When technology meets nutrition: do apps contribute to food well-being (FWB)?

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Abstract
Food consumption is increasingly mentioned as a fundamental of health, but also as a major source of health risks. Harmful consequences of overeating fat, sweet and salty food and of ingesting undesirable additives and pesticides have been scientifically established and are understood by an increasing number of consumers. Eating healthy is a primary concern for consumers, but beyond their will, it requires knowledge and time to look for and to process all the information about the numerous food products they compare and choose everyday. In this context, nutritional apps seem to be a solution to simplify information processing and decision-making. Literature on nutritional apps focuses on the consequences of using these apps on health or diet. Yet, the well-being attached to food consumption cannot be reduced to its dietary and functional aspects. Therefore, the objective of this article is to characterize the impact of using nutritional apps on food well-being (FWB), as conceptualized by Block et al. (2011). To this aim, a qualitative study based on semi-directive individual interviews was led on 14 French users of the major French nutritional app, *Yuka.* Our results reveals that nutritional apps are not fully consumer-oriented and only partially contribute to FWB. Indeed, they are not adapted to consumers' special needs and focus on health instead of embracing the diverse dimensions of consumer's FWB.
Key words
Food well-being, nutritional app, food consumer behaviour.

Résumé
La consommation alimentaire apparaît comme un élément fondamental de la santé, mais aussi comme une source majeure de risques sanitaires. Les conséquences néfastes d'une consommation excessive de graisses, d'aliments sucrés et salés et de l'ingestion d'additifs et de pesticides indésirables ont été scientifiquement établies et sont comprises par un nombre croissant de consommateurs. Manger sainement est une préoccupation primordiale pour eux, mais au-delà de la volonté, il faut des connaissances et du temps pour rechercher et traiter toutes les informations sur les nombreux produits alimentaires qu'ils comparent et choisissent chaque jour. Dans ce contexte, les applications nutritionnelles semblent être une solution pour simplifier le traitement de l'information et la prise de décision. La littérature sur les applications nutritionnelles s'est concentrée sur les conséquences de l'utilisation de ces applications sur la santé ou l'alimentation. Pourtant, le bien-être lié à la consommation alimentaire ne se limite pas à ses aspects diététiques et fonctionnels. Par conséquent, l'objectif de cet article est de caractériser l'impact de l'utilisation d'applications alimentaires nutritionnelles sur le bien-être alimentaire, tel que conceptualisé par Block et al (2011). A cet effet, une étude qualitative basée sur des entretiens individuels semi-directifs a été menée auprès de 14 utilisateurs français de la principale application nutritionnelle française, *Yuka*. Nos résultats révèlent que les applications nutritionnelles ne sont pas suffisamment orientées vers le consommateur et ne contribuent que partiellement au bien-être alimentaire. En effet, elles ne sont pas adaptées aux besoins particuliers des consommateurs et se concentrent uniquement sur la santé au lieu d'inclure les différentes dimensions du bien-être alimentaire du consommateur.
Mots clés:
Bien-être alimentaire, application nutritionnelle, comportement alimentaire du consommateur.

French consumers are becoming increasingly attentive to what they eat[1]: 71% of them say they consume healthier products, they do not hesitate to exclude certain foods from their diet because of the presence of additives (64%), because of sugar, salt or fat (63%) or because of pesticides (63%). However, 78% of them feel they lack information on the impact of food on health. In this context, nutritional mobile apps have emerged to better inform consumers about food – in a store or at home. *Yuka*, *Kwalito*, *Open Food Facts*, *Scan eat* or *Is my food good* are the major nutritional apps in France, with an intuitive interface for consumers.

Eating involves a whole range of perceptions and sensations during which consumers appear to experience well-being. Food affects the way we feel (King and Meiselman, 2010) and is generally an essential part of living, a prerequisite for people's satisfaction with their lives (Grunert and Wills, 2007). However, literature on nutritional apps focuses solely on their impact on health or diet (Lowe and Fraser, 2015), without considering food well-being – a positive and multidimensional relationship with food (Block et al., 2011).

