



On the alchemy of cooking with ashes: an exploratory review on global practices and a Portuguese perspective provided by cookbooks and vernacular cuisine



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Abstract

The article explores a world-wide selection of historical recipes and dishes that highlight the culinary versatility of ashes application, the nutritional and flavor value, stressing their role in transforming, preserving, and enhancing food products across cultures and over different time periods. A particular analysis is then made regarding the culinary use of ashes in the Portuguese context, through a cookbook analysis as well as vernacular cuisine' procedures identification. Ashes have been employed by various cultures for millennia. Among other social functions, ashes are a circular, versatile technological advancement tool for transforming and preserving food products, either in vernacular or haute cuisine. They ease the effort of preparing food, reducing cooking time and enhancing flavors. In haute cuisine, ashes are used with the purpose of creating novelty, improving aesthetics, and expressing creativity. A comprehensive analysis on ashes' functions have been performed, aiming at presenting an analysis framework. The search has been performed through a thorough bibliographic analysis of ashes in culinary practices.

Keywords: Traditional cooking; Lime; Lye; Cooking techniques; Portuguese traditional cuisine

Introduction

The use of ashes by humans has always depicted interest due to its many significances and circular applications, namely due to its connotation and interconnections with renewal and rebirth. Ashes, as a termination point of a burned material, would either retain a symbolic and/or religious significance, associated or not with rites of passage but also as a medicine, as an insect repellent, as a stain remover on clothes, among many others. Its usage is culturally determined and geographically differentiated. However, ashes have been extensively incorporated in culinary processes throughout the world and for centuries, namely as a transformative technological resource that would either modify or change the texture and the final appearance of a dish's components. Ashes have been used in culinary both as a heat source, when hot, allowing slow cooking processes over ashes and ember, but also, which we tried to focus, the use of ashes as an ingredient itself, by integrating ashes as a part of the dish or delicacy. This introduction of ashes has been made to ease the consumption of food products, with the immediate cases arising

from Mesoamerican nixtamalization procedures or from the ancient preparation methods of noodles, where alkali, ash-based water was used to provide attractive rheological properties to the final product.

The technological evolution of culinary techniques and the improvement of raw materials utilization have always resulted from the need, mostly from the physiological need, from hunger [1]. Currently, many concerns are rising to a safer, more transparent way of using culinary products, being the reason ashes are being converted to more stable, alkaline-wise products, such as lye water. In Portugal, ashes have been thoroughly used over many centuries, on many everyday aspects and on the preparation of food products, including at the Michelin-star restaurants. In our research, we have tried to bridge a gap in literature regarding the culinary uses of ashes, not only in the case of Portugal, our research object, but as a systematized and structured work on the topic. In this article we aim to answer to the following research question "What are the historical and contemporary culinary

processes and recipes that uses ashes and how has their usage evolved in the context of historical cookbooks, vernacular cuisine and haute cuisine?".

Theoretical background

Hunger is understood as one of the reasons for culinary technique evolution and culinary technological adaptations [1]. Those techniques are developed to either preserve or transform food products so that the effects of time would not pose a barrier to food edibility [2], but also to allow taste improvements, efficiency in the culinary preparation and to tackle digestibility concerns, as seen below. In its evolution, cuisine has met, according to Jack Goody, a British anthropologist, a binomial evolution. On one hand, low, popular cuisine, practiced by low-income classes, was characterized by the generational culinary knowledge transmission on an oral basis, according with customs and the final cooked product reached based on imitation, whereas on the other hand, an elitist cuisine, practiced for elites and soon performed by public cooks (chefs) was characterized by its structured composition and cosmopolitanism based on the written transmission of knowledge, allowing home techniques to be monetized and sold to a not less elitist public. Each of the ways had its own path. The first very dedicated to subsistence while the latter specially turned for socialization through exceptional, high-standard techniques and food [2,3]. Even though the cooking techniques are sometimes the same as the ones practiced in the household environment, those get slightly ameliorated to a more creative and distinctive goal: to impress guests [4]. This is important to denote as the uses of ashes faced two-fold ways, both in terms of household items culinary preparations and in luxurious, exquisite high-cuisine environments in order to delight the customer with culinary technique.

