MENU

JOURNAL OF FOOD & HOSPITALITY RESEARCH

FOOD, BEVERAGES, SERVICES
through SOCIAL SCIENCES, ECONOMICS, COGNITIVE SCIENCE & NUTRITION

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Aims and Scope

MENU, Journal of Food and Hospitality Research aims to publish articles on food behaviors, in link with culinary arts, foodservice and hospitality. Its scientific ambition is both thematic and methodological. Firstly, it proposes to publish the work of PhD students, researchers interested in food, culinary arts and gastronomy, who place people – cooks, consumers, waiters... - at the centre of their works. Secondly, from a methodological standpoint, the journal gives priority to ecological studies of these activities, promoting the development of in situ approaches. Thirdly, as multidisciplinary approaches are at the heart of the journal, Menu aims to maintain the dialogue between behavioral and experimental sciences, social sciences and humanities together with food and nutrition sciences. As a scientific journal, it also aims to bring the academic, public and private sectors together, through the diffusion of applied research to a wide reading audience.

Articles published in MENU are subject to a review process mainly involving the researchers of the Centre for Food & Hospitality Research of the Institute Paul Bocuse and their scientific collaborators.

The journal contains four types of publications:

- **Research articles** reporting accomplished or exploratory research works. (max. 4000 words).
- **Book / Literature reviews** are short articles presenting a critical view on recently published books or papers on a given research question. (max. 4000 words).
- **Fieldnotes** presenting ongoing research works (max. 2000 words).
- **Summary of symposia** on food behaviors and hospitality research (max. 4000 words).

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Editorial

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Menu: Journal of Food and Hospitality Research is a journal dedicated to food-related practices, usages, behaviors, decisions and perceptions, with a special focus on culinary arts, foodservice and gastronomy. Food is at the same time a product with sensory properties, a marketable good, a means to meet physiological needs and a symbolic stand. As such, its study calls for a diversity of approaches.

Among the range of approaches available, the scope of Menu is to focus on human beings and on the relationships between food and people, rather than, for instance, food engineering, ingredients chemistry or culinary processes. Among the many journals which address the topic of food behaviors, Menu aims to create a dialogue between foodservice, culinary arts and political, economic, social and life sciences. Technology is seen through the lenses of users: food properties, sensory qualities and culinary techniques are described as the results of perceptions, behaviors, practices and complexes. process of decision making. Restaurants, kitchens and any places where people eat and cook are social arenas where people live. This is what we would like to capture through a scientific glimpse.

This issue includes two research articles and two literature review, which allow having a better understanding about eating practices and food preferences in different countries and in different populations in the same country. Thanks to these studies, several questions about social representations and cultural usages in different populations are explored. In addition to these papers, one Book Review and a summary of a workshops on protein consumption are included.

This issue of Menu wishes to illustrate again the multidisciplinary approach of the Center for Food and Hospitality Research, Institut Paul Bocuse.
Literature review:
Changes in olfactory and gustatory perceptions in patients undergoing chemotherapy

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Abstract:
Chemotherapy generates several side effects including changes in sensory perception that may affect the quality of life of patients. The purpose of this literature review is to evaluate the impact of chemotherapy on the chemical senses (olfaction and gustation) and its consequences on patients' food behavior. A research gap was found concerning the direct relationship between sensory modifications and changes in food preferences and food behavior.

Keywords: Chemotherapy, sensory perception, olfaction, gustation, food behaviors.
1. Introduction

The link between sensoriality and health is a topical issue because of the age of the population, the increasing incidence of obesity, and the medication that may have an impact on sensory perceptions. However, taste—with all the sensory modalities involved in its development, is still understudied in the case of some pathological conditions.

The pleasure of eating passes through several sensory systems (sight, smell, taste...) but also through social context of the meal. In the case of cancer treated with chemotherapy, tasting and olfaction are the most exposed pathways to sensory changes. These chemical senses are the first actors in the development of taste and appreciation of the flavor of food, hence, any modification at their level may have consequences on the hedonic judgment of food. This can induce a change in food preferences, promote the development of aversions, and therefore significantly reduce the pleasure of eating [1].

Chemotherapy is a systemic therapy which affects cells with high mitotic index. The anti-cancer agents present in the treatment try to inhibit or slow down the evolution of the tumor by blocking the proliferation of cells with rapid division. Since this mechanism of action is not selective, it also attacks healthy cells with frequent renewal, as is the case with the epithelial cells of oral and nasal cavity.

Malnutrition that affects a large proportion of patients undergoing chemotherapy is considered to be an important predictor of morbidity, mortality, response to chemotherapy and its toxicity. However, the link between sensory alterations and nutritional status of patients remains unclear.

We hypothesize that changes in olfactory and gustatory perceptions induced by chemotherapy are involved in decreased appetite and loss of eating pleasure, as well as in the avoidance of certain dishes or foods by patients. Thus, we first tried to understand the physiology and role of olfaction, tasting, and other sources of sensory information in the development of taste in the broad sense. We subsequently found in the literature the consequences of chemotherapy treatments on chemo-sensory systems, food preferences and nutritional status of patients, in order to identify unexplored research pathways for the aforementioned problem.

2. The development of "taste"

The elaboration of the taste passes through three chemo-sensory systems of the oro-nasal area: olfaction, gustation and trigeminal sensibility. The term flavor is then used to describe the unitary perception, which combines information from (i) tasting, (ii) olfaction, and (iii) oral somesthesia.

2.1. The gustatory system

Taste sensitivities arise from the interaction between specialized epithelial cells (localized in the oral cavity, the oropharynx, the larynx and the upper third of the esophagus) and sapid molecules. The taste buds present on the tongue contain 50 to 100 taste receptors with a life span of about 10 days. These receptors are able to detect and identify 5 primary flavors: sweet, salty, acid, bitter and umami, which can combine to form more elaborate taste sensations [2].

By detecting sapid substances, the taste system provides qualitative information of the ingested food. Once stimulated, the taste cells transmit information to the primary taste cortex and then to the secondary cortical areas common to olfactory and gustatory sensations [3, 4].

2.2. The olfactory system

The olfactory system is characterized by the large number and the diversity of its sensory receptors located on the receptor cells of the olfactory epithelium. Its structures allow the integration and processing of olfactory information. The olfactory epithelium is a tissue of about 2cm² located on the roof of the nasal cavity. It includes cells at different stages of differentiation, basal cells (which ensure the permanent renewal of tissue), support cells, and microvillar cells. The olfactory receptors are able to detect and
discriminate a very large number of odors [5]. The neurons of the olfactory receptors are the only neurons in direct contact with the environment, which facilitates the detection of environmental chemical molecules.

Once the fragrant molecule / receptor interaction is established, the information is transmitted to the olfactory bulb via the olfactory nerve. The olfactory bulb is a small structure located in the cranial chamber at the level of the two hemispheres. It is essentially composed of excitatory and glutaminergic mitral cells. It is the first brain structure to receive and code olfactory information. Thereafter, the olfactory tract connects the bulbs to the brain areas involved in the perception and identification of odors: (i) the primary olfactory cortex (including the piriform cortex, part of the amygdala) plays a role in recognition (iii) the orbito-frontal cortex and insula (play a role in hedonic and associative treatment with other sensory modalities) (ii) thalamus, entorhinal cortex, hippocampus (involved in the memory inter alia). Thus, the sense of smell is closely related to other senses (including gustatory sensitivities and trigeminal), as well as to emotion and memory.

There are two ways of transporting odoriferous molecules towards the nasal epithelium: the ortho-nasal pathway which allows the detection of molecules by the olfactory receptors following their passage through the nasal cavity. The retro-nasal pathway is triggered by the action of chewing the food and, which induces the release of its flavors.

2.3. The trigeminal system

The trigeminal system is sensitive to tactile (spicy, tingling, pressure ..) and thermal (hot, burning, fresh, cold) information. It is controlled by the trigeminal nerve, the fifth cranial nerve. The trigeminal nerve is called “mixed” because it is both sensitive and motor (proprioceptive and kinesthetic sensibility). The somatic sensitivity of the face and associated cavities is ensured by its three branches: ophthalmic, maxillary and mandibular [6].

In addition to its tactile, thermal and pain sensitivity, the trigeminal nerve has a diffuse chemical sensitivity, expressed in the mucosa of the nasal and oral cavities in response to several odoriferous or sapid molecules at high levels concentration. Thus, the spiciness of pepper, the burning of ginger, the sparkling of carbonated drinks, the astringency of red wines, are likely to activate trigeminal chemical sensitivity.

The three abovementioned systems work in a complementary manner in order to allow recognition and appreciation of the flavor of food [7].

2.4. Role of saliva

Saliva is the first digestive fluid in the food canal. It is secreted by the salivary glands and poured directly into the oral cavity. When chewing food, saliva is secreted in a reflex way controlled by the autonomic nervous system. It helps in chewing food, forming and swallowing the food bolus, and digesting starch (amylase). Also, saliva is the solvent of the sapid molecules in the mouth. In fact, the sapid molecules need to be dissolved in order to be detected by the taste receptor cells. In addition, the permanent presence of saliva in the oral cavity regulates “buccal homeostasis” by protecting the mouth from bacteria, virus or fungus (lysozyme, peroxidase, liga).

The amount of saliva in the mouth is estimated to 2ml secreted every 15 to 20 minutes. A decrease in the salivary flow can lead to a xerostomia (dryness of the mouth), which makes the mastication and swallowing more difficult, and may expose to some oral attacks such as mucositis or candidiasis [8].

3. Effects of chemotherapy on chemo-sensory systems

In the case of chemotherapy treatments, 70% of the patients report alterations of at least one of the sensory systems mentioned above [10]. This leads to modifications in their eating behavior and a deterioration in their quality of life. The incidence of these changes is likely to increase with the duration of treatment [9]. For example, about 68% of patients on chemotherapy for bronchial or gastrointestinal cancer have altered taste and smell [10]. The prevalence of changes in olfactory and taste perception varies according to the stage of the disease and the prescribed treatment. It can
range from 16% to 70% during chemotherapy and from 50% to 70% during radiotherapy. However, these disorders do not show up continuously throughout the treatment process. In a study conducted in 2014, Boltong et al. demonstrated the cyclical occurrence of the changes in perception and appreciation of sweet and umami flavors throughout the course of chemotherapy. The taste function is thus altered at the beginning of the cycle, a few hours to 1 day after the administration of the cancer treatment, and starts to recover towards the end of the cycle [11].

3.1. Impact on the gustatory function

The gustatory function may be affected at a peripheral level: cytotoxic molecules may either induce a cellular necrosis of active taste sensory receptors, or attack the basal cells responsible of the receptors renewal. Furthermore, some chemotherapy molecules may induce their own taste when they are secreted in the saliva and get in direct contact with the taste buds. The patients complain about chemical or metallic persistent taste in the mouth [12].

A drug induces its own taste when its molecules reach saliva by one of these three ways: (i) oral ingestion, (ii) excretion in saliva, (iii) diffusion from the blood vessels of the tongue to activate the receptors on the baso-lateral and apical surface of the taste cells [8]. Most drugs are dosed so that their taste is subliminal and therefore not perceived by the patient, but an accumulation of metabolites in the taste buds can lead to taste perception after several weeks of medication. Hyposalivation is a frequent consequence of antineoplastic treatments. This can cause uncomfortable oral dryness for patients and increase the risk of exposure to fungal and inflammatory disorders [8].

A recent study of 289 people with various types of solid or hematological cancers revealed dysguesia - distortion of taste perception - in 64% of patients. In addition, this study showed a significant association between the type of treatment and the occurrence of dysguesia [13].

3.2. Impact on the olfactory function

Smell disorders and their impact on cancer patients food behavior is an under-researched topic. Some studies based on olfactory thresholds or self-reporting show decreased olfactory capacity in patients on chemotherapy [14, 15, 16], while other studies suggest that olfactory perception is exacerbated and patients undergoing chemotherapy are therefore more sensitive to odors [17]. There is therefore an impact of chemotherapy on the olfactory sensitivity of the patients, but the lack of consensus in the results of the studies conducted does not allow to identify the way in which these perceptions are influenced.