Therefore, the present study aims to determine whether – and how – nutritional apps contribute to consumers' food well-being in their personal, daily experiences. For this purpose, we conducted a qualitative study based on 14 semi-directive individual interviews and focused on consumers' relationship with food, their use of food app(s) and the evolution of consumer behaviour through the app(s). This research examines the behaviour of consumers using the main nutritional app in France: *Yuka* (8 million users in 2019). Instead of doing it only through a nutritional and functional lens, we choose the larger and holistic conceptual framework of food well-being (Block et al., 2011), making it an original approach.

After presenting the theoretical framework of food well-being and our qualitative methodology, we discuss the results of this study and outline recommendations.

Consumer tools for healthy food choices

Key barriers to healthy eating are the ability to manage time and to choose healthy foods (Reid et al., 2015). Moreover, food features have significant effects on healthful consumption (Cook, 2016). Indeed, many consumers do not fully understand nutritional information for a single product, left alone for a greater number of products (Cowburn and Stockley, 2005). They tend to incorrectly estimate nutritional information, even for simple calorie-based measures (Chandon and Wansink, 2007; Wansink and Chandon, 2006) and they tend to use a range of other cues such as "low-fat," which bias their evaluation of how "good" or "bad" a food product is for them (Wansink and Chandon, 2006).

In order to overcome these biases, two types of consumer tools were developed. First, some systems of nutrition scoring appearing on the pack have been designed to help consumers make healthier food choices in store (Dzhogleva and Inman, 2015). The color-coded labelling, providing an easy and quick interpretation, has proven to help consumers with lower self-control (thus hardly resisting food temptation) make more healthful food choices (Koenigstorfer et al., 2014).

Second, many nutritional apps have been created to help consumers better understand nutritional information about products: *Yuka*, *Open food facts*, *Scan eat*… Nutritional apps provide aggregated information about the nutritional content of one's diet, sometimes using color-coded labelling like nutrition scoring on pack. They assist users in nutritional information processing. Moreover, they enable consumers to find more detailed information on the product components (e.g. presence of additives, level of fat, salt, sugar) in an interactive and user-friendly way. Consequently, they help consumers to better understand

[1] "Sustainable food: the French more and more attentive to what they eat", IPSOS, 2016

their dietary intake (Thomas and Bond, 2014) and become more conscious of their consumption practices (Bahl et al., 2013; Sheth et al., 2011).

Food Well-Being (FWB)

Literature hence highlights tools consumers can rely on in order to make healthy food choices, such as nutrition scores on pack and nutritional apps. However, being more aware of one's dietary intake does not guarantee to improve one's food well-being, as suggested by research (Bublitz et al., 2013, Mugiel et al., 2019).

Food well-being (FWB) is a positive psychological, physical, emotional, and social relationship with food at both individual and societal levels (Block et al., 2011). In line with the transformative consumer research, Block et al. (2011) conceptualized "food as well-being" and emphasized the contributions that food could make to consumer well-being, beyond nutrition-focused health concerns. The older "food=nutrients=health" paradigm suggested a functional and medicinal, paternalistic and normative vision of food, based on restriction and Body Mass Index (BMI) surveillance. On the contrary, the FWB paradigm as proposed by Block et al. (2011) offers an integrative and holistic, positive and consumer-oriented vision of food consumption. It rather relies on attitudinal and behavioural cues than on medical quantitative indicators such as BMI. Five domains have been suggested by the authors to compose FWB: food socialization (parenting, family, meals, peers), food literacy (tools, heuristics, procedures, techniques), food marketing (consumption, cognition, emotions), food availability (accessibility, variety, availability), food policy (calorie intake, disease, personal beliefs).

Improving knowledge structures and leading to more favourable perceptions about a behaviour may only be effective when consumers are given the wherewithal to change their behaviour (Lowe et al., 2015). In this context, nutritional apps might be a solution to improve FWB. Indeed, in addition to providing self-benefits such as knowledge and improved decision-making, apps provide relational benefits (feeling relaxed, enjoyed and rewarded, better mood, attention held) and collective benefits (users feel more a part of their community and better citizens through the values they share with other users) (Alnawas and Aburub, 2016; Calder et al., 2009; Nambisan and Baron, 2007). However, nutritional balance is part of health, which is only one of the various conditions of well-being. In addition, optimizing dietary intake using a food app may have negative side-effects on relationship with food and, in the end, lower FWB. Therefore, the following study aims to determine to what extent nutritional apps contribute to consumers' FWB in their personal, daily experiences.