Although the ethnographical work "Codex Florentino" (1570) by friar Bernardino de Sahagún (1499-1590) spread the information on the use of ashes in corn processing in the Mesoamerican cultures [5], ashes were already in use for centuries as a technological advancement in several parts of the world. This was the case during the Roman empire in which ashes were used in white wine clarification, something that has been considered as quite common [6]. Also, evidence points out to the baking of a specific type of bread, known in Portuguese as "pão de soborralho" (bread over ashes) or "fogaça" (bread), a bread directly baked under the heat of remaining ashes would already be known before the appearance of ceramics [7]. By accepting this thesis, we could frame the use of ashes in the ancient forms of baking some millennia ago.

Concept of ashes, vegetable ashes and ashes substitutes

Ashes are the "non-volatile products and residues that remain after a combustion process" [8], which "consists mainly of minerals in oxidized form" [9]. Besides the culinary use, ashes have also been used by humans for a wide range of purposes, such as in

human healing or treatment [10,11] in religious and magic rituals [10,12], in wastewater treatment [13], in construction products [14], as an insect repellent [15], as an agricultural fertilizer [16] clothes treatment [17], or also in the production of soap [18,19], just to cite some examples.

Ashes are rich in soluble salts, mostly the vegetable ashes coming from the burning of *Zea mays* L., *Hygrophila auriculata* L., *Carica papaya* L., *Sorghum bicolor* L. and *Ficus carica* L. ashes are mostly composed of sodium, potassium, magnesium, calcium, chromium, manganese, iron, nickel, copper, zinc, cadmium, lead, and mercury ions [10,20] The chemical composition of ashes differs due to variations in the burnt materials, leading to differences in the end results and thus its adaptation to different culinary uses.

Technologically, ashes are sometimes substituted by limestone, quicklime, and lye, even for cooking purposes. Limestone refers to calcium carbonate CaCO_3 (s) and is not soluble in water, quicklime refers to calcium oxide CaO (s) and is obtained by heating calcium carbonate – carbon dioxide (CO_2 (g)) is also released [21]. When calcium oxide is added to water calcium hydroxide (Ca(OH)_2 (s)) is formed [22]. Calcium hydroxide is marginally soluble in water, but it is more alkaline than a potassium carbonate or sodium carbonate solutions. Lye (sodium hydroxide NaOH) can be obtained from calcium oxide and sodium carbonate. The result gives rise to sodium hydroxide and calcium carbonate: while sodium hydroxide is more alkaline than calcium carbonate, when reacted together they produce a stronger alkali than either of the two separately. Calcium oxide is often used when large quantities of a strong but inexpensive base is required [23].

Methodology

As this paper endeavours to explore the multifaceted and diverse applications of ashes, the incorporation of comprehensive and diverse documental sources becomes paramount in attaining its objectives to understand the use of ashes in cooking world-wide, focusing later on the Portuguese scenario displayed both in cookbooks as in the vernacular cuisine. In this regard, an extensive bibliographic analysis and review has been conducted, departing from Google Scholar database, in the period March-April 2023. The researched keywords and expressions (and also the Booleans used) were: "culinary use of ashes", "ashes"+"culinary", "ashes"+"food". This research comprehended the investigation and the synthesis of existing literature pertaining to the culinary utilization of ashes. The inclusion of grey literature in this study has been decided acknowledging its significance in transmitting invaluable insights from everyday practices and traditions that are not always communicated in a scientific way [24].