3.3. Phenotypes of sensory modifications

The modification of gustatory and olfactory perceptions varies between patients. Hypersensitivity and hyposensitivity to gustative stimuli are both reported while for odors, an increased sensitivity is reported in most cases [10]. In a study of 192 patients treated for cancer (unspecified type), there is a higher proportion of individuals who perceive the 4 primary flavors as well as odors more intensely [28]. This effect is particularly observed at the end of chemotherapy for the detection of several odors and salty flavor [14].

For both taste and smell, a significant difference in perception between men and women is observed: More women reported an increased sensitivity and more men reported a decrease in taste and smell perception. Men and women vary particularly on sweetness perception (with a higher proportion of men who have difficulty perceiving it), acidic and bitter flavor (perceived as stronger in a large majority of the female population), and odors, which are perceived as stronger by women [10]. It is difficult to have an accurate prevalence given the diversity of used methods and the heterogeneity of the cohorts of the undertaken studies. Sensory modifications in patients treated with hormonal therapy or immunotherapy are still understudied [18].

4. Effects of chemotherapy on food preferences

The pleasure of consuming a meal is a substantial source of motivation to eat. But in the case of chemotherapy, this pleasure is reduced for various reasons mentioned by the patients. The results of directive or semi-directive interviews allowed the identification of some specific
constraints experienced by patients. Personal experience and food preferences emerged as the main factors influencing food choices. The main motivations given by patients are beliefs about the benefits of nutrition including: the social benefits of the meal, the benefits on health, and the fact that diet gives them strength to cope with the next cycle of chemotherapy [29]. Patients also report seeking transparency and naturalness in their diet [19].

A study on 1119 patients with different types of cancer proposed a ranking of the most appreciated/avoided food. Fruits and vegetables, soups, poultry, pasta and fish were the most appreciated, while fried foods, spicy dishes, acidic foods, Indian and Mexican dishes were less appreciated and thus avoided by most of interviewed patients [20]. The same study tried to characterize food preferences according to the type of cancer. It seems that chemotherapy for breast cancer increases the sensitivity to odors as well as the preference for vegetarian dishes. Patients with gastrointestinal cancer are more sensitive to food odors specifically, and show a greater aversion to spicy dishes. Finally, this study indicates that 43.3% of patients have a developed aversion for at least one odor (kitchen, fish, perfume ...).

5. Effects of chemotherapy on body composition

The decrease in taste function was significantly associated with a decrease in food intake, energy intake (in kilojoules), and protein intake especially at the beginning of the third cycle of chemotherapy. In addition, loss of appetite in the middle and the end of chemotherapy was positively correlated with a decrease in Body Mass Index of patients [11]. Malnutrition with weight loss and involuntary muscular mass wasting is observed in 40 to 50% of cancer patients. It is generally associated to an increased risk of complications and poor prognosis of survival [10]. Improving the nutritional status of patients may improve the tolerability of chemotherapy treatment. It is suggested that certain factors (associated with malnutrition) may exacerbate the side effects of the treatment. For example, decreased protein intake leads to lower plasma protein levels, which increases the concentration of circulating molecules of cytotoxic drugs and exacerbates their side effects [21].

6. Sensory alterations and nutritional status

The moment of the meal is an entire part of the patient's routine and contributes to his autonomy. Sharing a meal is a privileged moment with family/friends that helps to avoid the tendency to isolation often observed in this population. It is therefore essential to understand the mechanisms by which changes in taste and smell influence the diet of patients undergoing chemotherapy.

Taste and smell modifications may have significant consequences on the frequency of food intake, appetite, food choice, and thus on nutritional status [11]. The alteration of senses can interfere with the hedonic value of food, and cause aversion [22], but the gustatory function, food appreciation and appetite seem to return to their initial score 8 weeks after the end of the treatment [11].

Olfaction and nutrition are linked by complex interactions. A pleasant food odor will seem less pleasant after a meal. This can be explained by the level of circulating hormone that varies between these two states: after a meal, the circulating level of leptin and insulin is higher, while in the fasting period, the level of orexin and neuropeptide Y increases in the central nervous system. An increase in olfactory sensitivity is observed at the same time [3]. Moreover, the smell that comes from a dish influences its appreciation, and the taste of a food is perceived as more intense if it is congruent with its smell.

The loss or distortion of the chemical senses (taste and smell) results in a decrease of motivation to eat. In fact, the stimulation of these two senses initiates the salivary, gastric, pancreatic and intestinal secretions that are essential for the absorption and digestion of food. When taste and smell are affected, they no longer intervene correctly in the initiation, the progress and the finalization of food intake and this may have consequences on the quantity of ingested food and the size of consumed dishes [12].
7. Conclusion

Sensory modifications are observed in patients undergoing chemotherapy for all cancer types. However, it is difficult to have precise data on their prevalence due to the diversity of the study methods used and the heterogeneity of the populations studied. The studies differ in the number of participants, cancer types studied, treatments and stage of the chemotherapy cure. Moreover, the diversity of the phenotype of perception makes the study of sensory modifications complex. The most probable causes of this side effect are the necrosis of active sensory receptors cells and the blocking of cells regeneration of the olfactory epithelium and the oral mucosa. A longitudinal study including different cancer types and chemotherapy regimens may provide a better understanding of the nature and the scale of this phenomenon as well as its consequences on the perception of tastes and odors, and thus on the eating behavior.

Body composition of patients may change irreversibly during treatment, which contributes to the increase of some cancer recurrence. Therefore, it is important to develop nutritional patient-centered interventions that take into consideration the sensory modifications experienced.

The nutritional management of patients must encompass many aspects including the improvement of the pleasure of eating, which will play a substantial role in improving their quality of life.

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Literature review: Investigation of food and beverage pairing. A review

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Abstract:

Generally a food or a beverage is not consumed alone. They are paired together in order to create a good match. But what makes a good match between food and beverage? This review offers a summary of what is known about food and beverage pairing in summarizing both, the experts and scientific knowledge. Experts knowledge bring up the pairing principles mentioned in books, websites and blog as some rules to respect, in order to create a good match. Scientific knowledge bring up the different variables investigated in food and beverage pairing as liking, the perception of products’ sensory properties or the cultural dimension of matching these two products together. It also offers an analysis of the link between all these dimensions and gives recommendation for future researches.

Keywords: food, beverage, pairing, liking, sensory properties.
1. Introduction

Generally a food and a beverage are not consumed separately but together (de Castro, Bellisle, Feunekes, Dalix, & De Graaf, 1997; Hébel, 2011; Vandevijvere, Lachat, Kolsteren, & Van Oyen, 2009). But how to combine two products?

1.1. Experts knowledge

General rules seem to emerge from the expert literature to pair food and beverage together in order to create a good match whatever the foods and beverages (Harrington, 2008; Pierre, 2014):

- The notion of similarity consisting in pairing two product sharing similar flavors
- The notion of contrast consisting in pairing two products which have opposed flavors
- The notion of complementarity consisting in pairing two products which have analogue flavors in order to bring something more to one of the two products.
- The notion of “Terroir” consisting in pairing two products which comes from the same region

However, these notions are not clearly defined.

1.2. Scientific knowledge

There is still a lack of scientific information on the mechanisms occurring in a match between food and beverage.

3. Analytic approach of food and beverage pairing

The food and beverage pairings can be approached in an analytic way in considering the products separately. Indeed, the effect of prior food consumption in the perceived sensory properties of beverage and the effect of prior beverage consumption on the perceived sensory properties of food were assessed thanks to a sequential tasting method. The prior consumption of food significantly modulated the sensory properties of beverages in decreasing or enhancing their perceived intensities (Madrigal-Galan & Heymann, 2006; Nygren, Gustafsson, Haglund, Johansson, & Noble, 2001; Nygren, Gustafsson, & Johansson, 2002).

However, these modifications were product dependent. Indeed, Nygren et al. (2001) found, a significant difference in the effect of the prior consumption of hollandaise sauce on wine according to their fat level but it depended on the type of wine. Indeed, the butter aroma was increased more by the low fat sauce in the unoaked wine whereas it was more increased by the high fat sauce in the oaked wine. However, the role of the other sensory properties, which differed from a wine to another, in the perception of the butter aroma, has not been taken into account and it was therefore impossible to draw precise conclusions. Indeed, in this example, the oaked and unoaked wine had significant differences in the perceived intensity of sourness, toasted aroma, citrus and butter aroma and the sauces had significant differences in the perceived intensities of butter aroma and creamy mouthfeel. These characteristics could modulate the effect of the fat level on the change in the butter aroma intensity of wine and further research with more controlled samples have to be realized to bringing out the mechanisms which occur.

Moreover, the prior consumption of beverages modulated some of the sensory properties of food in decreasing their intensities (Nygren et al., 2001; Nygren, Gustafsson, & Johansson, 2003) As above, the variety of tasted product did not allow to demonstrate the precise mechanisms explaining the modifications of the perceived sensory properties in food after beverage consumption. It is therefore necessary to deepen the study about the interactions between each product’s properties for future research. The use of more controlled samples will be a mandatory way to bringing out more precisely how the products’ properties interact in a match.

4. Holistic approach of food and beverage pairing

The match between food and beverage can also be considered as a unique object which can be investigated in different approaches.
4.1. Perceptive approach

The level of match was described as following; “a non-match is when the interaction of the wine and food creates a negative impact on the senses when tested together, and a synergistic match is when the wine and food combines to create a superior and ideal gastronomic effect” (Harrington & Hammond, 2005).

Products liking as predictor

Donadini, Spigno, Fumi, and Pastori (2008) found a highly significant positive correlation between the level of match between beer and Italian dishes, and the liking for the beer.

Sensory properties as predictors

It seems there is a relationship between the level of match and the products’ sensory characteristics (Donadini et al., 2008; Harrington & Hammond, 2005, 2006; Harrington, Koones, Gozzi, & McCarthy, 2012). Indeed, the wine color (Harrington & Hammond, 2005) have an effect on the level of match with cheese and a stronger match were found between red wines and cheese. However the results not did not allow to explain this stronger match. Maybe it is about some sensory perceptions or maybe it is just because matching red wines with cheese is deeply rooted in our tradition.

Donadini et al. (2008) found some correlation between the level of match between beer and food and the sensory characteristics of the two products. For example, the more robust the body of a beer was, the more it was appropriate for the pairing with the BBQ which had a high level of perceived intensity for different descriptors (suculent (ability of a given food to cause salivation), fatty (tactile sensation in the oral cavity due to the presence of fats in food), persistent (duration of sensations after swallowing) and structured (depends on the variety, the complexity and richness of the ingredients employed to cook a given dish)). It seems these two products went well together when their “body” intensities were similar. They also pointed out a correlation between the level of match of three beers (JOP, stout, 5.5% ABV; RAU, Rauch bier, 5.1% ABV and CHI, Trappist beer, 9.0% ABV) and the structure, sapidity (-taste- determined by the presence of salt added during cooking or seasoning) and aromatic persistency of the food. These beers had a high level of the perceived intensities for body, persistency, and bitterness. The similarity of the persistency in the two products seems to be involved in the level of match perception. These notions of similarity in body level of products and in persistency were also found in the expert literature and deserved to be investigated more deeply.

Moreover, the perceived beverage and food sweetness, spiciness, acidity and astringency have a significant positive or negative relationship with the perceived match level depending upon the tasted products. (Harrington, 2005; Harrington et al., 2012). Once again the variety and the uncontrolled tested products did not allow to know what exactly happened. However, Harrington and Hammond (2006) demonstrated that the relationship between the perceived astringency of wine and the perceived level of match seemed to depend on the level of fattiness in food. The notion of balance between these sensory properties appears to be necessary to create a good match.

