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Culinary Concept

The use of the sea fennel as a new spice-colorant in culinary preparations

Massimiliano Renna*, Maria Gonnella

Institute of Sciences of Food Production, CNR—National Research Council of Italy, Via G. Amendola, 122/O – 70126 Bari, Italy

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Abstract

The sea fennel (*Crithmum maritimum* L.) is a wild plant from the same family of the parsley and celery, that is used as a fresh ingredient for many food preparations. In this work, some alternative culinary uses for this aromatic plant as a dried ingredient have been proposed. Therefore, two drying technologies were applied with the aim to obtain a new spice-colorant without chemical synthesis. The results are discussed in terms of visual quality, odor and taste of the dehydrated products. Moreover, the effects on the overall sensory properties of some dishes prepared using the two different types of this new spice are reported. The introduction of the dried sea fennel in gastronomy could increase the sensory appeal of some traditional dishes and support the creation of many new recipes.

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Keywords: Wild plant; *Crithmum maritimum* L.; Dried product; Overall sensory quality; Cuisine applications

Introduction

Simply wild plants or forgotten resources?

The Italian flora is very rich and account for over 50% of the 12,500 plant species found in Europe (Blasi et al., 2005). About 2500 wild species are recorded in Apulia region (Southern Italy) (Fig. 1) and over 500 among them may be consumed as food (Bianco et al., 2009). In the past our ancestors have usually gathered and eaten wild plants, but at the present also the most expert farmers know and utilize only few species. Fortunately, a recent interest on wild species is increasing both for the greater attention toward a healthy diet and for the higher needs to restore a link with nature and with old gastronomic traditions (Łuczaj et al., in press). In this context, the sea fennel (*Crithmum maritimum* L.) may be one of the most appealing ingredients with the aim to obtain new food products made from wild plant

of the Apulia region. The sea fennel is a facultative halophyte also known as crest marine, marine fennel, sampier and rock samphire (Fig. 2). This aromatic plant is from the same family (*Apiaceae*) of the parsley and celery but grows wild on maritime rocks, piers, breakwaters and sandy beaches along Mediterranean and Black sea coast, as well as along the Atlantic coast of Portugal, South and South-West England, Wales and Southern Ireland. It is traditionally used in many countries as edible vegetable with interesting sensory attributes. These attributes include a slightly salty taste and some notes of celery, followed from light notes of common fennel and peel of green citrus with a pungency aftertaste. Sea fennel has existing culinary uses in many European countries. The leaves are washed, cut into small pieces and prepared for salads that are served with a dressing of mixed juice and olive oil (Bianco et al., 2009). In British Isles as well as in Southern Italy the leaves are kept like capers in vinegar (Region of Puglia, 2010; Atia et al., 2011). The fresh leaves can also be used to prepare soups and sauces or seasoning especially for fish based dishes.

A possible functional food

Apart from the use as a gastronomic ingredient, the sea fennel has been largely used for nutritional and medicinal

*Corresponding author. Tel.: +39 080 5929306; fax: +39 080 5929374.

E-mail address: massimiliano.renna@ispa.cnr.it (M. Renna).

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Fig. 1. Map of Italy with highlighted Apulia region.



Fig. 2. Sea fennel in the wild.

purposes. It was consumed in the traditional diet of the first European farmers as a potent source of minerals, vitamin C and other bio molecules. *C. maritimum* L. is also used in folk medicine as appetizer, tonic, carminative and diuretic (Cornara et al., 2009). As reported by Cunsolo et al. (1993), the sea fennel was used by sailors during food preparation to protection against scurvy. In Italy, the infusion of shoots harvested before the fructification were used against inflammations of the urinary tract and prostate (Atia et al., 2011). Moreover, sea fennel shows tonic and purgative action while the infusion of leaves has been largely used for the digestive diseases and for renal therapy (Cunsolo et al., 1993; Guil-Guerrero and Rodriguez-Garcia, 1999). Some authors also reported that *C. maritimum* L. extract exhibited high phenol content, radical scavenging activity, and antimicrobial properties against a large panel of human pathogenic bacteria (Rossi et al., 2007;

