



**Escola Nacional
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UNIVERSIDADE NOVA DE LISBOA

**Evaluating children exposure to digital marketing of
unhealthy foods in Portugal with World Health Organization
Framework CLICK**

Curso de Mestrado em Saúde Pública

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Evaluating children exposure to digital marketing of unhealthy foods in Portugal with World Health Organization Framework CLICK

Dissertação apresentada para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Saúde Pública, realizada sob a orientação científica do Professor Doutor Adalberto Campos Fernandes, do Professor Doutor João Rodrigues da Silva Breda e da Prof. Doutora Maria João Gregório.

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ABSTRACT

Introduction: Exposing children and adolescents to marketing of unhealthy food and beverages impacts their eating preferences and behaviour, affecting their body weight. Hence, the World Health Organization recommends restricting and monitoring such marketing. This study aims to provide insights on the exposure of Portuguese children to digital marketing of HFSS foods and beverages from different sources. **Methods:** Three steps of the World Health Organization Framework – CLICK – were applied. This consisted of a review of published-available data for Portugal, a content analysis of YouTube videos from two popular influencers among Portuguese children and a pilot-study with 11 children testing a software that identifies paid-for digital marketing aimed at children. **Results:** Of the 68 YouTube videos analysed, 60% of these included food and beverage cues, of which 70% were classified as less healthy. Ready-made and convenience foods (23.1%) were the most frequent featured products. In the pilot study, the participants were exposed to 162 ads on YouTube (n=9) and 670 ads on Instagram (n=6 children). 1.9% of the YouTube ads and 3.6% of the Instagram ads promoted HFSS foods and beverages. **Conclusion:** This study tested novel methodologies, providing insights on the current situation in Portugal where children are being exposed to HFSS food from paid-for advertising. Additionally, and given the growing body of evidence on the impact from influencer food marketing on children's eating behaviour, this exploratory study provided important insights on the digital content which children are being exposed to. More research is undoubtedly needed in this area.

Keywords: food marketing, digital marketing, children, influencers, monitoring

RESUMO

Introdução: A exposição das crianças ao marketing digital de alimentos e bebidas não saudáveis influencia as suas preferências, comportamentos e o seu peso corporal, sendo uma recomendação da Organização Mundial da Saúde a restrição e monitorização desta exposição. Este estudo pretende explorar a exposição das crianças portuguesas ao marketing digital de alimentos e bebidas com elevado teor de gordura, açúcar e sal (“HFSS”). **Métodos:** Foram implementadas três etapas da Framework da Organização Mundial da Saúde Europa – CLICK, através da realização de uma revisão de estudos publicados, uma análise de conteúdo a vídeos de YouTube de dois influenciadores, populares entre as crianças portuguesas, e um projeto piloto, com 11 crianças, para testar um software que identifica publicidade paga. **Resultados:** Dos 68 vídeos do YouTube analisados, 60% incluíram referências a alimentos e bebidas, dos quais 70% foram classificados como menos saudáveis. As refeições pré-preparadas e de conveniência (23,1%) foram os produtos mais frequentes. No estudo piloto, os participantes foram expostos a 162 anúncios no YouTube (n=9 crianças) e a 670 anúncios no Instagram (n=6 crianças), tendo 1,9% dos anúncios do YouTube e 3,5% dos anúncios do Instagram promovido alimentos e bebidas “HFSS”. **Conclusão:** Este estudo testou metodologias inovadoras, permitindo obter uma indicação da situação atual em Portugal, na qual as crianças estão a ser expostas a publicidade paga de alimentos “HFSS”. Adicionalmente, e considerando a crescente evidência do impacto do marketing alimentar promovido por influenciadores no comportamento alimentar das crianças, este estudo contribuiu para uma melhor compreensão do conteúdo desta exposição. É, inquestionavelmente, necessária mais investigação nesta área.