Balance as predictor

The balance of a pairing is defined as how the tastes, flavors and textures of the beverage and the food are balanced or how they dominate the pairing.

King and Cliff (2005) and Bastian et al. (2009) considered the ideal match as the pairing for which neither the cheese nor the wine dominates. They found that wine and cheese are compatible for pairings but their study do not allow an understanding of why they go well together. The results of Donadini and Fumi (2014) and Paulsen, Rognså, and Hersleth (2015) seem to confirm that the ideal match is the pairing for which neither the food nor the beverage dominates. However, the balanced pairings are not systematically the most liked (Donadini, Fumi, & Lambri, 2013). There is no consensus regarding the effect of the overall balance of pairing in the level of match. The mechanisms which occur to create an overall
balance or dominance in pairing have therefore to be studied.

Harrington and Hammond (2006) found that for wine and food pairing, the level of match was significantly related to the balance between the wine and food body (neither dominating). The body-to-body relationship is defined as the relative match between the food and the wine in regards to the feeling of weight, lightness-to-richness, smoothness-to-roughness (Harrington, McCarthy, & Gozzi, 2010) or fattiness-to-tannin (Harrington & Hammond, 2006) in the wine and food match. Indeed, if the food fattiness and the wine tannin are in the same level of intensity in products tasted separately, the two products tasted together created a synergistic pairing. This brings out the interaction between these two sensory properties and support the results of Peyrot des Gachons et al. (2012) which demonstrated an interaction between the astringency of a beverage and the fattiness of the food. It also brings out the importance of their perceived intensities in products tasted alone, to create a balance necessary to lead to a good pairing. However, even if the pairing is perceived as balanced for the body-to-body relationship, one product can dominate the match according to their flavor intensity.

### 4.2. Hedonic approach

The food liking depends on several factors related to the products themselves such as the sensory attributes of products (Liggett, Drake, & Delwiche, 2008; Moskowitz & Krieger, 1995; Wagner et al., 2014) or the perceived complexity of foods (Lévy, MacRae, & Köster, 2006), but also on variables related to the individuals such as culture (Cervellon & Dubé, 2005), familiarity regarding the product (Borgogno, Favotto, Corazzin, Cardello, & Piasentier, 2015) or personality (Byrnes & Hayes, 2013).

In the case of the food and beverage pairing, most of scientists tried to bring out the key elements driving the liking of a match in investigating the link between the overall liking of pairing and (i) the products liking, (ii) the modulation of the sensory characteristics, (iii) the balance of the pairing, (iv) the harmony of the pairing, and (v) the complexity of the pairing.

### Products liking as predictor

The relationship between the liking of products and the liking of a pairing is not assures (Donadini et al., 2013; Harrington, Miszczac, & Ottenbacher, 2008) but in some cases, if one given beverage is paired with different foods the liking of the match seems to be driven by the food liking when tested alone and vice-versa (Bastian, Collins, & Johnson, 2010; Donadini & Fumi, 2014; Donadini, Fumi, & Lambri, 2012; Donadini, Fumi, & Newby-Clark, 2015; Harrington et al., 2008).

Moreover, if the liking of foods are not significantly different but the beverage are differently liked, the liking of the pairing is driven by the liking of the beverages (Paulsen et al., 2015). However, two preferred products not necessary create the preferred pairing (Donadini et al., 2012, 2013; Harrington et al., 2008; Tuorila, HyvÖnen, & Vainio, 1994). The liking of pairing may depend on the suitability of the overall flavors of the match, of the interaction between the sensory properties of the two products but also of the individual differences in judgment.

### Sensory properties as predictors

The liking of food and beverage pairing seems also to be related to the sensory characteristics of the match. Indeed, a cheese and wine pairing is less liked when it tends to have a high astringency, possesses coarser tannins, more barnyard type aroma, and tends toward having more oak aroma and less fruit intensity (Bastian et al., 2010).

For cheese and beer pairing, the liking of the match was negatively predicted by the level of acidity, perceived level of carbonation, fruitiness and the perceived level of alcohol in beer, and was positively related to the sweetness of beer (Donadini et al., 2013).

In the case of chocolate and tea pairing the sweetness drove positively the liking of the match such as the caramel-like flavor, milk-like flavor and vanilla-like flavor. However the astringency, stickiness, mouth-coating and cocoa-like flavor drove negatively the liking of the match between chocolate and tea such as bitterness, tobacco-like
flavor and firmness. The sweetness, vanilla-like flavor drove positively the liking of chocolate and coffee pairing such as fatness, smoked, caramel-like and milk-like flavor. The flavor persistence, bitterness, astringency, sourness and dried fruit-like flavor drove negatively the liking of chocolate and coffee pairing (Donadini & Fumi, 2014).

In these different studies, the sweetness level seemed to drive positively the liking of pairing; however, Tuorila et al. (1994) demonstrated that regardless of the sweetness level of samples, the combinations between cookies and juice were equally liked. The role of sweetness level in the liking of pairing seems to depend on the type of pairing and can’t be generalized. Moreover, Donadini et al. (2015) found that liking for bottom fermented red beers and cheese pairings is driven by several sensory properties which differ from one cluster to another. For one of their three clusters, the liking of the pair is negatively driven by fruity aroma, for another one it is negatively driven by caramel and malty aromas and for the last one it is negatively driven by roasted and burnt flavors. The individual preferences and sensibility for the different sensory properties have therefore to be assessed in this kind of studies.

“they don’t go well together” to “they go very well together”.

The complexity of a pairing corresponds to the number of perceived sensations in a match. It was assessed with a 9-point Likert-type scale from “few” to “many”.

It has been demonstrated that the more complex a pairing is, the more liked it is but only if all the perceived sensations go well together (Paulsen et al., 2015).

**4.3. Cultural approach**

Pettigrew and Charters (2006) investigated the consumers’ expectations and representations of food and alcohol pairing. Two parallel studies were performed to explore the role of wine and beer in Australian culture and how cultural activities are combined with the beverage consumption.

Furthermore, the moderate spicy characteristic of food increased significantly the consumers’ liking for food and beverage pairing but only when the beverage has a certain level of bitterness (Harrington et al., 2008) This provided support for the information mentioned by the experts in the vulgarized literature which postulates that beverage and food flavor intensity should be balanced to create a good pairing.

**Balance of pairing as predictor**

There is no consensus in the role of balance in the food and beverage pairing experience. Indeed, sometimes the pairing with a flavor dominance of food increased the pair appreciation (Donadini et al., 2013). Sometimes, the balanced pairing are the more liked (Donadini & Fumi, 2014; Paulsen et al., 2015) and sometimes, the balance of pairing had no bearing on the liking for the wine and cheese pair (Bastian et al., 2010).

**Harmony and Complexity of pairing as predictor**

The harmony of pairing is defined by Paulsen et al. (2015) as “how well does the different sensations and aromas in the pairing go together” and were assessed thanks to a 9-point Likert-type scale from...

The consumers’ expectations were explored thanks to focus groups and interviews which took place in several geographic regions and different contexts such as standard interview environments or drinking contexts. It seems that cultural codes, families, peers, gatekeepers and advertising lead the consumers to think there is a “proper” food and beverage pairing.

**5. General discussion & Conclusion**

The food and beverage pairing was approached in several ways (perceptive, hedonic, behavioral and cultural) and different elements seem to have a role in the perception and judgment of a match (Figure 1).
Indeed, when two products are paired, their sensory properties interact. If this interaction leads to the increase of the perceived intensity of the pleasant sensory properties, the match is more liked. Moreover, if this interaction leads to the decrease of the unpleasant sensory properties, the match is more liked. The modulation of the products’ sensory properties in pairing seems to play an important role in the match perception and judgment such as the notion of balance, complexity and harmony which are connected to these sensory properties. The role of these elements in the match perception and judgment is still not clear and seems to depend on the tasted products. Before to be able to investigate the role of these elements in the perception and judgment of a match, it is necessary to better understand what is a balanced, complex and harmonious pairing. The mechanisms which occur to create an overall balance/dominance, complexity and harmony in pairing have therefore to be studied. It is currently difficult to draw general conclusions because of the impossibility of comparing studies because of their wide variability. Finally a lot of question remains.

![Figure 1: Overview of the explored variables in food and beverage pairing.](image)

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Abstract:

Although the study of food culture and its worldwide dynamics has increased in the past 20 years, the study of cooking still remains an under-represented theme in this literature. This situation is surprising, because cooking practices are one of the most important expressions of food culture, and of a culture in a larger sense. The present pilot study aims at exploring the possibility of gaining some knowledge about food culture dynamics through a qualitative approach of material culture linked to cooking. The method combines a questionnaire and a collection of pictures. The investigators were students in culinary arts from different schools member of the Institut Paul Bocuse Worldwide Alliance network, and a researcher from a partner school in Mexico. They recruited families with at least one child between 1 and 12 years old and took a picture of the cooking space and of the different equipment used for cooking. Householders were asked to classify the equipment regarding their frequency of use: frequent (at least twice a week), relative (twice a month to once per week), rare (twice a year to once a month) or never (once a year or less). This pilot study raised the importance of the terminology, confirming the difficulties to define “cooking”, whether it is related to the place, the equipment or the practices. It also revealed that many local specificities seem still to exist, despite the globalization process.

Keywords: Cooking practices, food pictures, cooking equipment.
Although the study of food culture and its worldwide dynamics has increased in the past 20 years (Albala, 2011; Bryant, DeWalt, Courtney, & Schwartz, 2003; Counihan & Esterik, 1997; Watson & Caldwell, 2004), the study of cooking still remains an under-represented theme in this literature (Sutton, 2016). This situation is surprising, because cooking practices are one of the most important expressions of food culture, and of a culture in a larger sense. These aspects have been raised a long time ago by researchers like Claude Levi-Strauss (1965) or James Goody (1982), among others. Especially, cooking is a good way to study the transmission of cultural practices, and also the globalization process in relation to food – which is more often addressed by the products used. The lack of research on cooking practices could be explained by several reasons such as the difficulty in defining this polymorphic practice or the fact that everyday cooking is generally a very private activity. Another obstacle could be the difficulty to choose between several ways of approaching this practice, which implies almost all the sociocultural aspects of the actors, making it a possible “total social fact” (Mauss, 1923). Thus, cooking can be studied through the, the social interactions, the products consumption, the social and symbolic representations or materials or the “Techniques of the Body” (Mauss, 1936). The present pilot study aims at exploring the possibility of gaining some knowledge about food culture dynamics through a qualitative approach of material culture linked to cooking.

1. Methods

Following the existing benefits of visual methods for the food studies (Salazar, 2011), the method combines a questionnaire and a collection of pictures. The investigators were students in culinary arts from different schools member of the Institut Paul Bocuse Worldwide Alliance network, and a researcher from a partner school in Mexico. They recruited families with at least one child between 1 and 12 years old and took a picture of the cooking space and of the different equipment used for cooking. Householders were asked to classify the equipment regarding their frequency of use: frequent (at least twice a week), relative (twice a month to once per week), rare (twice a year to once a month) or never (once a year or less). All the results were gathered in a report. A similar questionnaire in English was sent to every volunteer student; it was up to them to translate the instruction to the households if needed. They were explicitly asked not to go in their own family or in the family of other culinary arts students to avoid the particular equipment implied by this special relation to cooking. For Mexico, some questionnaires has been directly sent to households and self-reported.

Five countries were concerned by the study:

- Canada: 3 households
- South Korea: 2 households
- Finland: 3 households
- Singapore: 3 households
- Mexico: 11 households

In order to question the notion of “tradition”, a special focus was made on Mexico. Thus, 3 interviews were made with Mexican students to complete the data and pictures collected through the questionnaires, and a Mexican researcher brought her complementary expertise.