Meot-Duros et al., 2008, 2010; Meot-Duros and Magné, 2009). Furthermore, the oils extracted from leaves contain high concentrations of fatty acids of the ω -3 and ω -6 series. These fatty acids notoriously play an important role in modulating human metabolism and show beneficial effects against coronary heart diseases (Guil-Guerrero and Rodriguez-Garcia, 1999). Moreover, sea fennel is rich in volatile compounds as sabinene, γ -terpinene, thymol methyl ether, dillapiol, α -pinen, p-cymol, apiole, *cis*- β -ocimene and terpinen-4-ol (Pateira et al., 1999); it also contains different water-soluble compounds as sugars, organic acids and many minerals (Atia et al., 2011).

Toward the gastronomic evolution of the sea fennel

Generally, the aromatic plants are used in gastronomy as a spice due to their aromas (i.e. thyme, sage, rosemary) and/or color (i.e. saffron, paprika), attributable to chemical compounds. In some cases, different parts of the aromatic plants are subjected to a drying process before the use (i.e. black pepper, cinnamon, nutmeg, oregano). Therefore, the food industry has developed a great market for the dried spices, proposed as a single ingredient or mixtures (i.e. curry powder, chili powder). On the other hand for some aromatic compounds also chemical synthesis is applied to produce them (i.e. vanillin). However, the natural products derived from plants show a greater appeal for consumers and chefs. As a consequence, the introduction of new spices and natural colorants from plants could stimulate new opportunities for gastronomy. Currently, there is no market demand for a dried spice made from sea fennel and there are no culinary experiences with this type of dried product. For these reasons and considering the interesting properties of the sea fennel, the aims of this study were: (i) to apply two different drying technologies for obtaining a spice, starting from fresh leaves of this plant; (ii) to evaluate the effects of these different technologies on the sensorial quality of the spice; and (iii) to assess some potential applications of this spice on different gastronomic preparations.

The more general goal was to create a new and appealing spice for potential users and also to favor the gastronomic experimentation through the use of an alternative and natural ingredient.

Material and methods

Material

The aerial part of the sea fennel (*C. maritimum* L.) was randomly collected from many plants along the shoreline in Monopoli (Bari, Italy). Then, the plant material was immediately transferred to the postharvest laboratory of the Institute of Sciences of Food Production – National Research Council of Italy – and was subsequently cleaned and separated into “edible” and “refuse portion” categories. The latter generally consisting in the older leaves and fibrous stems that are removed during normal food preparation. Edible leaves were mixed and stored at 4.0 ± 0.5 °C until the time of processing.

Spice processing

The spice production from the sea fennel was carried out using two different processes. A first method was carried out through the use of hot air. Fresh leaves were dried until constant weight in a forced-draft oven at 65 °C. This temperature was used as selected from our previous studies. Drying at lower temperature was not possible because the long time needed to remove moisture favoured alterations by microorganisms. A second method was carried out by freeze-drying of the fresh leaves. Therefore, the sea fennel was first frozen, in order to allow the subsequent dehydration of the frozen product by sublimation. Highlights points of this drying technology are the low temperatures, reduced air pressure and absence of liquid water in food during the dehydration. Anyway, for both freeze-drying and hot-air drying, the dehydrated product was ground until a powder was obtained. After processing, the spice was packed in glass jars closed with an air-tight cap and stored in refrigerated conditions without light. These conditions were applied to prevent alterations in the sensory profile of the spice promoted by oxygen, light and elevated temperatures (Schweiggert et al., 2007).

Sensory evaluation

In order to determinate the quality, odor and taste of the dehydrated products and also overall sensory properties of some dishes prepared using them, the evaluation was carried out essentially according to Renna et al. (2013), as it regards the training methodology. Thus, a select group of assessors previously involved as members of trained descriptive analysis for herbs, spices and spiced foods, was trained to describe the attributes of the sea fennel. Particularly, in this work a variety of sea fennel samples were presented to the panel group and discussion were conducted from the panel leader during the training sessions. This, in order to develop along with the panelists a list of descriptor attributes. The evaluation sessions were held in the laboratory at the Institute of Sciences of Food Production. All samples, both the spices and dishes, were presented to the panelists at room temperature under normal lighting conditions.