Besides, the historical significance of ashes usage in Portuguese culinary was also sought. In this regard, four classic Portuguese cookbooks have been selected to understand the use of ashes in their recipes. The criteria to choose the cookbooks

resided on the high-distribution, high-reconnaissance of those cookbooks, and besides the centurial representativeness was also a reason to choose the sources. With this criteria in mind, the books that have been selected were “Livro de Cozinha da Infanta D. Maria de Portugal” (15th-16th century, no exact date) [25], “Arte da Cozinha” (by Domingos Rodrigues [1637-1719] and the first printed Portuguese cookbook, published for the first time in the 17th century in 1680) [26], “Cozinheiro Moderno ou Nova Arte da Cozinha” by Lucas Rigaud published in the 18th century (1780) and the book “Thesouro do Cosinheiro, Confeiteiro e Copeiro” published by the widow of Jacinto da Silva [27] in the 19th century. A participant observation approach was also included. By incorporating both established academic sources and more elusive yet culturally significant materials, this research aims to provide a holistic and nuanced understanding of the widespread and eclectic use of ashes in various contexts.

Results

Culinary use of ashes

The versatility and the alkali properties of ash got widespread in food products and evenly contributed to the creation of food additives and products. From here, it is important to differentiate the cooking process that happens over ashes (used, for instance, in the case of the Moroccan Tanjia dish (International Information and Networking Centre for Intangible Culture, 2019)) or the actual use of ashes within the cooking processes. In this article we focus on the latter. Ashes, namely those resulting from wood or vegetable matter burning, have been used in popular cooking as a technological advancement in three main ways: either 1) on the transformation of food products, but also 2) to preserve (or help preserving) food products and finally 3) to simplify the cooking process. The use of ashes in haute cuisine is explored. Finally, the Portuguese findings are presented.

Ashes on the transformation of food products

On the first dimension –transformation of food products – ashes have been used in the preparation of cereals, pulses, fish, lichens, noodles, baked goods, fruits and vegetables, but also in other subproducts such as salts, to be used during cooking processes. One of the classiest examples and direct use of ashes to transform food is well-known in alkaline corn preparation in ancient Mesoamerican civilizations. Traditional nixtamalization consisted of boiling corn in an alkaline solution composed of volcanic ashes and water, being lime (calcium hydroxide) also used for the same purpose [28]. This process would soften up its skin (pericarp), being the reason behind this technological exploration, as it foremostly happens, by Mesoamerican woman [2]. Besides, nixtamalization also develops additional aromas and flavor [29,30]. While performing changes in the corn structure, this technique would also release lysine, tryptophan and niacin (vitamin B3) allowing the consequent absorption by the human

body, also benefiting its digestibility [5, 30-34]. Nixtamalization could also be applied to pulses and other cereals such as sorghum and chickpeas [35].

Ashes have also been historically associated with transformation of fish. In the Lutefisk - a Christmas fish dish from Norway, Sweden and a part of Finland - is traditionally transformed and prepared with an infusion of burned broad-leaf trees wood ashes or birch-wood ashes in water, an alkaline water, in which fish was traditionally soaked and cured [31,36,37]. Today ash water is substituted by mixing quicklime and lye in water [37]. Other direct applications of wood ashes in food products' transformation include the Icelandic moss, which used to be soaked in ash water before consumption to enhance its digestibility and the Nigerian use of wood ash for cooking legumes to reduce the amount of cooking time or even to produce akanwu, limestone (sodium carbonate) that will be used, as well as wood ash in the cooking of local dishes, such as soup, cereals and also salad dressings [38].

The use of ashes has also been historically associated with doughs and baking processes. It is the situation of yellow noodles, also known as alkaline noodles, trace back to the 17th century to southeast China, from where it started its diffusion in the Asiatic continent [39]. They owe their name to the chemical reactions allowed between the flour components and the alkali, traditionally made using decanted ash water [40]. Its modern substitute, kansui (or lye water), rich in soluble salts such as sodium hydroxide (NaOH) and potassium hydroxide (KOH), helps create a yellowish color in the noodles, while easing the kneading and dough works process. Kansui is used in noodles making [39]. The soluble salts resulting from the alkaline compounds allowed a more intense flavor and aroma while improving its texture [39-41].