2. Results

2.1. The notion of “Cooking spaces”

Most commonly, the cooking space has been presented as a particular room in the house or in the apartment, dedicated to cooking practices. Most of the pictures do not allow us to know if the room can also be used for eating, as the focus is generally on the cooking spaces along the walls. However, there has also been an extended and a more limited definition of cooking spaces. For instance, in Finland, two of the three households added a picture of a small space organized outdoor around the barbecue that can thus be interpreted as an extension of the indoor kitchen. On the contrary, the pictures of the cooking space in the three Singaporean households showed only the heating equipment, suggesting that there is no particular room dedicated to cooking, but just a part of the apartment with some cooking equipment. According to the investigators, this is linked with the very small size and high prices of the accommodation in Singapore and with the fact
that it is very common in Singapore to eat out. Altogether, the notion of “kitchen” might be inadequate to describe the cooking spaces, whereas the presence of cooking equipment is the main indicator to define cooking space. However, this concept of “cooking equipment” is also subject to various definitions.

2.2. The notion of “Cooking spaces”
Except Canada and Singapore, the equipment used to heat food (“cuisson” in French) is rarely mentioned. When they are mentioned, they are more hotplate or ovens, but very rarely microwaves (a little bit more in Mexico, where microwaves were quoted 5 times on 11 households). The most common equipment is utensils, pots or small appliances like mixers. From that, speculate that the direct contact with food is more linked to “cooking”, and that warming up is not always considered as cooking.

2.3. Frequency of use
The type of equipment frequently used is consistent within the same countries, but it differs a lot between the different countries. For example, the charcoal oven has been systematically mentioned in Singapore. In Korea, the presence of pliers and chopsticks linked to steam cooking and of several utensils linked to rice consumption are also shared. In Finland, the more frequently used utensils are linked to cutting and fire cooking, and the coffee machines is also always mentioned (Finland being the world first coffee consumer per habitant). If electric appliances are often quoted in the reports from the different countries, there are generally presented as not being very frequently used. From these elements, it seems that there are still a lot of (or at least national) specificities in cooking practices, despite of the globalization process.

2.4. Tradition and modernity: the case of Mexico
In a first phase, the interviews and the expertise of a Mexican researcher allowed to list the cooking equipment that can be considered as “cultural markers” in Mexico (fig. 1)

In a second phase, the results of the questionnaires have been gathered and quantified (fig. 2)

![Figure 1: Equipment considered as "cultural markers" in Mexico](image-url)
Figure 2: Equipment mention in reports from Mexico

The equipment considered as cultural markers are not mentioned frequently in the reports. Based on the interviews, clay pots appeared 3 times and only once as frequently used. They were also criticized as being toxic due to their coating, which could explain the fact that they are not presented as commonly used equipment. The Molcajete appears only once, which is probably to be put in relation to the great number of mention of the blender and the mixer, that seems to have replaced it. The comal is mentioned only 5 times, and 3 as frequently used, which is surprisingly low regarding the importance of the tortillas in Mexican cuisine, eaten every day. From the interviews and the reports, it seems that other types of pans are nowadays more frequently used to warm up the tortillas than the comal. These three examples show that although the equipment used has evolved, the type of cooking practices did not really change. Thus, it appears that the “cooking culture” cannot only be studied through the equipment, but also through the way they are used and the practices associated with it.
4. Conclusion

This pilot study raised the importance of the terminology, confirming the difficulties to define “cooking”, whether it is related to the place, the equipment or the practices. It also revealed that many local specificities seem still to exist, despite the globalization process. Moreover, the evolution of the equipment does not necessarily mean that the practices and the ingredient are changing too, as there can be some substitutions between traditional and new equipment. All these elements highlight the methodological limitations of the approach through questionnaires and interviews only, and creates the need of a proper ethnographic fieldwork to better understand the local vision and definitions of cooking and to comprehend the practices in their social context.

Bibliography


Research article:
Appetite for life - Maintaining appetite for foods at old and very old age

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Abstract:
Maintaining appetite for foods at old and very old age is important for keeping a reasonable health status and quality of life in this growing group of citizens. Since the personal health status and living condition change for people at higher age a loss of independence in the way they are accustomed to prepare and consume foods is often a consequence. This may lead to changes in consumption patterns and a deteriorated living condition. Full attention should be given to different approaches on how quality of life and appetite for food can be maintained in this group of citizens. The present short communication addresses this topic from multiple angles and presents the results from a discussion by experts on the topic.

Keywords: Elderly, Appetite, Food provision.
1. Introduction

The ageing of populations in countries across the globe is a major societal and public health concern now and in the coming decades. Older and very old people form a heterogeneous group with rather different needs for assistance and support in their daily routines and living conditions. One important health issue among the elderly is the increasing risk of developing malnutrition which can be considered as a multifaceted phenomenon linked to health problems and to periodic or permanent loss of independence. The negative consequences of poor nutrition lead to a general decline in the quality of life and associated costs for health and nursing care (Arvanitakis et al., 2008).

With support from society and relatives, a growing share of European elderly live independent, active and healthy lives in their own homes. It is, typically, elderly in the age of 85 or older (referred to as the oldest old) who are most prone to lose the ability to live independently due to limited mobility, frailty, or other declines in physical or cognitive functioning. Depending on the degree of independence in the food provision situation, elderly can be divided into different groups; 1) living in their private home alone or in a household with complete or partial independence of food provision; 2) living at home with complete dependence on food provision (e.g. meals provided by the nursing services coming into their houses) and 3) living in caring and nursing homes with completely arranged food provision.

The food provision situation is influenced by different factors such as financial constraints, decreased mobility (e.g. for shopping) or decreased movability (e.g. for cooking) (Edfors and Westergren, 2012). The different groups may have impaired physical abilities as well as cognitive, physiological and sensory functions. Even though several changes are clearly apparent, elderly themselves have often insufficient of knowledge about losses in sensory perception and changing nutritional needs.

Although the grouping of elderly according to their degree of independence in food provision is practiced by decision makers allows an individual to enrol in meals-on-wheels or move to a day-care centre, the underlying causes and risks for loosing appetite and developing anorexia may be very different between individuals. Several psychological, personal health and social health factors have been identified leading to losses in appetite and development in anorexia at higher age (Morley, 1997) and deserve careful attention. Eating enough nutritious food is also influenced by the situation of food provision for the individual elderly. Food provision in this context means the ability to perform food shopping, food preparation and eating of the cooked or prepared food. Preparing and cooking foods are challenging tasks for different groups of old people. Furthermore, changes in sensory perception are also considered an important factor to uphold adequate food consumption since sensory perception is key to food liking, which is an important driver for food intake. Studies have shown that compensation for losses in taste and smell by increasing flavour intensity (not oral heat and flavour complexity) among elderly in dependent and independent living situations worked best for elderly being dependent on food provision (Song et al., 2016). Therefore, sensory compensation aspects could be utilised in elderly care to make foods more appealing and appetising. Loss of appetite and reduced food intake is, however, a common phenomenon in the old and very old citizens and may be due to a multitude of factors such as decreased physical ability, the meal situation including social interactions, health condition, etc. (Nyberg et al., 2014). The present report considers several reflections on how food intake in the elderly who are complete or partially dependent on food provision can be maintained or improved.

2. The Workshop

This communication reports on the “Appetite-for-life in a sensory perspective” workshop held at the 11th Pangborn Sensory Science Symposium in Gothenburg, Sweden, 24 August 2015. This workshop followed the earlier discussions at the “Health and quality of life in an aging population:
Food and Beyond” workshop during the 6th Eurosense meeting, 7-10 September 2014 in Copenhagen, Denmark (Giacalone, et al., 2016). The workshop was divided into five themes of 1) Appetite and health status in different groups; 2) The food provision situation; 3) Living situation; 4) Design of nutritious foods; and 5) Sensory Variety. The central question addressed was how to stimulate appetite and nutritious food intake in the elderly from a sensory perspective? The workshop was organized around brief presentations by invited speakers on the five themes followed by group discussions in the audience. Each group discussed specific questions in depth according to each theme. The outcome from all the groups was gathered and presented followed by a joint discussion among all participants.

The aim of “Appetite-for-life” workshops was to discuss the current situation of food appetite in the elderly, define challenges and bring out new ideas on how to increase appetite from a sensory and living condition perspective, especially for those elderly being at risk for developing malnutrition.

Theme 1 Appetite and health status in different groups
A recent example of studying appetite and health status among elderly is the French Aupalesens survey (Maitre et al., 2014). The survey was conducted in four French cities (Angers, Brest, Dijon, Nantes) on 559 elderly people over 65 years with a good cognitive health (MMSE>20), dependent for food or not. Its main objective was, in a multidisciplinary approach, to identify how appetite, eating pleasure, meal satisfaction and sensory abilities were correlated to nutritional status and health. Using a Clustering and Disjoint Principal Component Analysis, we identified seven clusters which naturally split in three groups being on average less than 80 years old and four groups being on average more than 80 years old. As expected, the nutritional status, measured by the Minimal Nutrition Assessment (Guigoz, et al. 2002), decreased with age. Since malnutrition in the groups of elderly below 80 years was almost non-existing and the proportion of individuals at risk of malnutrition was moderate, interventions at this stage seems most relevant. Among the groups of less than 80 years old, one group consisted of individuals living at home, of which 64% were living alone. This group was characterized by less eating pleasure and a lower level of satisfaction with meals. They were as selective as the two other groups but liked meat less (Maitre et al., 2014). The elderly groups of 80 years and older had lower olfactory capacities, in particular odor discrimination (Sulmont et al., 2015) compared to the groups below 80 years of age. Among them, those who had a good appetite and kept pleasure in eating had a better nutritional status than the other ones, characterized by either loss of interest in food, associated to depression, either difficulties in eating.

**Theme 1 question:** Could we imagine a holistic approach, including sensory keys, to keep the motivation to eat for elderly who are no longer interested in eating?

Theme 2 The food provision situation
The autonomy and involvement of the elderly is of key importance when creating new solutions for better food provision situations at home (Edfors & Westergren, 2012). The adoption of information and communications technology (ICT) tools such as smartphones, tablets, etc. could provide opportunities to improve the food provision for the individual. Also, these mobile devices may support elderly during their preparation of food. It has been shown that elderly still have the ability to learn to use unfamiliar technology (Pijukkana & Sahachaisaeree, 2012). However, people above 55 years have been slower in adopting PCs and using the Internet. Once the initial lack of confidence has been removed, they became and remained enthusiastic users. Interactive communication platforms including face-to-screen communication and social networks are widely available and may be more effectively used in promoting food consumption. Besides ICT tools to engage elderly in food preparation and eating, other tools are available for people lacking physical abilities. These tools can be very simple adjustments of cutlery to advanced robotised aids to assist transport of food from the plate to the mouth (Lindborg and Lindén, 2015).
**Theme 2 question:** How much and in which way can ICT help us to support the food provision and to improve sensory pleasure during eating.

**Theme 3 Living situation**
Several elderly who are living independently are in need for professional guidance to avoid development of malnutrition. Dean et al (2009) showed that the variety of food intake was dependent on material resources such as income, mobility, living arrangement and health. Also other factors, eg appetite, food knowledge, distance to shop, access to high-quality products, kitchen facilities, access to service were shown to contribute to the variety of food intake.

Poor cooking skills, especially among elderly men, have been shown to be a barrier to energy intake, healthy eating and appetite (Hughes et al., 2004). Frailty and motoric difficulties may further hinder food provision and cooking. Aids and adaptations are often only accepted by those wholly dependent upon them. The various aids and adaptations for cooking and eating are insufficiently known among elderly people and care takers.

There is also a need for the development of easy-to-cook, nutritious recipes that meet the sensory needs and food culture of the individual. The dishes should contain few and easily accessible ingredients, readily available from the nearest food-store or provided in a practical way (e.g. a prepacked, home-delivered grocery bag). The recipes should consider the design and availability of kitchen utensils and appliances.