Results and discussion

Sensorial quality of the spice

Differences between drying methods were found. Samples obtained through freeze-drying were characterized by a color that resembled the color of fresh sea fennel leaves. On the contrary, the product dried by hot air resulted in a darker green color when compared to freeze-dried samples (Fig. 3). In agreement with the data reported by some authors (Ibrahim et al., 1997; Díaz-Maroto et al., 2003) on different aromatic vegetables, the darkening of the color in hot-air dried sample could be due high temperature during dehydration. Regarding the odor, the freeze-dried product revealed aromas of fresh herbs, while tobacco and earthy notes are perceived in

the spice dried by hot air. As for taste, the freeze-dried product showed an initial note of herbs and freshness that turned into a celery flavor with a hint of salt. While, the hot-air dried product showed a lower herbs flavor and was considerably more salty. Moreover, it was possible to perceive a slightly spicy taste and a bitter aftertaste followed by notes of tobacco. Regarding odor and taste, the attributes of aromatic herbs perceived in the freeze-dried sea fennel may be attributable to the favorable conditions of this type of dehydration. In fact, the low temperature and poor oxygen presence during freeze-drying could preserve the native compounds of the fresh plant. On the other hand, the various aromatic notes in the hot air-dried spice could be the result of the possible conversion reactions of essential oils (i.e. terpenoids) due to heat and higher presence of oxygen (Turek and Stintzing, 2012). This conversion may be responsible of the spicy taste in the hot air-dried product.

Cuisine applications

Using the two types of dried sea fennel alternately could cover a broad range of applications in food. The visual effect may prevail in some cases due to the colorant action, while peculiar flavor characteristics are well perceived in other cases. So, some of the culinary preparations that is possible to realize through these new dried products are represented by following examples:

- Green *tagliatelle* in *marinara* style: this recipe highlights the coloring effect of the freeze-dried sea fennel on food in which is added. However, the aftertaste of the spice-colorant inside pasta is perfectly blended with the flavor coming from sauce of langoustine, mussels and squid (Fig. 4).
- Spiced “dome” on puree of apple and purple carrot: in this case the spice predominantly gives a flavor between saffron and sweet curry to the rice, while the coloring effect is very less important. The overall sensory perception of these spiced pilaf rice combines well with the bittersweet taste of the puree (Fig. 5).
- *Gourmet* beef in sea fennel dressing: the sensorial perceptions of this dish are complex but very intriguing and original. In this case the recipe requires, at the same time, the use of both products obtained through the different methods of drying. So, before the tasting, it is possible to enjoy the green color given to the sauce from the sea fennel. On the other hand, the interaction of flavors between the meatballs and the spiced sauce delivers an intensive feeling in the mouth. Moreover, the lingering aftertaste and aromas make this a very tasty dish (Fig. 6).

Conclusions

A new spice-colorant can be obtained from fresh leaves of sea fennel through two different drying processes. This dehydrated product is a very interesting ingredient that produces many different aromas, as well as a special visual impact during tasting.



Fig. 3. Powder of sea fennel: freeze-dried (left); dried by hot air (right).



Fig. 4. Green tagliatelle (pasta with sea fennel) in marinara style (sauce with langoustine, mussels and squid).



Fig. 6. Gourmet beef (Italian style meatballs) in sea fennel dressing.



Fig. 5. Spiced “dome” (pilaf rice cooked with sea fennel) on puree of apple and purple carrot.

In this context, the freeze-dried product gives a green color (more or less intense depending on the used amount) to food to which is added. Therefore, the choice between the two products (freeze-dried or dried by hot air) in the culinary preparations must consider not only taste and odor, but also the overall sensory traits, including the final color of the dish. In all cases, the use of this aromatic plant as a spice in gastronomy could increase the sensory appeal of some traditional dishes or enable the creation of many new recipes.

Nevertheless, this work represents only a first investigation about the potential drying process of a spice from sea fennel and its possible culinary use. Therefore, further aims would be to optimize the drying process (i.e. different temperatures of the air in a forced draft oven) and/or to apply other ones (i.e. microwave and/or combined techniques). Finally, a possible next goal could be the assessment about what happens with the nutritional and medicinal sea fennel components following the dehydration.

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