Palavras-chaves: marketing alimentar, marketing digital, crianças, influenciadores, monitorização

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LIST OF ABBREVIATIONS

Ad - Advertisement

AVMSD – Audio-visual Media Services Directive

DGS - Directorate-General of Health

DMP – Data Management Platform

DSP – Demand Side Platform

ECHO - Commission on Ending Childhood Obesity

EU – European Union

GDP – Gross domestic product

GDPR - General Data Protecting Regulation

HFSS – high in fat, sugar and/or sodium

INSA – Portuguese National Health Institute Doutor Ricardo Jorge

NPM – Nutrient Profile Model

OECD – Organisation for Economic Co-operation and Development

PT-NPM – Portuguese Nutrient Profile Model

REFCAM – Reactivity to Embedded Food Cues in Advertising Model

SSP – Supply Side Platform

TYNY – This Year Next Year

UK – United Kingdom

UN – United Nations

WHO – World Health Organization

1. INTRODUCTION

Childhood obesity is an important and serious public health challenge and priority, demanding a comprehensive approach to tackle it (1). In Portugal, according to the Childhood Obesity Surveillance Initiative from the World Health Organization (WHO), in 2019, 29.6% of the Portuguese children had overweight, of which 12% were living with obesity.

Childhood obesity can persist into adulthood and is strongly associated with adult comorbidities (2). Obesity can impact child's health, quality of life and academic performance. It can have several outcomes, such as high blood pressure, dyslipidaemia, type 2 diabetes, increased risk of broken bones and other metabolic and cardiovascular complications (3-7). On the other hand, it can have psychosocial consequences, such as anxiety, depression, low self-esteem, and children may suffer from bullying, which can result in poorer school performance (3).

Obesity is a complex and multifactorial disorder. The energy imbalance, resulting from a consumption greater than the body effectively spend, is deeply influenced by the obesogenic environment. Such environment is characterised by changes in the production, availability, marketing and prices of food, as well as a decrease in physical activity with an intensification of screen-based and sedentary activities (1, 8, 9). The marketing of ultra-processed and energy-dense food products, considered extremely flavoursome, contributes significantly to these environments, and substantial evidence demonstrates the influence of these food and beverages on children dietary habits (10-14). As a result, public health experts (15), the American Association of Pediatrics (16), as well as leading global health agencies, such as the WHO, have recommended implementation of policies to restrict or eliminate unhealthy food marketing to children¹ as a critical strategy for obesity prevention (17). According to the OECD, regulation on advertising is the policy with the highest return on investment, with 5.6 US Dollars returned in GDP benefits for every US Dollar invested (18).

In Portugal, since 2009, national food companies have signed a set of common commitments, under the European Union Pledge. Companies have committed to not advertise food on mass media where children under 12 years old make up 35% of the

¹ Henceforth, the terms "child", "children", "youth" and "young children" are used to refer to children under the age of 18 years, in line with the United Nations Convention on the Rights of the Child (17) and the WHO Ending Childhood Obesity Commission report (1), hence "children" refers to both children and adolescents.

audience, unless their products comply with category-based thresholds on sodium, saturated fat and total sugar and no marketing related to these products is permitted in primary schools. In November of 2018, the European Union's Audio-visual Media Services Directive (AVMSD) was published and required transposition by countries into national legislation after 21 months, harmonising all national legislation on all audio-visual media, both traditional TV broadcasts and on-demand services (19). In 2019 a statutory regulation was approved in the Portuguese Parliament. The Law no. 30/2019 of 23 of April restricts the marketing of foods and drinks that are calorie dense, nutrient poor and high in salt, sugar, saturated fat and trans fatty acids (HFSS) aimed at children under 16 years old (20). The law covers the schools, public playgrounds and a 100 m-radius around these places; television, on-demand media services and radio, in the 30 minutes preceding and following children's programmes, as well as programmes with an audience of at least 25 % below 16 years; cinemas, in films with an age rating for children under 16; and also, websites, social networks and mobile applications where the contents are intended for children under 16 years of age. The food and beverage products must meet the nutritional criteria defined in the Portuguese Nutrient Profile Model (PT-NPM), developed by the Directorate-General of Health (DGS), based on WHO Regional Office for Europe Nutrient Profile Model (21, 22).

This law was an imperative step towards reducing children's exposure to the marketing of unhealthy foods and drinks in Portugal. Nevertheless, monitoring and evaluating it's crucial and challenging to ensure compliance with the law and protect children and young people. In Portugal only food marketing on TV and on some brands' websites has been measured (23). Nonetheless, digital marketing presents significant barriers to accurately measure and access it (24). Once the time spent online is increasingly shifting to social media and mobile devices, especially by young people, personalized and targeted advertising predominates. Also, the assessment of children's exposure to marketing is usually self-reported, which is less reliable. Therefore, it is essential to monitor and aggregate data on children's interaction with some websites and social media itself, and to collect reliable data on this topic.