Being independent and being able to eat and cook for yourself are strongly associated with wellbeing and increased self-esteem. Since food consumption is not only an exercise of nutritional intake but also part of a meal occasion providing comfort and wellbeing for the individual, it is crucial to develop various types of strategies that may enhance mealtime experiences (Mahadevan et al., 2014).

**Theme 3 question:** How to design recipes for easy home cooking in a culinary and efficient way?

**Theme 4 Design of nutritious foods**
Relationships between orosensory exposure, food intake and degree of satiation have been well established. Among others, the sense of taste is thought to be a nutrient sensor which informs the brain and the gut about the inflow of nutrients. The ingestion of energy-yielding beverages and foods low in fibre content, which can be consumed very quickly and have a short orosensory exposure, leads to a higher energy intake in humans (Viskaal-van Dongen et al. 2011). It has also been shown that a prolongation of the orosensory exposure time to foods triggers an earlier meal termination and/or a higher satiety response in young adults. Obviously, the focus in all these studies was mainly on unravelling the underlying mechanisms with the aim of being able to design foods that promote earlier satiation and/or a longer satiety response. However, these mechanisms might also prove to be useful when one aims to design foods in such a way that they promote a certain amount of overeating in nutritionally frail seniors (Doets and Kremer, 2016).

Recently, several interesting observations have been made with regard to seniors. Firstly, a prolonged orosensory exposure time (i.e. 150% or 200% of the habitual number of chews) reduced the postprandial pleasantness of a food, i.e. pizza rolls, but did not impact on actual appetite or consumed meal size in older consumers. Interestingly, in young adults, the same intervention resulted – in line with the above described mechanisms – in a reduced meal size (Zhu and Hollis, 2014). Secondly, a recent study showed that with repeated exposures the wanting and consumption of a soup increased in seniors, despite the fact that the liking for this soup remained stable. Finally, in older consumers it was observed that regardless of energy content and portion size of a meal, absolute intake was always around 81% (beef meals) and 89% (chicken meals) of the served portion (Ziylan et al., 2016). Thus, it seems that the participants ceased eating when a certain percentage of the provided meal was consumed, rather than when a certain amount of energy was consumed. Taken together, these findings suggest that seniors’ meal size might be based on habitual intake behaviour rather than on food liking and/or actual feelings of hunger. For
future research, systematic studies that examine both orosensory exposure times of foods and total portion size as possible modulators of seniors’ intake are strongly encouraged.

**Theme 4 question**: Could (protein-enriched) foods be designed in such a way that they could promote a certain amount of overeating in nutritionally frail seniors?

**Theme 5 Sensory Variety**

Seeing, smelling, touching or tasting a food can lead to a decrease of its liking during consumption. This phenomenon is known as sensory specific satiety and can be measured in real consumption settings (Fernandez et al. 2013). The working hypothesis of the present theme is based on the reverse phenomenon: could an increase in sensory variety lead to an increase of eating pleasure and hence of food intake. For instance tasting a variety of foods has been shown to delay satiation and choice variety appeared to increase food intake (Hollis et al., 2007). Changing food contextual elements (choice variety or condiments) of the meal improved residents’ meal satisfaction and increase food intake of meat or vegetables. However, factors affecting the context of the meal (names of dishes, decor) in the elderly nursing home proved to be ineffective.

Pouyet et al. (2015) tested single versus pair presentations of small aperitive toasts made of eggplant puree on soft bread (104 participants; mean age 89). The number of toasts increased significantly when two variants were presented as compared to when only one type of toast was presented. Results showed a positive influence of sensory variety on food intake of elderly in nursing homes. However, the effect was not shown in elderly with cognitive impairments. Sensory variety could be brought by varying the flavor, the color or the texture of a given food or by increasing the number of food presented without increasing the overall quantity of the offered food and without affecting the overall cost of the meal. For instance, we compared a green beans portion to a portion of mixed green and yellow beans one presented in a nursing home restaurant (78 participants, mean age 84). Results showed an increase of food consumption, with a significant increase of the meat consumption.

**Theme 5 question**: Which sense is the most efficient to increase food intake: appearance (colour enhancement)/ flavour (taste – aroma – trigeminal enhancement)/ texture (soft/hard contrast)?

3. Results

The central question was: How to stimulate appetite and nutritious food intake in the elderly from a sensory perspective? This question was then divided into the five themes: 1 Appetite and health status in different groups: 2 The food provision situation, 3 Living situation, 4 Design of nutritious foods and 5 Sensory variety. The results were divided into these themes and an overview of suggestions given on how to answer the different theme-questions are given Figure 1 and in the text below.
Theme 1 Appetite and health status in different groups
Knowing the individual history of the elderly, why they lost interest in food seems very important to adapt food and food supply. Food preparation, packaging, labelling, etc. should be thought to make the food easy, attractive, interesting and appealing in different ways adapted to different groups of the elderly, taking into account how variable the elderly population can be. We have to make the food preparation fun, as a social activity and as an opportunity to use the senses to increase appetite. E.g. take care of which spices to use, less hot ones but avoid tasteless food, colours to make the food attractive, etc. SAPERE methodology may be used for elderly to maintain interest in food and also create interest for new foods. The eating environment is of importance, lightning, sound, the social interaction and conviviality. Motivation to eat may also be linked to maintain motivation for other activities, including activities related to smelling, or related to discover other cultures.

Theme 2 The food provision situation
It should be easy to find sites and chats where menus and tips for a healthy life on-line can be found and shared with each other. Here also chats and on-line meetings are easy to create, e.g. to have dinner together or just talking within own generation or with young people. The step is not far to have apps in mobile devices, e.g. have-a-drink apps, cooking apps, etc. Food shopping on-line is already a reality. Smart kitchens, e.g. fridge with sensors telling what is needed and smart housing. Use E-health and link to health care in connection with eating.
connection with eating is an important task. ICT security issues have to be taken into account such as easy safe passwords and accessibility.

**Theme 3 Living situation**
Smart recipes should provide nutritious food with ingredients easily found in food stores and easy to cook. The amount of ingredients should be kept low. The packaging of the food ingredients should be of small sizes and also be informative and inspiring. When developing recipes targeted for different groups of elderly it is important to use the skills and culinary experience of the elderly and consider how such knowledge can be transferred between elderly and between generations.

**Theme 4 Design of nutritious foods**
It is possible to tailor-make food for different groups, with different nutritional contents, even though it is not easy. The sensory goal is to have nutritionally dense food to be perceived as low nutritious food. It is well known that different sources of proteins may give different effects on satiety. E.g. “bubbles” of proteins can be used in the development of such foods, and also use advantage of different flavourings. To make people aware that the nutritional needs change with age and tips on how to combine protein intake with exercise might be a motivation factor. General recommendations should be avoided and instead be made more personalized and turn to different target groups with specific recommendations and advices. Cross disciplinarily is of importance.

**Theme 5 Sensory variety**
Sensory variety is a potential lever to increase food intake. Familiarity is to be considered as a prerequisite before looking for any variety. Sensory variety should be searched within familiar food forms to avoid rejection. Labelling, packaging or the dressing of the food have to be attractive and create positive feelings. The food itself should be specific to the targeted group in terms of convenience, size, texture, etc. Further suggestions are: to offer various foods in a enjoyable presentation; to offer different forms of the same food such as raw/ half cooked/ cooked and; to offer various sensory combinations concerning colour, flavour intensity, contrasted textures.

The results show the need for individual attention around food provision addressing the wide variety of living conditions and requirements in the older citizens. The importance of food and eating as a social activity and the importance food attractiveness, variety and convenience are highlighted. Also familiarity of foods and dishes is an important issue as well as the eating environment. New technologies and ICT should be adapted and used as tools to facilitate everyday life. Food and food activities should be fun and easy to increase appetite as well as appetite for life.

4. Discussion and Conclusion

The discussions during the workshop certainly reflected the ongoing discussions in the society where it is often stated that the individual has to be in focus. Individual needs, requirements and requests differ between groups and individuals, and this is something that we need to take into consideration if we should be able to reach the EU-devise “add life to years”.

In addition to the sensory perspective in improving appetite and food intake among elderly people, the scientific approach in the workshop pinpointed the importance of social aspects associated with food and food consumption contexts. Several suggestions were presented for how new interactive technology could be incorporated into the daily food routines for elderly people in order to offset disadvantages related to, for instance, lack of company or memory deficiencies.

Because of the multidisciplinary aspect of all food intake related factors and elderly consumers, use of knowledge and involvement of specialists from disciplines not normally working together, was seen as central for bringing the field forward. For instance, specialists in welfare technology as well as in ICT need to collaborate with health personnel as well as chefs, scientists and designers are combinations that can contribute fruitfully with new ideas and innovative solutions.

On a more general plane, future research should be focused on holistic and individualized solutions concerning living conditions, nutrition and health.
in older citizens becoming more dependent on food provision.

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Book review:
Analyse critique de Houellebecq aux fourneaux, de Jean-Marc Quaranta,

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Etrange objet que ce livre. Maître de conférences en littérature française à l'Université d'Aix Marseille, Jean-Marc Quaranta propose un Essai littéraire / livre de cuisine - ces deux mentions figurant en miroir sur la couverture - et initie pour l'éditeur Plein Jour une analyse littéraire d'un genre inédit. Inédit puisqu'à la finesse de l'étude universitaire répondent des appréciations personnelles de l'auteur, des anecdotes le concernant et ses propres recettes de cuisine. Aussi, le lecteur habitué à une approche strictement académique de l'analyse doit-il faire abstraction de ses premiers réflexes de défiance face aux diverses mentions de souvenirs familiaux et gourmands de l'auteur.

La forme choisie par l'auteur lui octroie, bien sûr, de nombreuses libertés. Ainsi le champ sémantique de la nourriture est omniprésent dans l'analyse littéraire - on pourrait frôler l'indigestion. Dans ses recettes, en revanche, l'auteur choisit de développer les références à la littérature. Ainsi, le niveau de technicité requis est signalé selon une échelle dont les valeurs sont données par des personnages houellebequiens, du moins expérimenté (Valérie dans Plateforme) au plus expert (Anthony et Georges, le couple de restaurateurs-chefs à la mode dans La Carte et le territoire). Le coût des recettes est évalué en suivant la dotation de prix littéraires (du prix Tristan-Tzara au prix Goncourt) et le temps de préparation nécessaire correspond à la longueur de différents genres littéraires : haïku, poème, roman, roman-fleuve.

Ces préciosités peuvent surprendre ; elles offrent sans doute l'avantage de favoriser l'accès de cette étude à un public plus vaste, tout en proposant des pistes de réflexion qu'une lecture plus attentive permet également. Dès lors qu'on accepte les surprises que réserve cet ouvrage étonnant, sa lecture s'avère passionnante, que ce soit pour le bonheur de se remémorer une œuvre déjà maîtrisée, ou même pour la découvrir.

Il faut noter que l'auteur ne se contente pas d'une très belle et subtile analyse littéraire de Michel Houellebecq ; il donne aussi des informations précieuses relativement à la psycho-sociologie de l'acte alimentaire, pour un public qui ne s'en serait pas préoccupé auparavant, en s'appuyant sur les ouvrages fondateurs de la discipline¹.

Bien sûr, les personnages de roman s'alimentent « pour que le lecteur perçoive quelque chose dont le manger est le signe »².

Pourtant, quand on évoque Michel Houellebecq, la cuisine n'est pas un domaine dans lequel on suppose pouvoir aisément découvrir des indices forts de sa pensée. Mais apprendre sa perception des aliments nous offre des pistes d'exploration assez originales, et, surtout, très judicieuses de son univers romanesque et de sa réflexion.