Sample, data collection and analysis

Fourteen semi-directed individual interviews were conducted with consumers (see appendix) that downloaded the nutritional app *Yuka* (8 million users in France) more or less recently, or at least that knew this app. The first segment of the interview guide dealt with consumers' relationship with food. A second part dealt with their use of food app(s). A third part dealt with the evolution of consumer behaviour through the app(s). The sample provided sufficient data for thematic saturation to be reached (Goulding, 2005 ; Guest et al., 2006) and for overall themes to be conceptualised. To analyse content, we grouped together respondent observations by theme (Tesch, 1990 ; Savoie-Zajc 2000). We then coded observation operations. Employing an abductive approach, the data were analysed and categories of meaning were allowed to emerge from respondent remarks.

Results

Content analysis corroborates the elements identified in previous studies especially through the five domains suggested by Block et al. (2011). However, even though all domains are represented, the results highlight ambivalences or contradictions in the respondents' speeches.

1. Food socialisation

Pleasure, pedagogy and discussion Vs Discomfort and conflict

Respondents explain how pleased they feel when preparing a healthy meal for their family and friends, for Pascal (59) "*When I cook for my family or friends, I take more pleasure in cooking healthy foods that I have been able to select thanks to the Yuka app*". Nutritional apps also provide food education to children by showing them "*What they eat and how it is evaluated through the app*" (Myriam, 49). Thus, nutritional apps make it possible to negotiate common choices in the family, they generate discussions that democratize nutrition: "*We have spoken more with children about nutrition with Yuka*" (Anne-Marie, 71). Besides, respondents indicate the conflicts that the app can generate: "*My children hate me (laughs). Because I only take organic food now. I don't even buy Nutella anymore.*" (Elise, 40). They may also feel embarrassed when they use the app in store "*I sometimes don't feel good, almost criminal, at scanning openly*" (Myriam, 49).

2. Food literacy

Information availability Vs Expected information

Respondents appreciate having a quick access to nutritional information: "*I use Yuka to see the quality of the products I buy and that we don't necessarily suspect*" (Chantal, 55). Similarly, for Fabien (33) "*The app makes it simple to analyse a product*". This information has allowed them to develop their nutritional expertise: "*With Yuka, I have developed an interest in the composition of the foods I eat*" (Luc, 66). They distance themselves from the app's recommendations by selecting the information that seems most relevant to them: "*If it tells me there are too many additives, I don't like it. If it tells me it's too fat or too sweet, it's not a big deal, I'll take it.*" (Françoise, 66). Along with the development of their nutritional expertise, they expect more information on food origin, pesticides or farming methods: "*The first criterion is the origin and it is not indicated*" (Pascal, 59); "*I would like to have more information on pesticides. When I buy a non-organic product, I don't know if there are many or few pesticides in it*" (Elsa, 35); "*Concerning meat I would like to have more details. With or without GMOs? With or without antibiotics?*" (Thomas, 39).

Yuka for efficient decision-making Vs Pleasure disconnection

Respondents indicate that nutritional apps automatically encourage healthy choices: "*Thanks to Yuka, I'm aware that what I eat is good for my health*" (Patrick, 65); and help avoid unhealthy choices in conscience: "*Yuka is the little angel who tells me what to eat or not to eat*" (Julie, 20), "*If I scan the product during my shopping and it appears to be unhealthy, I don't buy it*" (Chantal, 55). Despite healthier food choices thanks to the nutritional app, they say that it totally disconnects them from the pleasure of cooking: "*If only Yuka offered recipes with the emphasis on products that are good!*" (Pascal, 59); "*My colleagues scanned a plastic ready-cooked dish and said, "Oh great, it's 88 out of 100 on Yuka!" You shouldn't replace fresh food with plastic ready-cooked dish because they're 88. I place all my love in the food I cook!*" (Myriam, 49).

