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Original Research Article

A study of ultra-processing marker profiles in 22,028 packaged ultra-processed foods using the Siga classification

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ABSTRACT

Ultra-processed foods (UPFs) are characterized by the presence of markers of ultra-processing (MUP), either additives (A-MUP) or non-additive ingredients (NA-MUP). The present study aims to characterize the MUP profile of approximately 22,000 UPFs, representative of assortments in French supermarkets. UPFs were ranked according to Siga classification within five UPF technological groups, from C01 to C3, depending on the nature and number of MUPs (MUP1 and MUP2), presence of risk-associated additives, and contents of salt, sugar and/or fat. Then, UPFs were categorized within 10 food categories. The results showed that UPFs contain more NA-MUPs than A-MUPs, on average 1.3 more by UPF. The main MUPs are NA-MUPs, *i.e.*, refined oils (52.5 % of UPFs), extracts and natural aromas (42.7 %), synthetic aromas (26.5 %), glucose syrup (20.0 %), native starches (19.1 %), and dextrose (16.2 %). The NA-MUP/UPF and A-MUP/UPF ratios were not correlated in the 10 food categories. Among UPFs, 19 % contained only one MUP, and 31 % contained more than five MUPs. In conclusion, additives are not a sufficient marker of ultra-processing. It is proposed that NA-MUPs in UPFs should be taken into greater consideration and that foods be scored with indices based on the degree of processing, not compositional scores, which fail to filter MUPs.

1. Introduction

More than forty-three epidemiological studies have shown that excessive and regular consumption of ultra-processed foods (UPFs) was positively associated with several chronic diseases, notably overweight/obesity, type 2 diabetes, cardiovascular diseases and total cancers, and all-cause mortality (Lane et al., 2020; Pagliai et al., 2020; Askari et al., 2020; FAO et al., 2019), and UPF consumption has also been associated with DNA damage (Edalati et al., 2020) and shorter telomeres (Alonso-Pedrero et al., 2020). Prior to the development of the UPF concept in 2009 (Monteiro, 2009), other studies also showed the importance of the degree of food processing for health, *e.g.*, whole-grain *versus* refined cereals, fruits *versus* 100 % fruit juice *versus* sweetened fruit juices, red *versus* processed meats, and minimally *versus* highly processed plant-based foods (Fardet and Boirie, 2014; Satija et al., 2017).

Ultra-processed foods were assessed using the NOVA classification according to the extent and purpose of processing in four technological groups: un/minimally processed foods, culinary ingredients, processed foods and UPFs (Moubarac et al., 2014). The Siga classification extends the NOVA classification with additional subgroups, taking into account added salt, sugar and fat contents; "at risk" additives; "matrix" effects; ultra-processed ingredients; and the number of markers of ultra-processing (MUPs), where UPFs are defined as "*characterized by the presence of at least one deliberately added substance obtained by synthesis or by a succession of physical, chemical and/or biological processes leading to its purification and/or substantial deterioration compared to the original material in the list of ingredients. UPFs can also be created by the direct application of a deterioration process (e.g., extrusion-cooking) to the food matrix. These substances are named MUPs and can be indifferently an ingredient or an additive, most of which are obtained by technological processes relating to cracking or synthesis*" (pages 2031–2032) (Davidou et al., 2020). Therefore, Siga distinguishes additive MUPs (A-MUPs) and non-additive MUPs (NA-MUPs). Finally, the Siga classification distinguishes, from the least to the highest processed, nine technological groups combining previous NOVA groups with five more specific sub-groups; then foods are ranked according to an algorithm based on a decision tree including criteria mentioned in Fig. 1.

NA-MUPs are mainly aromas (synthetic, extracts and natural

Abbreviations: MUP, marker of ultra-processing; A-MUP, additives MUP; FSA, Food Standard Agency; NA-MUP, non-additive ingredients MUP; UPF, ultra-processed food.

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