Contrairement à ce qu'on imagine de prime abord, les personnages houellebequiens ne se contentent ni de calmants ni d'alcools. Ils explorent, et ce n'est pas systématiquement sans goût ni désir, les diverses nourritures de la modernité et de la postmodernité : nourritures

traditionnelles d’avant la révolution sociétale des années soixante-dix, cuisines exotiques (mexicaine, dans les années quatre-vingt, puis asiatique), la gastronomie des étoilés Michelin, les bons petits plats, rassasiant et savoureux, apanages des rares couples s’épanouissant dans le temps... et même des nourritures fantasmatiques. En effet, les clones de La Possibilité d’une île « mangent » des cachets de sels minéraux\(^3\), tandis que les restes d’une humanité revenue à l’état sauvage se nourrissent de chair crue, sommairement rôtie quand c’est possible, voire se livrent à l’anthropophagie\(^4\).

Dans les six romans publiés, à ce jour, par celui que Dominique Noguez avec sa fulgurance usuelle, a qualifié de « Baudelaire des supermarchés »\(^5\), J-M. Quaranta en axant son étude selon un ordre bibliochronologique (comme l’a fait le personnage de François, dans Soumission, pour son étude de Huysmans dont il est le meilleur spécialiste et éditeur pour La Pléiade) a dénombré près de 200 plats, soit une moyenne de 34 par livre. Ces très importantes occurrences surprentraient si les moments de repas n’étaient pas, surtout, d’excellents marqueurs des rituels sociaux et professionnels, ainsi que de précieux indicateurs de l’état psychologique des personnages lorsqu’ils mangent seuls, et du devenir de leurs relations amicales ou amoureuses, voire simplement sexuelles, lorsqu’ils partagent un repas avec autrui.

Parmi les thèmes développés avec le plus de précision dans cette étude figure, bien sûr, la construction des relations amoureuses et leurs effets sur le mode alimentaire des protagonistes. En effet, et nous le savons depuis fort longtemps, l’action de se nourrir est très intimement liée au sentiment amoureux\(^6\). Le corolaire évident de ce lien chaleureux à la belle et bonne nourriture des personnages aimés et aimants est la malbouffe dans laquelle semblent se complaire, ou au moins accepter, les personnages malheureux, solitaires, désespérés d’eux-mêmes comme du monde. Les relations tristes et mornes s’accompagnent d’un manque d’appétit assez évident.

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Ainsi, dans le premier des romans publiés, Extension du domaine de la lutte, les parents du narrateur le conçoivent, de toute évidence sans amour, après le dîner – « Ils avaient mangé du poulet froid »\(^10\). Cette remarque extrêmement

\(^3\) P. 145.  
\(^4\) P. 145.  

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Aurélien Bellanger\(^7\), et pas seulement dans le regard de Fox, le chien de La Possibilité d’une île. Des sentiments forts et sincères s’expriment, et leur rareté les rend plus précieux encore, comme la nature de ce qui attache Michel, le narrateur de Plateforme, à Valérie. Michel se découvre, soudain, dans le même temps et avec une surprise inouïe, également amoureux et heureux de cuisiner\(^8\).

Jed Martin, dans La Carte et le territoire fréquente avec sa compagne Olga les restaurants étoilés et les Relais & Châteaux ; elle lui « apporte la culture de la nourriture »\(^9\). Dans Soumission, François partage deux repas avec Myriam. Le premier, une catastrophe culinaire, marque leur difficulté à se retrouver, alors que le second (dans le roman) et dernier (de leur histoire commune) est un délice à tous points de vue et rendra François terriblement nostalgique de cette histoire sentimentale différente des autres.

De même, les rares couples harmonieux dans la durée savent développer une complicité les protégeant de la brutalité du monde extérieur. Ils se réconfortent dans les plaisirs gourmands concoctés par une femme aimante comme Françoise dans Soumission et font de leur table un espace de convivialité simple et sincère où des personnages moins heureux vont faire la découverte d’instants joyeux dont le doux souvenir renforce la douleur des moments de solitude et de mal-être ultérieurs.

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8 QUARANTA, J-M. Houellebecq aux fourneaux... op. cit, p. 105  
9 id, p. 206.  
10 id, p. 31.
déstabilisante pour le lecteur est soulignée par la précision suivante : « A l’époque, on trouvait encore de vrais poulets » \(^{11}\). Cette simple mention nous permet d’entrevoir, et le texte le confirme amplement, que les parents du narrateur n’ont pas su se monter à la hauteur d’une société qui proposait encore quelques bonheurs. Ils n’ont pas non plus su préparer leur fils Michel à une vie épanouie, ni tirer avantage des progrès et des libertés que la société des années soixante-dix aurait pu leur offrir. Il est important de relever que ce thème, houellebecquien par excellence, est présent dès son premier roman édité.

Dans le même ouvrage, le champ sémantique des volailles est également utilisé par le personnage principal, Michel, qui compare l’amour rêvé, sublimé mais impossible, à « des cailles dodues » \(^{12}\) tandis que son malheureux collègue Tisserand « que son physique et son peu d’estime de soi rejettent loin des femmes se voit "comme une cuisse de poulet sous cellophane dans un rayon de supermarché" (...) loin des cailles dodues et de l’amour » \(^{13}\).

Au contraire des personnages heureux (donc amoureux), les plus tristes perdent, nous l’avons vu, l’envie de bonnes nourritures, et même le goût. Allant plus loin, lorsqu’un cas est totalement désespéré – psychologiquement et/ou physiquement - il ne s’alimente plus de solide mais régresse et retrouve une alimentation liquide et enfantine. C’est devant un bol de « Nesquik » que Tisserand avoue sa douleur de n’avoir encore jamais connu l’amour physique.

Souffrant d’une maladie incurable et choisissant de disparaître, Annabelle prépare le cocktail mortel qu’elle absorbera\(^{14}\). Enfin, et c’est toujours dans \textit{Extension du domaine de la lutte}, que Michel, interné en hôpital psychiatrique, passe de l’aliment solide à l’aliment liquide et même « ombilical » : « Toute ingestion d’aliments solides me fut impossible. Je vomissais aussitôt avec des hoquets douloureux. J’avais l’impression que mes dents [devenues inutiles avec tant d’évidence] allaient partir avec. Il fallut recourir aux perfusions » \(^{15}\).

La place réservée aux nourritures dans \textit{Extension} montre à quel point ce premier roman porte déjà en lui les thèmes essentiels de Michel Houellebecq. Le lire est non seulement une invitation à se plonger dans les suivants, mais aussi un outil précieux pour guider une lecture analytique de l’ensemble de l’œuvre.

C’est ce qui explique que l’ouvrage de J.-M. Quaranta aborde tant de thèmes avec une précision aussi fine dès son premier chapitre : « Métaphysique du tube digestif » \(^{16}\).

Naturellement, le thème des relations amoureuses et celui des liens tissés entre manger et aimer domine ce livre. D’autres thèmes qu’explore Michel Houellebecq sont bien sûr développés, avec une grande finesse, par J.-M. Quaranta. Par exemple, dans \textit{La Possibilité d’une île} qui nous propose une impressionnante plongée chez les élohimites, il expose l’évidence avec laquelle l’interdite alimentaire que l’on fait peser sur autrui est une manière de se l’accaparer et de le forcer à faire groupe\(^{17}\).

Ces pages sont aussi l’occasion de souligner des réflexions que Michel Houellebecq exprime d’autant mieux qu’il le fait de manière extrêmement discrète, par le truchement de certains de ses personnages les plus aimables. Ses livres deviennent, à notre grande surprise, un moment pour lui d’évoquer, comme en son nom propre, des thèmes préoccupant notre époque, et qui pourtant paraissent futiles au regard de ceux plus franchement abordés. Ainsi, il évoque la question du bien-être animal, y compris pour le bétail destiné à l’alimentation des hommes\(^{18}\) ou encore le respect de la saisonnalité des produits\(^{19}\), thèmes aujourd’hui omniprésents dans les discours diététiques et gastronomiques.

On note avec plaisir des traits d’un humour froid (et irrésistible) dont Houellebecq parsème ses

\(^{11}\) id.
\(^{12}\) id, p. 30.
\(^{13}\) id.
\(^{14}\) id, p. 64.
\(^{15}\) id, p. 37.
\(^{16}\) id, p. 29.
\(^{17}\) id, pp. 148 et 149.
\(^{18}\) id, p. 108.
\(^{19}\) id, p. 125.
textes pour une mise à distance extrêmement efficace de ses propos. Ainsi, dans Plateforme celui qui s’apprête à devenir le plus grand proxénète du monde commande des maquereaux pour son repas^20 !

J.-M. Quaranta, dans une continuelle recherche d’érudition, précise, vérifie, complète les informations données par Michel Houellebecq. Il va même jusqu’à corriger le texte, par exemple en précisant que le premier restaurant de la chaîne Mac Donald en France a été implanté en 1979 à Strasbourg, alors qu’on en trouve un, dans Les Particules élémentaires boulevard Saint Germain dès 1975^21. Même si cette correction est juste sur le plan de l’exactitude historique, elle ne s’impose pas nécessairement. En effet, mieux que le réel, ce qui s’affirme avec le plus de force dans l’écriture de Michel Houellebecq, c’est ce qui « semble réel »... d’où la puissance des trompe-l’œil, des vérités relatives et des mensonges par omission qui interrogent le lecteur et le perdent dans l’observation de l’auteur et de son personnage^22.


La lecture de cet ouvrage s’affirme donc avec évidence, aussi bien pour les curieux de la place des aliments dans une œuvre majeure de notre époque que pour les spécialistes de Michel Houellebecq — étudiants de troisième cycle ou amateurs éclairés.

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^20 id, p. 129.
^21 id, p. 88.
^22 Comme le montre par exemple la présence d’un écrivain assassiné dénommé Michel Houellebecq dans La Carte et le territoire, ou bien l’auteur jouant son propre rôle dans L’Enlèvement de Michel Houellebecq (film de Guillaume Nicloux, 2014)
^24 QUARANTA, J.-M. Houellebecq aux fourneaux... op. cit, pp. 175 et 176.
Summary of an International symposium:  
The role of proteins within a nutritious, healthy and sustainable diet

Anestis Dougkas¹

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Speakers:

Sophie AUSTIN, University of Bristol, UK
Charlotte M. BUCKLEY, University of Bristol, UK
John COVENEY, Flinders University, Australia
Anestis DOUGKAS, Institute Paul Bocuse, France and Lund University, Sweden
Annabelle GOYON, Group SEB, France
Laetitia GUERIN-DEREMAX, Roquette, France
Christelle GUILLET, University Clermont Auvergne, France
Alex JOHNSTONE, University of Aberdeen, UK
Nicole NEUFINGERL, Unilever, Netherlands

Abstract:
A sustainable diet is not just one that has a low environmental impact, but also one that contributes to optimal nutrition and to a healthy lifestyle. The symposium aims at sharing the ongoing fundamental and applied research on the role of proteins within a nutritious, healthy and sustainable diet.
1. **Summary of the scientific symposium**

1.1. **Protein for appetite control across the life course**

**Speaker:** Alex JOHNSTONE, University of Aberdeen, UK

Alex JOHNSTONE is a Senior Research Fellow and Registered UK Nutritionist at The Rowett Institute, University of Aberdeen. Her position is funded by the Scottish Government's Rural and Environment Science and Analytical Services Division (RESAS) within a Programme of Strategic Research to be delivered, in relation to "Food, Health and Wellbeing". She leads internationally competitive research in the area of human appetite control in the context of weight loss. More recent work has been on regulation of appetite with high-protein diets.