Besides, the center-European pretzel was traditionally cooked in an alkali solution made from lye obtained from ashes, as this will habilitate starch degradation on the surface of pretzels and enhance oven-browning [31,42]. Pretzels' bath is today made either with food-grade sodium hydroxide tablets, which are easier for bakeries [43] or using lye water [40]. Also, regarding baked goods, ashes could be found in the traditional making of Greek Christmas honey cookies (“melomakarona”) [44]. Other example of ash usage in Greek cuisine is “moustalevria” (a wine must jelly sweet) [45], in which ashes are used to clarify the must. Ash water has also been described to transform properties on fruits and vegetables [40]. This was the case of the 19th century technique to remove unwanted sticky texture from unripe figs [46], to make orange blossom or lemon preserves and to remove whole-peaches skin to make preserves.

Finally, ashes have also been used to obtain food raw materials. It is the case of culinary salts obtained from vegetable ashes in Africa, wood would be burned to produce salts after ashes

lixiviation, namely in the pre-colonial era and before the mineral sodium chloride distribution [10].

Ashes on the preservation of food products

On the second dimension – preservation of food products – literature points out its usage as food preservatives due to their alkaline pH and antimicrobial properties [30]. Vegetable ashes have been used to preserve cheeses both in the inside (e.g., Morbier AOP cheese, France) and also on the outside (e.g., Valençay Frais Cendre AOP cheese, France), being gradually substituted by activated charcoal [30,47]. Ashes are also used in the preservation of eggs [48] and were used in the fermentation of duck eggs to obtain either xian dan (salted eggs) or pidan (the so-called thousand-year-old eggs), where buckwheat ash or chestnut wood ash would be traditionally used [39,49,50].

Meat curing and meat preservation also relied in ashes to preserve salumi [48] and some experimental work has been done in producing ash cured meats, such as duck meat [30,51]. In this situation, ashes allow both the transformation and preservation of food products. Finally, the use of ashes is also identified as a preservative in olives and a Roman technique to avoid spoilage [31,52], which was also present in the preservation of walnuts to allow the degradation of the outer skin [53].

Ashes as a culinary helper

The introduction of ashes in corn nixtamalization intends to “(...) softening the pericarp and endosperm and facilitating grinding” [35]. This finding is in line with the process of ashes addition (namely fig tree wood ashes) in the making of “milhos aferventados” dish, which comprises a corn nixtamalization process, in the Algarve (Portugal) [54]. Ashes would prevent corn nixtamalization from sticking to the pot as well as would ease the stirring process [55].

Use of ashes in haute cuisine

Differently from the usage of ashes in the popular cuisine, which techniques are learnt and generationally transmitted mostly by observation, haute cuisine works specifically to impress and delight its guests, while recoding and mobilizing some traditional practices with the usage of more advanced technologies [2,4]. Thus, to work on skills mastering and on aesthetical aspects is the quintessence of “high cuisine” [56]. Ashes started being used in the kitchen not as a matter of “incompetence in the kitchen” [57] but exactly on the other way around: as a sign of transformation of a traditional technique, and to introduce some creativity and drama to the restaurant experience (idem). This was the aforementioned duck meat case of Chef Andreas Rieger (from einsunternull restaurant) with his ash-coated duck.

It is challenging to chronologically frame the first use of ashes in the global haut-cuisine scene. However, one of the first records of ashes usage in haute cuisine dates back to 1997 when Chef Ferran Adrià at elBulli restaurant would serve its dishes of

charcoal-oil flavored lambs’ brains and the “vegetables on the grill” dish where charcoal-oil was also used [57]. Although this was an infusion, ashes resulting from combustion of vegetables gave the motto to a lot of different dishes coming up from several restaurants, establishing a trend that lasts until today.

From the most renowned ash users, NOMA, the three-Michelin stars Danish restaurant by the hand of Chef René Redzepi, would stand up due to their use of leeks ash. NOMA launched in the period before 2007 dishes such as “Norway king crab and ash-dusted leek” (and other variations), the “Hay-baked celeriac, hay ash, Bornholm wood ants, sturgeon caviar, sauce of last year’s fermented white asparagus and buttermilk” dish or the charred meringue and leeks coated in its ashes would be some of the more important usages of the technique [57]. Besides, they are also known for the “Cooked leeks and caramelized pork stock, ashes and hazelnut” dish.

