joint problems and vitamin deficiencies, followed by digestive and respiratory disorders. Some 59% of participants observed improvements following use of these products, demonstrating a generally positive perception of their efficacy. However, 39% expressed uncertainty about the benefits observed, reflecting doubt or lack of direct experience with these products. The remaining 2% observed no benefit, underlining the importance of taking inter-individual diversity into account when recommending these products.

Regarding adverse effects, the majority of participants reported allergies as the main side effect, followed by taste problems, drug interactions, contamination by pollutants, and digestive disorders. These observations highlight the need to carefully monitor patient reactions and consider potential risks when recommending these products [23].

Finally, an overwhelming majority of participants (95%) felt that there was a need for more information and training on the therapeutic applications of marine products, highlighting an urgent need for continuing education and teaching resources to better inform healthcare professionals on the benefits and risks associated with these products. In terms of safety and efficacy, the majority of respondents expressed moderate confidence, while a significant proportion remained undecided, probably due to a lack of knowledge about these products. The majority of pharmacists also

indicated that they were not in frequent contact with medical representatives presenting these dietary supplements, suggesting that promotion of these products remains limited in pharmacies.

The availability of marine products is perceived as low and their cost as high, with equal percentages. Regarding regulations, the majority of respondents expressed the need for stricter regulations, tailored to each product. A minority felt that these products, as dietary supplements, did not warrant increased regulation, reflecting a perception of their relative safety [24].

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## 5. Conclusion

This study has enabled us to gain a better understanding of the place of marine products in therapeutic practices in Algeria, revealing that their use is still limited and concentrated mainly on a few products such as seawater and cod liver oil. The main obstacles to their dissemination are a lack of regulations, insufficient training for healthcare professionals, and a lack of awareness among the general public.

To develop this sector, it is essential to improve the training of healthcare professionals in the use of marine products, increase public awareness, and strengthen the regulatory framework to ensure the quality and efficacy of these products. In addition, these products need to be made more economically accessible and integrated into hospital care as complementary therapies.

Finally, it would be worth exploring new fields of application for marine molecules, such as cosmetology, phytotherapy and functional food, where their nutritive and antioxidant properties could contribute to the prevention of public health problems.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors and all co-authors declare that they have no conflicts of interest in connection with this document.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study

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## Appendix

### Questionnaire addressed to healthcare personnel and relatives.

#### Assessment of Algerian healthcare professionals' knowledge of the therapeutic applications of marine products

Dear Healthcare Professional,

The aim of this survey is to gather data on the knowledge, experiences and opinions of healthcare professionals, in order to deepen our understanding of the trends, challenges and opportunities associated with the use of marine-derived products in healthcare. We sincerely thank you for taking the time to participate in this survey.

1. What do you do for a living?
  - Pharmacist
  - Doctor
  - Nurse
  - Other :
2. How long have you been in the profession?
  - Less than 5 years
  - Between 5 and 10 years
  - Over 10 years
3. Are you familiar with seafood products for human health?
  - Yes
  - No
4. If so, please name a few:
5. Are you aware of the therapeutic applications of marine products in the field of human health?
  - Yes
  - No
6. Have you prescribed or recommended marine-based food supplements to your patients for therapeutic reasons?
  - Often
  - Occasionally
  - Rarely
  - Never
7. For which indication(s) is (are) this type of product generally recommended? (One or more answers are possible).
  - Respiratory disorders / allergies
  - Joint
  - Digestive disorders
  - Vitamin supplements or deficiencies
  - Other :
8. What type(s) of marine products would you recommend to your patients? (One or more answers are possible).
  - Cod liver oil
  - Spirulina
  - Sea water
  - Shark cartilage
  - Other :
9. Have you observed any improvements or beneficial effects in your patients following the use of marine products?
  - Yes
  - No
  - Don't know
10. What are your main concerns regarding the use of marine products for therapeutic purposes? (One or more answers are possible)
  - Allergy
  - Drug interaction
  - Taste problems
  - Contamination by pollutants
  - Gastrointestinal problems
  - Other
11. Do you feel that more information or training is needed on the therapeutic applications of marine products?
  - Yes
  - No
12. In terms of safety and efficacy, how confident are you in the quality of human health marine products available on the market?
  - High confidence
  - Moderate confidence
  - Limited trust
  - No confidence
  - Don't know / can't evaluate
13. Do you think there should be (stricter) regulations or specific standards for marine products intended for therapeutic applications? (One or more answers are possible)
  - No; the nature of these products does not require specific regulations or standards.
  - Yes; stricter regulations are needed
  - Yes; more specific standards are needed
  - Yes, but it depends on the product (some may require closer monitoring than others).
  - Don't know
14. As a health professional, do you frequently meet medical representatives who present dietary supplements based on marine products?
  - Yes
  - No
15. Based on availability and price, how would you rate the Algerian patient's access to these products? (One or more answers are possible)
  - Easy access (available)
  - Easy access (reasonable price)
  - Difficult access (limited availability)
  - Difficult access (too expensive)
  - No access (unavailable or expensive)