Dr. Alex Johnstone provided an excellent introduction to the theme of the symposium by presenting evidence on the effect of protein on body weight loss, appetite and in different populations including adults and the elderly. Briefly, she described data from an EU project, based at The University of Aberdeen, Full4Health ([http://www.full4health.eu](http://www.full4health.eu)), which has completed a five year programme of work, with a multidisciplinary team of collaborators from across Europe, investigating the mechanisms of hunger, satiety and feeding behaviour, and how these change across the life course (Mercer, Johnstone & Halford, 2015). The effects of dietary components and food structure on food-gut-brain mechanisms have been explored (Amin & Mercer, 2016). The project outcomes identified possible routes to exploitation of our understanding of the food-gut-brain axis, to address obesity, chronic disease and under-nutrition, using data from human intervention studies. In Full4Health, they studied 391 subjects across Aberdeen and Athens, as 103 children (8-10 years), 109 adolescents (13-17yrs), 97 adults (25-45yrs) and 82 ageing adults (65-75yrs) in a within-day dietary intervention study, using protein drinks as a dietary challenge. It is known from previous work, that appetite and satiety are influenced by time of eating and macronutrient composition (Lobley et al., 2015). Several studies have shown that dietary protein is the most satiating of the macronutrients in conditions of both energy restriction and energy balance. Recent findings suggested that an elevated protein intake seems to play such a key role in body-weight management, through (i) increased satiety related to increased diet-induced thermogenesis, and its effect on (ii) thermogenesis, (iii) body composition, and (iv) decreased energy-efficiency (Martens & Westertero-Plantenga, 2014). The second part of her talk was on the role of protein for an ageing population in the prevention of sarcopenia (loss of lean mass): Few studies have addressed appetite control of the elderly and how to deliver food to maximize nutrition. The current data adds to the evidence for delivery of protein in the diet, without compromising subsequent intake, later in the day. Designing foods for specific situations like in elderly patients with poor appetite may modulate the pathophysiological processes leading to muscle loss. Future partnership with the food industry sector will help design and create foods for specific situations such as poor appetite in elderly patients, which may modulate the pathophysiological processes leading to muscle loss. Recent evidence also indicates that a multimodal approach combining adequate nutrition with exercise, hormones, and specific drugs may be a more appropriate treatment for limiting the development of sarcopenia with ageing. The third part of her talk covered the important role of breakfast for appetite control in young people to influence energy balance: Over-consumption of calories relative to energy expenditure, and the consequent development of overweight and obesity, is responsible for much of the burden of chronic disease in the developed world (WHO, 1999). Even quite modest amounts of weight loss can have a substantial beneficial effect on morbidity and mortality, reduce healthcare cost burden (DOH, 1995), and improve metabolic health profile. Reducing caloric intake, coupled with a healthier lifestyle, is the most effective route to this goal. Thus, understanding the mechanisms of hunger and satiety and how particular foodstuffs and nutrients affect these processes is important for evidence-based interventions to achieve body weight management, and for rational design of
community-wide preventative strategies, across the life-course. This includes scenarios of hunger and satiety at the negative energy balance end of the spectrum – especially in the elderly consumer. Taken together, the research findings to be presented contribute to building a foundation for the identification of targets for life style and therapeutic interventions, using food. Ongoing research will further our understanding of the effects of obesity on body weight homeostasis and potentially enable us to exploit, at least for some obese individuals, the effects of gut hormones involved in the regulation of appetite. The gastrointestinal tract has important endocrinological functions in the regulation of energy intake and appetite.

1.2. Investigating the relationship between savoury taste and protein content in blended foods

**Speaker:** Charlotte M. BUCKLEY, University of Bristol, UK

Charlotte M. BUCKLEY is a final year PhD student in the Nutrition and Behaviour Unit within the School of Experimental Psychology, University of Bristol. Her PhD is focused on the effects of dietary protein on appetite and satiety, and I am working with Prof Peter Rogers and Dr Natalia Lawrence (Exeter). She graduated in 2013 with a BSc in Psychology with Neuroscience and again in 2014 with an MRes Psychological Research Methods, both from the University of Sussex, UK.

An appetite for protein has been linked to the savoury taste of foods and selecting savoury foods after consuming a protein depleted diet has been argued to reflect protein seeking behaviour. The modern diet contains a large amount of processed foods, many are highly savoury to taste, but not necessarily high in protein. Charlotte Buckley presented a study aimed to investigate the relationship between savoury taste and protein content (actual and estimated), including this new category of low protein savoury foods. Participants (n=37) completed 100mm VAS ratings of the sensory and nutritional qualities of 18 familiar foods, categorised as sweet or savoury and high or low protein. Foods were blended to a fine consistency to disguise their identity and ensure ratings were based on taste, as previous work using the unblended counterparts may have been biased due to prior knowledge. Multilevel linear regression was used to test associations between savoury taste and actual protein content. Results showed protein content was not a significant predictor of savoury taste rating (b=-.08, p=.937). Belonging to the savoury category was a significant predictor of savoury taste rating (b=49.74, p<.001), whereas belonging to the high protein category was not (b=3.94, p=.731). Results also suggested that participants may overestimate the protein content of an unidentified savoury food. This is indicated by a shift in the spread of estimation scores which show a greater level of overestimation in blended compared with unblended foods, predominantly in savoury foods which participants could not identify. These results provide preliminary evidence that savoury taste and protein content are not well linked in the current food environment, but taste may guide nutrient estimations about unidentified foods. Her current work aims to expand on this by investigating how protein intake affects appetite for protein-containing versus savoury foods.

1.3. The effects of breakfasts varying in protein source on appetite and energy intake

**Speaker:** Anestis DOUGKAS, Institute Paul Bocuse, France and Lund University, Sweden

Anestis DOUGKAS is a researcher in nutrition, health and eating behaviour at the Centre for Food and Hospitality Research at Institute Paul Bocuse. After receiving his MSc in food science and nutrition and his PhD in nutrition, within the Nutritional Research Group at University of Reading, UK, he got a postdoctoral research fellowship at Food for Health Science Centre, Lund University, Sweden. His research interests are within the area of appetite regulation and obesity prevention.

Dr. Anestis Dougkas looked at the satiating effect of animal vs plant proteins, which still remains...
unknown. The study examined the effects of breakfasts containing animal proteins [milk (AP)], a blend of plant proteins [oat, pea and potato (VP)] or 50:50 mixture of the two (MP) compared with a carbohydrate-rich meal (CHO) on appetite, energy intake (EI) and metabolic measures. A total of 28 males [mean age 27.4 (±SD 4.2) years, BMI 23.4 (± 2.1) kg/m²] consumed three isoenergetic (1674 kJ) rice puddings matched for energy density and macronutrient content as breakfast (25% E from protein) in a single-blind, randomised, cross over design. Appetite ratings and blood samples were collected and assessed at baseline and every 30 and 60 min, respectively, until an ad libitum test meal was served 3.5 h later. Free-living appetite was recorded hourly and EI in weighed food records for the remainder of the day. There were no differences in subjective appetite ratings after consumption of the AP, VP and MP and between the AP, VP, MP and CHO breakfasts in ad libitum EI and self-reported EI during the remainder of the day. Although insulin metabolism was not affected, CHO induced a higher glucose response (P=0.001) and total amino acids concentration was in the order of AP=MP>VP>CHO breakfast (P=0.001). Dr. Dougkas concluded that manipulating the protein source of foods consumed as breakfast, elicited comparable effects on appetite and EI at both laboratory and free-living environment in healthy men. Thus, whole or partial replacement of animal by plant proteins may offer an effective and sustainable alternative when targeting the satiating capacity of high protein foods.

1.4. NUTRALYS® pea protein, when Nutrition & Health meet food innovation

**Speaker:** Laetitia GUERIN-DEREMAUX, Roquette, France

Laetitia GUERIN-DEREMAUX is Senior Research Manager in the Nutrition & Health R&D team with more than 15 years of experience in nutrition at Roquette. She is more specifically involved in the development of the nutritional data for Roquette’s fibers and proteins. In this position, she manages preclinical and clinical studies, confirming nutritional benefits of these ingredients through a scientific approach. Her main fields of expertise are satiety and weight management, blood glucose management, colonic health and muscle development. Laetitia has co-authored many scientific papers published in peer reviewed journals. She obtained an engineering degree in biology from the University of Technology of Compiègne (France) in 2002.

Dr. Laetitia Guerin-Deremaux illustrated the attempts that industry sector is making by demonstrating that pea protein provides an appropriate form of protein supplementation. The worldwide protein consumption has changed dramatically over the last years. The major challenge now is to play on the quality of the proteins consumed without increasing the quantities. In addition, the strategy is to find a good balance between animal and vegetable proteins intake. Thanks to its excellent functional and nutritional properties, NUTRALYS® pea protein is the right solution used in a wide range of food applications targeting populations with specific protein needs. A standardized protocol for protein quality evaluation has shown a good nutritional quality with a Protein Digestibility-Corrected Amino Acid Score of 93 for adults. A clinical study in healthy volunteers has demonstrated that NUTRALYS® pea protein and whey protein equally reduce energy intake associated to a modulation of fullness. In a second clinical trial, in addition to an appropriate training, the supplementation with pea protein has promoted a greater increase in muscle thickness as compared to placebo and especially for sportsmen starting or returning to a muscular strengthening. Finally, an observational study was conducted in nursing homes in elderly in order to evaluate the perception of the hedonic qualities of a compote enriched with NUTRALYS® pea protein. NUTRALYS® pea protein is opening the door to opportunities in food and nutrition.

1.5. Role of dietary protein intake in the prevention of sarcopenia of aging

**Speaker:** Christelle GUILLET, University Clermont Auvergne, France
Christelle Guillet is an associate professor at University Clermont Auvergne and member of the research team on diet and musculoskeletal health managed by Prof. Yves Boirie. She did her PhD in Human Nutrition (2003) and post doctoral position at the Anesthesiology and Intensive Care Unit, Karolinska Institute, Stockholm, Sweden (2005-2006). Her research interests include muscle protein metabolism, insulin resistance, sarcopenia, obesity and muscle function.

Sarcopenia is defined as age-related progressive and generalized decrease in muscle mass and strength, associated with a higher risk of adverse outcomes such as physical disability, poor quality of life and increased morbidity. The causes of sarcopenia are multi-factorial and include disuse, changing endocrine function, chronic diseases, inflammation, insulin resistance, and nutritional deficiencies. Muscle growth is dependent upon protein consumption and the accompanying hyperaminoacidemia, which stimulates muscle protein synthesis. Insufficient dietary protein intake to satisfy daily protein requirements leads to negative protein balance and results in skeletal muscle atrophy, impaired muscle growth, and functional decline. There is mounting evidence that older adults need more dietary protein than their younger counterparts to support good health, promote recovery from illness, maintain functionality and preserve muscle mass loss. One of the key mechanisms involved in sarcopenia is a reduced response of muscle to anabolic stimuli such as nutrients. Nevertheless, it has been shown that aged muscle is still able to respond high amino acid intakes, notably to essential amino acids. Thus dietary protein intakes in elderly should be adapted to induce optimal increase of plasma concentration in amino acids in order to counteract the aged muscle anabolic resistance. Besides the daily amount of protein that should be higher in elderly, the quality, the digestion rate of proteins and the timing and distribution of protein consumption throughout daily meals may be important to consider to prevent or to limit sarcopenia during aging. However, there remains a need for large, long-term, randomized clinical trials examining whether the positive effects of dietary protein on muscle metabolism, observed in acute studies, will translate over the long term into gains of muscle mass, function, and on the overall health of older adults.

1.6. Do humans value one macronutrient more than other?

Speaker: Sophie Austin, University of Bristol, UK

Sophie Austin is currently a Masters by research student (MRes) within the School of Experimental Psychology at the University of Bristol. She is working with Professor Jeff Brunstrom, in the Nutrition and Behaviour Unit. Their specific research area is focused on macronutrient regulation and valuation. She graduated from the University of Plymouth, UK in 2015 with a BSc in Psychology.