Some other Chefs and places are known for their ash-containing dishes: Spanish Chef Andoni Luis Aduriz (from Mugaritz restaurant, Errenteria, Spain) developed a dish called “Charcoal, Ashes and a 64th Egg”, a “brined squid and ginger, garlic paste and a broth of burnt vegetables” and a “grilled toast of bone marrow with herbs and horseradish ash”. Years before, Chef Andoni presented at Madrid Fusión an ash-coated beef dish. Moreover, Chef Pascal Aussignac also produced (at Club Gascon restaurant, London, United Kingdom), a juniper ash-flavored olive oil for his dish “Confit line-caught cod with juniper ashes, butternut squash and liquorice sabayon”. Chef Juan Mari and Chef Elena Arzak (at Arzak restaurant, San Sebastián, Spain) took “seabass with leeks ash” to Madrid fusion in 2010. Chef Ronni Mortensen also produced at AOC (Copenhagen, Denmark) an ashes bread composed of hay, leeks, and onion ash. Chef Yoshihiro Narisawa (at Narisawa restaurant, Tokyo, Japan), produced two ash-based dishes called “Sumi” and “Sumi 2009”, mentioning the year of appearance of the dish on the menu. The dishes were composed of a steak coated in leeks “sumi”, an ash produced from charred vegetables or charcoal, and a deep-fried onion coated with charcoal and leeks ash, respectively [58].

The context of culinary use of ashes in Portugal

In Portugal, the utilization of ashes in food transformation processes is observed both in popular cooking preparations and in haute cuisine. The examination of written sources allowed us to understand that the word “decoada” seems to have been used for the first time in the 16th century [59]. In Portuguese sources, the use of ashes is generally described as “cenrada” (or “senrada”), “decoada,” or “barrela.” In this article, “cenrada” refers to the water that has boiled with ashes (the same as “decoada”), and “barrela” refers to water that is poured over a layer of ashes. These terms can be used in relation to the preparations made for dishwashing and bleaching clothes, respectively [60-62] also applying for the blanching treatment of linen thread and fabric [63].

Ashes in classic Portuguese cookbooks

Livro de Cozinha da Infanta D. Maria de Portugal

In an analysis of the most relevant literary work in Portugal, one of the earliest chronological written references to the use of ashes in Portuguese cuisine, including in noble households, is found in the culinary notes of Infanta D. Maria de Portugal (1538-1577). This work was published as “Livro de Cozinha da Infanta D. Maria de Portugal” is chronologically framed in between the 15th-16th century [25] and includes the treatment of fruits, particularly in recipes XLIII (“Receita para fazer pêssegos” [recipe to make peaches], p.93) and XLIV (“Para fazer limões” [to make lemons], p.95). In the first recipe, a preserve for whole peaches, the unripe fruit is submerged in water with ashes to remove the skin. Afterward, it should be washed in several waters and then cooked [25]. In the second recipe, a method for preserving lemons, the lemons will be cut in half without separating the two halves and placed in a “decoada” and then thoroughly washed and boiled in a 15-day long sugar simmering sugar syrup. The authors also refer a type of bread related to this cooking method, the “fogaças” - “balls of/or thin bread,” which has been “baked under ashes since the Middle Ages” (idem, p. XXVI).

Arte da Cozinha

In the book “Arte da Cozinha” by Domingos Rodrigues, a 17th century royal cook, considered the first cookbook in Portugal from the endings of the 17th century, the technique of “cenrada” is also mentioned as “água de cinza a ferver; barreira; senrada; decoada” (water of boiling ashes, “barreira”, lye water and water obtained from the ashes) [26] which technique is employed to remove the peaches and apricots’ exocarps. With the purpose of preserving them, the recipe “IX Pêssegos secos” initially instructs to “Limpos os pêssegos em uma senrada (...)” (“once the peaches are cleaned in a senrada (...)”) [26] the recipe instructs to place the fruit in a sugar syrup to initiate a process of crystallization and preservation (idem).