Satisfaction Vs Guilty feelings

Respondents indicate their satisfaction from having chosen their food well: "*When I eat my Gerblé cookie, which is healthier than the sugar and fat-filled cookies I used to eat, I realise it won't hurt me, I enjoy it*" (Patrick, 65). However the use of nutritional apps can produce a guilty feeling when the food is classified "orange" or "red": "*Yuka make us feel guilty.*" (Luc, 66); "*I went shopping with Yuka, and I was depressed! What I was taking really wasn't rated well, it seemed like I could only buy vegetables from now on!*" (Elise, 40).

Mindful food shopping Vs Time pressure

The nutritional app contributes to mindful food shopping, for Thomas (39) "*It motivates us to take more time to do our shopping, that's good! We have to see it as a necessary time to eat better, to take care of ourselves and our family*". Nevertheless, time pressure can question the use of nutritional apps and mindful food shopping: "*It takes a while to look at everything on it because you have to click, to look... Usually I don't have time*" (Lucie, 19).

3. Food marketing

Yuka for a rational brand choice Vs Emotional brand choice

The information provided by the nutritional app will be of greater significance than the brand when choosing a product: "*With Yuka, you realise that Intermarché or Carrefour products are as good as branded products*" (Augustin, 27). Respondents even try to find alternatives to the most famous brands "*For my children, when I use the app, it is mainly to find alternatives to products that they wish to eat... Kinder for example!*" (Elsa, 35). But when brand loyalty is strong, *Yuka*'s evaluation comes next: "*I love Granola cookies, I know it's not good, but I love it... So I don't scan them and I buy them, even if I were scanning them, it wouldn't change my decision.*" (Thomas, 39).

Trust in the information provided Vs Mistrust toward the integrity of the app

Respondents trust the information provided by the nutritional app. They compare the products and follow the suggested alternatives: "*Instead of cookies that appear in red, now I buy Gerblé cookies because Yuka recommended them to me and the score is better*" (Patrick, 65). Nutritional apps rebalance power for the benefit of consumers "*It is a counter-power to the purchasing chains. In the sense that it is a counterweight to hypermarket marketing.*" (Luc, 66). However, despite this trust in the information provided, some respondents expressed mistrust toward the nutritional app: "*Is this app really objective? Aren't there some big brands behind it that orient you more on this or that product? We don't know.*" (Elise, 40).

4. Food availability

Freedom Vs Frustration

The variety of products offered in the possible alternatives on nutritional apps simultaneously creates freedom in product choice and frustration. Respondents explain that the alternatives help them choosing practical products with a good nutritional score "*Cereal Bio prepared food rated between 90 and 100, at least that's not bad, when you don't have time, you do what you can*" (Myriam, 49); and sometimes they go to another distribution channel that offers better products: "*The app suggests several products, not necessarily more expensive. It could be a Lidl product. Besides, Lidl products are very well rated.*" (Françoise, 66). However, respondents may feel frustrated with alternatives that are not always available in store: "*I sometimes take the products that are recommended, but often they are not products from the same store. I won't drive 10 km to buy another fruit juice with less sugar*" (Elsa, 35). Also, the alternatives are not always to the person's liking "*It was not easy to find the right products, sometimes it was not to the children's liking*" (Fabien, 33). Finally, frustration can be generated by products that consumers would like to scan, but that do not have a barcode: "*There should also be a code for bulk products*". (Patrick, 65).

5. Food policy

Yuka Vs Nutrition labels on pack

Yuka seems much simpler than the classic nutritional labelling available on pack, "*I'm not going to look at the labels and watch them in detail*" (Françoise, 66); "*I can't read the labels, even with glasses, while with Yuka I can*" (Anne-Marie, 71). Some respondents noticed the Nutriscore. The habit of using the global rating format proposed by Yuka may encourage consumers to consult it more "*I look at Yuka because it has a nice presentation. Now I see that scores are sometimes in view on the pack in store, so maybe I'll look at them*

more"(Augustin, 27). Nevertheless, compared to *Yuka*, it can be mistrustful: "*I don't trust what the food industry calls nutritional score*" (Myriam, 49).