According to the presentation of Sophie Austin omnivores are likely to use learned and unlearned (sensory) cues to identify the macronutrient composition of foods. However, it remains unclear whether humans value a calorie of fat, carbohydrate, and protein equally. To explore this question, participants (N= 15) evaluated 17 foods in a two-alternative forced-choice computer task (N= 136 trials), and also rated their expected satiety and perceived healthiness. Foods (100-g portions) were selected to ensure a range of macronutrient compositions. Participants chose between picnic foods in two conditions; (1) when only fixed 100-g portions were available and (2), when unlimited portions were available. For each individual and each condition, we used binary logistic regression to estimate the importance of separate macronutrients as predictors of choice. With fixed portions we observed a significant difference between macronutrients, $F(2, 28)= 4.415, p= .022$. As hypothesised, choice was determined to greater extent by variation in protein (mean $\beta= 0.034$) than in carbohydrate (mean $\beta= 0.023$) and fat (mean $\beta= 0.006$). The same pattern was observed for unlimited portions but the differences failed to reach significance ($p= 0.067$; protein $\beta= 0.017$, carbohydrate $\beta= 0.010$, fat $\beta= -.004$). In combination, these results suggest that, calorie-for-calorie, macronutrients are not valued equally. Currently, we are exploring individual differences in the valuation of
macronutrients and the downstream effect this might have on food intake.

1.7. Effect of changing portion sizes on vegetable and meat consumption, waste and meal satisfaction

**Speaker:** Nicole NEUFINGERL, Unilever, Netherlands

Nicole NEUFINGERL completed MSc in Nutrition & Health at Wageningen University in 2006. She has been working as nutrition & health scientist at Unilever R&D (Netherlands) for 10 years on a range of topics related to dietary intake and behavior, including out of home consumption & nutrition for children and older adults. She conducts literature reviews, intervention studies, epidemiologic studies, that have been published in international peer reviewed scientific journals.

Nicole Neufingerl explored the consumer science at food service sector. Consumer research shows that diners want healthier meals when eating out and care about sustainable practices of restaurants. Increasing the amount of vegetables while decreasing the amount of meat/fish of a dish, could make restaurant meals healthier and reduce their environmental impact. Yet, there are concerns that this may negatively affect meal satisfaction and increase food waste. This study investigated the effect of changing portion sizes of vegetables and meat/fish in restaurant meals on intake, waste and meal satisfaction. The study was conducted in a typical Dutch restaurant. For a selection of nine main-dishes, the standard amount of vegetables served was increased from 117g in the control period to 150g during the intervention period. The amount of meat/fish served differed per dish (range 143-177g) and was generally reduced by 15%, resulting in portions of 122-150g. Furthermore, vegetables and meat/fish were presented as an integrated dish rather than separate components. Food intake and waste was measured by weighing the remainders of the dish components and subtraction from the standardized amount served. Meal satisfaction was evaluated with a questionnaire using 5-point likert scales. The intervention period is currently still ongoing. Preliminary results are based on consumption data of 149 diners, collected during the control period, of whom 118 also answered the questionnaire. Mean vegetable and meat/fish consumption was 102g and 139g, with 56% and 54% of diners, respectively, finishing the portions. On average, 13.0% (±22.1%) of vegetables and 9.1% (±13.7%) of meat/fish served was wasted. Of the diners, 26% considered the amount of vegetables served as (too) little, 12.7% indicated the amount of meat/fish served as a lot or too much. Nicole Neufingerl concluded that as the frequency of out of home consumption increases, small healthy changes to restaurant meals may have a large public health impact.

1.8. Food and The Environment: how do we plan for an environmentally sustainable food supply?

**Speaker:** John COVENEY, Flinders University, Australia

Professor John COVENEY is Dean of the School of Health Sciences, Faculty of Medicine, Nursing and Health Sciences at Flinders University. Professor Coveney has worked as a leading nutritionist and dietitian addressing regional, indigenous and international health issues. Professor Coveney has published more than 190 papers, sole-authored a number of books and worked on major international projects and collaborations attracting significant research and grant funding. He has research and education interests in public health nutrition; history of food and health; food policy; and social and cultural factors that influence food patterns and food intake.

The health of humans and the health of the planet on which they live have never been of more interest. Particular attention has been paid to the extent to which we can construct a diet that will help people lead healthy lives and the extent to which that diet has an impact on the quality and quantity of the necessary foundations of food: clean air, clean water, healthy soil. Using climate change as a starting point, Professor John COVENEY for the closing talk of the symposium, presented and examined the ways in which we can...
plan for an environmentally sustainable food supply.

**Summary of the applied workshop**

Appetite is strongly influenced by the environment and mood, expectations, prior beliefs and associations (Pilgrim et al., 2015). Navarro et al. 2015 showed a significant increase in protein, starches and energy intake after improvement of the presentation and appearance of the meal inspired by the criteria of gastronomy compared with a regular meal in a hospital setting. According to Pilgrim and al. (2015) using crockery with a contrasting color with food and a good light can also help for the visual appearance and could improve appetite. Flavor enhancement had a positive impact on food liking/palatability and consequently food intake regardless of the cognitive status in elderly (Pouyet et al. 2014). To improve the taste the addition of extra salt and sugar is not recommended, but pepper, herbs and spices may all be safely used according to personal preferences (Schiffman, 1997). During the symposium in March 2017 “The role of proteins within a nutritious, healthy and sustainable diet” at the Institut Paul Bocuse Research Centre, a workshop session was included in order to translate science in the field of protein to plausible applications in the development of healthy, nutritious and environmentally sustainable meals and recipes.

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**1.9. How to increase consumer perception and acceptance toward pulses?**

**Speaker:** Annabelle GOYON, Group SEB, France

Dr Annabelle Goyon is currently a food innovation project leader within Group SEB. Annabelle completed a Food Science Engineer degree from AgroSupDijon and continue her studies by completing a Culinarity expert French cuisine (Ecole supérieure de cuisine française). Her PhD was in Food Science and her main expertise includes human nutrition, food processing, food chemistry, sensory and culinarity.

Dr. Annabelle Goyon presented innovative cooking processes in order to offer different textures settings for cooked pulses and to prepare mixes with different grains for improved acceptance. Consumers’ perception toward pulses was studied using a word association task in France. A total of 52 French participants were asked to indicate all the words that came to their minds when the stimulus words “pulses”, “vegetal proteins” and “good pulses” were verbally presented. Participants tended to associate “pulses” more frequently with concepts such as foreign countries, culture and long preparation time. The words “vegetal proteins” tended to be associated with concepts such as agricultural products and sustainability. For “tasty pulses”, all participants elicited terms linked to taste, texture and nutrition. With these results, innovative cooking processes were created in order to offer different textures settings for cooked pulses and to prepare together different grains. Pulses hardness depends on soaking temperature, soaking time and ratio water:grains. Next study objectives were to look for textures preferred by consumers and study whether generally not consumed cereals and
pulses are more accepted when presented mixed. Instrumental texture properties were measured and a consumer test was carried with 106 French participants. The results show that the instrumental texture measurements correlated with sensory texture perceptions. When offering 4 different textures of cooked lentils to participants, they could feel a significant difference on texture and even on taste. Texture seems to influence aroma and taste perception in lentils. Same results were obtained on quinoa. Concerning mixes, global appreciation of pulses was higher when mixed with another grain like a cereal in a ratio 1:2. Global appreciation for mixed lentils with barley was 5.65 and 5.41 for only lentils.

A case study has been presented and the goal was to develop a cold starter with the use of pulses and grains for elderly in an attempt to show how the knowledge on protein, nutrition and sustainability could be applied in practical. It was asked to the participants to discuss about the nutrient requirements for elderly (protein, kcal for starter, etc). It was also requested to consider the importance of sensing different textures, flavors and colors is those components are not reduced by ageing, thus the foods and meals for the elderly should provide sensorial experiences. Vegetables provide natural and recognizable aroma and color compounds, which improve the pleasantness and palatability. Food for elderly should be well-cooked, tender and soft (easy to eat), Simple, designed with the elderlies’ taste in mind, taste home-made and with ingredients they know. Participants to take in account the importance of sensing different textures, flavours and colours, a well-cooked, tender and soft (easy to eat), with ingredients they know.

The first dish presented was a lentil, mushroom and tomato pie : the pie contains lentil, mushroom, tomato and red pepper. The dough was made with chickpeas flour.

Meals produced by the teams

<table>
<thead>
<tr>
<th>Tomato and lentil pie (Team 1)</th>
<th>Lentil sticks with hummus and Greek yoghurt dips (Team 2)</th>
</tr>
</thead>
</table>

Nutritional values Tomato and Lentil pie

<table>
<thead>
<tr>
<th>Typical values</th>
<th>100 g contains</th>
<th>Each serving (gr) contains</th>
<th>% R\textsuperscript{I}</th>
<th>R\textsuperscript{I} for an average adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
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<td>1049</td>
<td>12,5</td>
<td>8400 KJ</td>
</tr>
<tr>
<td></td>
<td>175</td>
<td>309</td>
<td>15,5</td>
<td>2000 Kcal</td>
</tr>
<tr>
<td>Fat</td>
<td>12</td>
<td>22</td>
<td>31</td>
<td>70 g</td>
</tr>
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<td>of which saturates</td>
<td>6</td>
<td>10</td>
<td>48,6</td>
<td>20 g</td>
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<tr>
<td>of which monounsaturated</td>
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<td>8</td>
<td></td>
<td>g</td>
</tr>
<tr>
<td>of which polyunsaturated</td>
<td>1</td>
<td>2</td>
<td></td>
<td>g</td>
</tr>
<tr>
<td>Carbohydrates</td>
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<td></td>
<td>g</td>
</tr>
<tr>
<td>of which sugars</td>
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<td>4</td>
<td>4,9</td>
<td>90 g</td>
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<tr>
<td>Fibre</td>
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<td>g</td>
</tr>
<tr>
<td>Protein</td>
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<tr>
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<td>Salt</td>
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<td>0,65</td>
<td>10,8</td>
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</table>

*R\textsuperscript{I} = Reference Intake

Nutritional values Lentil sticks with hummus and Greek yoghurt dips

<table>
<thead>
<tr>
<th>Typical values</th>
<th>100 g contains</th>
<th>Each serving (gr) contains</th>
<th>% R\textsuperscript{I}</th>
<th>R\textsuperscript{I} for an average adult</th>
</tr>
</thead>
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<tr>
<td></td>
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<td>605</td>
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<td>70 g</td>
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<td>of which monounsaturated</td>
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<td>g</td>
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<tr>
<td>of which polyunsaturated</td>
<td>2</td>
<td>7</td>
<td></td>
<td>G</td>
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<tr>
<td>Carbohydrates</td>
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<tr>
<td>of which sugars</td>
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<td>12</td>
<td>13</td>
<td>90 g</td>
</tr>
<tr>
<td>Fibre</td>
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<td>27</td>
<td>59</td>
<td>46 g</td>
</tr>
<tr>
<td>Sodium</td>
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<td>1031</td>
<td></td>
<td>mg</td>
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<tr>
<td>Salt</td>
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<td>2,57</td>
<td>43</td>
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</table>
2. Conclusions

Few studies have addressed appetite control of the elderly and how to deliver food to maximize nutrition. The current data shows that by manipulating the dose, timing and distribution of protein intake it is possible to enhance the delivery of protein in the diet, without compromising subsequent intake. Working alongside the food/drinks industry, food scientists and food manufacturers, it may be that plant or vegetable sources of protein can be effectively utilised as part of a healthy but sustainable diet. It is unlikely that the population will turn to a complete vegetarian diet, but substitution of alternative (non-meat) sources of protein may be a sustainable route for consumers. Protein remains a promising dietary tool to control appetite during weight loss. The source of protein and the role of complimentary proteins in an attempt to work on the quality of proteins than quantity seems prudent.

Designing foods for specific situations like in elderly patients with poor appetite may modulate the pathophysiological processes leading to muscle loss. Future partnership with the food industry sector will help design and create foods for specific situations such as poor appetite in elderly patients, which may modulate the pathophysiological processes leading to muscle loss. Recent evidence is limited and more studies are needed in this field to better elucidate the underlying mechanisms and understand the existing links between appetite regulation and dietary protein consumption in elderly people. There is definitely lack of evidence with regards to the role of plant proteins for sarcopenia in ageing population.