Cozinheiro Moderno ou Nova Arte da Cozinha

Published in 1780 by Lucas Rigaud, the book “Cozinheiro Moderno ou Nova Arte de Cozinha (...)”, mentions the culinary use of ashes in the recipe for “Receita para preparar azeitonas à moda francesa” (Recipe for preparing olives in the French style) and in the “Compota de amêndoas e damascos verdes” (Almonds and green apricots jam). In the first recipe, olives are soaked in water with ashes for at least twenty-four hours, allowing for their preservation and subsequent flavoring. Rigaud refers to this method as “À francesa” (the French way), as it originates from France, his country of origin (Rigaud, 2004, p. 286). In the compote of almonds and green apricots, the use of ashes is intended to remove the fruits’ skins.

Thesouro do Cosinheiro, Confeiteiro e Copeiro

One of the most noteworthy works that extensively report the

use of ashes is the “Thesouro do Cosinheiro, Confeiteiro e Copeiro (...)” book, which was released by the widow of Jacinto Silva [27]. In this book, several recipes that incorporate ashes are presented. Firstly, it provides instructions for olive preparation, specifically the “Receita para preparar azeitonas à moda Francesa” (recipe to prepare olives in French-style, p.9) and “Conserva de azeitonas” (olives preserve, p.176), both involving the use of ashes. Secondly, the book includes a charcuterie and egg-related recipes part. “Modo excelente para conservar os presuntos” (a good way to preserve hams, p.110) offers an excellent method for preserving hams by covering them with sieved vine ashes, after it is coated with vinegar, to ensure safe meat transportation. The process also includes “Conservação dos ovos em cal” (lime-preserved eggs p.11). Furthermore, the publication addresses the salvaging of food that is nearing spoilage. The recipe for “Restabelecimento da carne ou peixe que começa a apodrecer” (reestablishment of meat and fish that starts to get rotten, p.161) outlines a method for restoring meat or fish that is beginning to decay by cooking the protein with a sachet made of wood ashes [27]. Lastly, the work delves into the restoration of wine. The “Processo para tirar o azedume do vinho” (process to remove sourness from wine) outlines a method for removing sourness from wine using incandescent walnut ashes. Additionally, the “processo para conservar os vinagres” (process to preserve vinegars) involves the use of vegetable ashes to preserve vinegars (idem).

Vernacular and popular cuisine

In terms of vernacular cuisine, there is evidence of two nixtamalized corn dishes in Portugal, one in the Algarve and the other on the island of Madeira. The first one, known as “milhos aferventados” or “milhos de barreira”, is a dish primarily prepared by women and consumed in a region situated between Barrocal and Algarvian mountains, in the south region of Algarve [54,55, 64-67]. It consists of nixtamalized corn, which is then mixed, according to the specific area where it is consumed, with salted-cured meats, pork sausages, and other starchy ingredients such as potatoes, beans, or pasta. The advantage of nixtamalization, from the cook’s perspective, lies in removing undesired organoleptic properties from the final dish, such as the fibrous texture of the husk (pericarp) and the taste associated with tip cap (“olho preto”) [54]. According to our research, the process is conducted in order to ensure that the dish does not taste like straw, being considered one of the ways to measure the skills mastering by the cook [55,67,68]. Dias [69] identified this dish as the only using whole corn in the country referring to it as “milhos de barreira”. This is the oldest written reference to the dish, and the author mentions that the dish is “not very tasty”.

Also in Madeira Island, nixtamalization is employed to prepare “boiled” corn, which is used to make a traditional soup known as “Sopa de Milhos Escaldados” (scalded corn soup) [70,71]. Castilho frames the “Sopa de Milhos Escaldados” in the parish of Faial, municipality of Santana, on the island of Madeira [70] and its complete recipe can be found in the local ethnographic group [71]

and in the book “Sabores: receitas tradicionais madeirenses” [72]. Additionally, references have also been made to the seasoning of corn with “escabeche” sauce (a sauce made with garlic, vinegar, olive oil, bay leaf, and parsley) or simply with salt to be consumed as an appetizer. The “Sopa de Milhos Escaldados” would be prepared in times of bean scarcity and corn availability, and its ingredients would include white corn, cabbage, and other vegetables such as potatoes, sweet potatoes, chayote, and fresh or salt-cured pork. The wood used in the nixtamalization process would typically come from heather, laurel, or beech-tree. There is no specific festive or social context associated with this soup.