Personal benefits Vs Societal benefits

Some respondents indicate that *Yuka* provides personal benefits by helping them to manage special diets such as cholesterol: "*On Yuka, I check the composition of foods, whether they are high in cholesterol or not, and I don't buy those who can increase cholesterol*" (Patrick, 65). Also, it helps them take care of their health: "*What I'm looking for on Yuka is the health side, trying not to buy products that could poison us*" (Thomas, 39). Beyond personal benefits, respondents question the societal benefits of nutritional apps: "*I'd like to have information about the pack, not just on content. Which plastic is it? Will it be easy to recycle?*" (Elsa, 35).

Discussion/conclusion

From a theoretical point of view, our main contribution consists in showing that, while nutritional apps are designed to help consumers with their food shopping experience, paradoxically, they do not fully contribute to their FWB. Indeed, the use of nutritional apps does contribute to each of the dimensions of FWB identified by Block et al. (2011), but in a reductionist way for two main reasons. First, these apps are not fully consumer-oriented and lack a possible adaptation to consumers' special needs: diets, differences in terms of sensitivity to food components or food production, available time for food shopping, presence of children in the household. Second, these apps base their scores solely on health and not on well-being. Food is considered as a simple addition of components (nutrients and additives in particular), recommendations are functional and normative. Conversely, in a holistic vision, food is seen as more than the sum of its components, and food consumption has a wide variety of dimensions. For example, recent research highlights the consequences of processed food in comparison to freshly prepared dishes and meals: beyond components, the way the food is prepared impacts health and well-being (Monteiro et al. 2018).

Overall, this study shows that some consumers preserve their FWB by using nutritional apps occasionally and by keeping some distance with indicated scores and recommendations: they integrate their own criteria when evaluating food and take into account the quantity they'll eat and how they'll prepare it. This result calls for new research to better understand the process followed by consumers to adopt, use and eventually emancipate from nutritional apps.

From a managerial viewpoint, this research suggests several improvements for existing nutritional apps in order to better contribute to FWB. First, such apps could offer a customization of nutritional scores and recommendations: by taking specific diets (e.g. vegetarian, vegan, gluten-free, lactose-free) into consideration and by enabling users to choose the weight they attribute to each food component. In order to encourage a more positive, social vision of food, apps could also go beyond nutritional considerations: include recipes and product combinations, encourage consumer interactions by enabling users to share their experience with others (e.g. best alternative found for a given product), giving the platform a sense of community. This study also calls for more collaboration between food producers / retailers and nutritional apps in order to better satisfy consumer needs. For example, producers could willingly communicate data on the country of origin, the farming method and the ecological impact of the pack to the apps, which would then inform consumers. Given the rising use of bulk bins to buy dry products (Beitzen Heineke et al., 2017), retailers should also make sure that all foods have a barcode that can easily be scanned.

From a public health standpoint, nutritional apps are used by a significant part of the population (e.g. 8 million users for *Yuka* in France) and hence may interact with public health policies. This research shows indeed that such apps increase consumer knowledge on public

health issues such as an excessive consumption of salt or saturated fat. Moreover, with the recent introduction of "Nutriscore" – traffic light labels for foods – in France, nutritional apps such as *Yuka* prepare consumers to this information format (making the interpretation easier) and may increase their awareness.

While abundant and adequate precautions were taken, our study is not without a number of limitations that could be eliminated or examined in future research. First, it would be relevant to extend our research to other population groups since culture affects consumers' perception of well-being in a food context (Ares et al., 2015). It would be interesting to test the impact of nutritional apps on the different dimensions of FWB identified in this article through a quantitative study, taking into consideration other apps than *Yuka*. It would also be interesting to take into account behavioural intention and behavioural expectation (Maruping, Bala, Venkatesh, Brown, 2017) to predict acceptance of apps.

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APPENDIX : Respondent Profile

Name	Age	Profession
Lucie	19	Student
Julie	20	Student
Augustin	27	Seller
Fabien	33	Computer scientist
Elsa	35	Teacher
Thomas	39	IT project manager
Elise	40	Assistant
Myriam	49	University teacher
Chantal	55	Assistant
Pascal	59	Artisan/merchant
Patrick	65	Retired (merchant)
Luc	66	Retired (practitioner)
Françoise	66	Retired
Anne-Marie	71	Singing teacher