Besides, it is also mentioned that “cenrada” (water with ashes) was used in Portel (Alentejo) to soak chickpeas, to which orange or mandarin peels were added, in the late 19th and 2th centuries [61]. Regarding olives, contemporary references to olive preservation can still be found in the present. This technique was pointed, by the early 20th century, as having Roman origins and having already fallen out of use, both in domestic and industrial settings [73]. Finally, from an industrial point of view, ashes are present since the 15th century in the making of cane sugar, mostly to purify cane juice, whitening it, which could be used in associated with herbs (being lime also used as ashes substitute) [59,74]. Its use had the additional objective of “neutralizing the sugar cane acid” [74], a procedure that is also reported in the 18th century on sugar mills in Brazil, allowing for the fortification of sugar (*idem*). Nunes also presents a summary of the evolution of the term “decoada”, as well as its Spanish variants “lejía” or “lexía” with origins in the 15th century.

Usage of ashes in Portuguese haute cuisine

In Portuguese haute cuisine, ashes have also been introduced. In 2015, Chef José Avillez (from the restaurant Belcanto, Lisbon, Portugal) presented his “Carabineiro com cinzas de alecrim” dish (carabineiro shrimp with rosemary ashes).

Discussion

Amidst the COVID-19 lockdown, a significant essay penned by Monica Truninger, a Portuguese sociologist, has raised concerns about the apparent decline in the intergenerational transmission of culinary knowledge in Portugal, specifically pertaining to the daily popular cuisine [75]. This essay marks, in our vision, the first instance in history where such apprehensions have been explicitly articulated and documented, at least from our work point-of-view. Indeed, our research demonstrates that knowledge of the operational methods of popular and accessible culinary technologies – in the case, the use of ashes – has been disseminated through various means, including through popular cuisines, aristocratic culinary practices as evidenced in cookbooks, and haute cuisine, the one practiced in restaurants.

This dissemination and diffusion of culinary knowledge played a vital role in societal progress, facilitating culinary,

flavor, mechanical and nourishing advancements that improved communities’ health (sometimes in a serendipitous manner) and hypothetically ensured their continuity [2,5,76]. It is of central importance to state that ashes, as a culinary technological improvement, have accompanied social evolution, being developed as a technology for dishwashing, clothes washing, sugar production, workbenches cleaning [53], and associated with woman household burden. Indeed, some evidence is found that some nixtamalization procedures are kept as feminine work [77].

Although it remains unclear, for each use of ashes, the way human beings arrived in the conclusion that it could be an added value in their daily life, there could be a causality effect between that empirical use and its culinary adaptation. In this culinary field the use of ashes permitted significant advancements in what comes to transformation, preservation, and simplification of cooking processes. In Portugal, those three aspects could be found in the several cases, such as the “milhos aferventados” dish, olives, etc. Besides, there is evidence to suggest that in 21st century, culinary knowledge concerning the use of ashes in cooking continues to be generated and explored, however at a slow pace [77,78]. This latter observation is supported by our findings that suggested that, in the Algarve, the recipe of “milhos aferventados” is being done in the same way for more than one hundred years. Here the conventional ratio of ashes to water is typically 1:10 [54], whereas in Ecuador, people have already grasped that a more effective ratio of almost 1:2 yields better results [78]. These disparities in the application of ash-related culinary practices indicate a variability in the adoption and diffusion of culinary knowledge across different cultural and geographic contexts.

Those findings are particularly relevant in the scope of this work. If, for one side, we have understood that ashes started to be substituted by other chemically refined and more stable products (such as lye, lime, soda bicarbonate, etc.), haute cuisine for instance has been incrementally recuperating such popular technique and expanding it. This incrementalism, associated with the study of a technique like the use of ashes, allows its full comprehension, its expansion to other raw materials transformation, and create a Restaurant-Nature bond that transport guests to a down-to-earth connection with elements (in this case, the product of fire) [79].

Moreover, in the Portuguese case, the presence and use of ashes is still being made in the “low” and in the “haute cuisine”, in Portugal. Indeed, the use of ashes is still being made, as a popular technique to transform corn, as well as in olives preservation (even though Affonso stated, in 1905, that this technique had disappeared from Portuguese household and industrial environments [73]), as a fertilizer. Also, a Portuguese haute cuisine case of culinary use of ashes has been found. Finally, ashes replacement for other industrial, food-grade products should be further researched. The reasons for that replacement has not been

scrutinized by our research. However, looking for some of the identified cases, effectiveness and food safety concerns seems to be some of the reasons to its substitution. It is important to denote that in the Portuguese cases it remains unclear if ashes could or could not be used by the restaurant industry, more precisely in the case of “milhos aferventados” as there is no official statement with this regard. This could be generating the fear in having such recipe in restaurants and consequently being contributing to its disappearing [80,81].

Conclusion

The use of ashes as a supporting tool for life development has been practiced since time immemorial times by numerous cultures. From the Ancient Rome to Mesoamerican civilizations. Its *modus faciendi* has been transmitted both through an elitist, aristocratic way, in specialized literature, and complemented by the work of Chefs who employ and study the technique but also it has been passed down through imitation and oral tradition in the realm of popular cuisine or “low cuisine”. From the daily life routine, where ashes are used to aid in the cleaning of clothes and spaces, to a more intimate context, as an assistant in magic practices and rituals, ashes have played a significant role in human adaptation across diverse regions of the world. This fact also applies, in an equal manner, to its culinary uses.

Evidence of ash utilization has been found on almost every continent (except Oceania) concerning the dispersion of ashes for food preparation purposes. Whether as a tenderizer, cooking facilitator, preservative, or flavor enhancer, ashes have been relevant in culinary technological evolution. The versatility of ashes usefulness is also evident in the variety of products they are associated with vegetables, legumes, cereals, meat, fish, fruits, eggs, sugar, among others. While our study addresses a gap in the literature regarding the lack of exploration of this product in various contexts, with a particular focus on the culinary aspect and specifically in Portugal, it also gathers information that was previously scattered (demonstrated by the revision of an extensive bibliography), concerning the methods of operation and products that have benefited (and continue to benefit) from its use.

The primary contribution of our study lies in the systematic view, including the Portuguese case, of the use of ashes in cooking processes, transformation, and food preservation. We conclude that further studies are necessary, particularly from the perspective of food safety. In summary, the study on the utilization of ashes in food, which we have undertaken, exemplifies the diversity and historical richness of dietary practices and foodways, evolving with regards to cultural, social, and gastronomic needs. Documenting and elaborating on these practices are essential for preserving culinary heritage and contributing to the understanding of gastronomic evolution, bearing in mind that eventually part of this knowledge is not applicable nowadays due to new visions on ethical, environmental, cultural issues.

Study limitations

The technical limitations of this study are related, as in any exploratory work, to the limited scientific production on the subject, which entails extensive bibliographic research. We are convinced that much information will remain beyond the scope of this article. Furthermore, the historical information collected from reputable sources lacks a broader (sometimes cultural) context, which is necessary for understanding the facts. Besides, the lack of regulatory and food safety information leads to uncertainty about the true purpose that motivated the replacement of ashes with other food products. Finally, a major limitation of our work is linked with the culinary uses of ashes in haute cuisine. Despite having empirical knowledge of the distribution of the technique, especially in restaurants with contemporary cuisine, its documentation is extremely limited.

Future Research

Additional research should be performed to understand the safety concerns raised with the regard to the types of ashes that could be used in the kitchen and some foundational works are also relevant in the domain of regulatory affairs. This research is of keen importance due to the implications that this absence might have in the restaurant sector and in dishes preservation (such as the case of “milhos aferventados” in the Algarve, Portugal), where uncertainty remains regarding the possibility of practicing such technique.

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Declaration of Interests

The authors report there are no competing interests to declare. This is an original, conceptual work that has only been submitted to this Journal.

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