Heretofore, research has been exploring different aspects of children's exposure to digital marketing of unhealthy products, by analysing the proportion of HFSS foods and beverages on websites popular among children (25) and on social media (26-29), as well as recording children's own interaction with some social media apps (30). Considering

the complexity and barriers to evaluate the extent to which children are exposed to the marketing of unhealthy products online, the World Health Organization Regional Office for Europe (WHO/Europe) developed a monitoring framework – CLICK (31). Until the present moment, very few countries have started to pilot some steps of CLICK. This is the first study that presents data on children's exposure to digital marketing of unhealthy foods and drinks in Portugal, by piloting some steps of the WHO CLICK monitoring Framework. Such results are crucial for evaluating the coverage and compliance of the Portuguese Law nº 30/2019 of 23 of April. Nonetheless, this study is also relevant to test the developed innovative methodologies and to begin understanding the actual exposure of children to digital marketing, on a national, but also a regional level.

This dissertation is structured in six sections. In the first section is presented the literature review of the studied subject, namely the food marketing and its influence in children's preferences and choices, highlighting the digital marketing and social media influencers, that are the focus of this work. Thereafter it is explored the importance of restricting the children's exposure to digital marketing and the strategies to achieve it, as well as the challenges to monitor such exposure. The second section defines the main and specific objectives of the study. The methodology is described in the third section, including an explanation of the WHO monitoring Framework (CLICK), as well as the steps, and corresponding methods, of the Framework applied in this thesis. The fourth section presents the results of each of the three steps of CLICK. On the subsequent section, the results are discussed, exploring the challenges and limitations of each of the approaches foreseen in the Framework. Some recommendations for intervention on a public health level are also presented in this section. Lastly, on the sixth section the main conclusions of the study are described.

2. LITERATURE REVIEW

2.1 Food marketing and children's food choices

The WHO Recommendations on the marketing of foods and non-alcoholic beverages to children define marketing as “*any form of commercial communication or message that is designed to, or has the effect of, increasing the recognition, appeal and/or consumption of particular products and services. It comprises anything that acts to advertise or otherwise promote a product or service.*” (17).

Comparing to other age groups, children are preferentially targeted to a greater extent, (32). This is likely since children can affect sales in diverse ways: children may independently spend money (pocket money is often spent in snacks – primary market), they may influence family expenditure (when accompanying parents to the supermarket requesting for desired products – parental market) and children will become adults that are responsible for their own food choices and for those dependent on them (future market) (33, 34).

Some social cognitive theories foresee that repeated exposure to food advertising may induce beliefs and attitudes without consciously processing the information presented. Herewith, food marketing outcomes can occur without the awareness of the marketing stimulus, being adolescents especially susceptible to it (35). The Food Marketing Defense Model, established by Harris et al., proposes four necessary conditions to defend against influence of unhealthy food marketing: *awareness* of marketing stimuli, including conscious attention to a stimuli and considering its persuasive intent, *understanding* of how we are affected and the outcome (e.g. liking the brand, consuming more food), as well as understanding how to resist to that influence effectively, *cognitive ability* to resist plus available cognitive resources at the time of expenditure, and *motivation* to resist (35). This theoretical framework offers insights on how adolescents and adults, despite understanding the persuasive intent, can be influenced by marketing (36). Additional evidence has also revealed that adolescents' brains are biased towards rewards, being very sensitivity to environmental cues (37). On the other hand, children are particular vulnerable to the effects of marketing (33, 38, 39), becoming more conscious, as they grow up, of the vending intent of advertising. A literature review about children's consumer socialization suggests that three stages may occur: perceptual stage (3-7 years old), analytical stage (7-11 years old) and reflective stage (11-16 years old) (40). Children, with 4-5 years old, may distinguish an advert from a programme by its length and format, but it's only during the analytical stage that children become aware

of the selling intent of advertising. As stated above, even after the reflective stage, adolescents may still not have the cognitive skills to recognise the persuasive intent of marketing, alongside adults (35).

Certain marketing strategies, such as social media marketing, viral marketing (advertising content and messages spread among peers), celebrity endorsements and product placement may be more powerful and dangerous to older children and adolescents, compared to other marketing practices, as they are establishing their own identity and these marketing strategies appear to be even more appealing (35). Together, the combination of media platforms and techniques used within marketing communications determine the effectiveness of marketing campaigns. Thereby, this effectiveness depends on the exposure to the messages and on the persuasive power of that same messages (17). Exposure refers to the extent, frequency and impact of the messages. It depends on the media platforms used for spreading the message, on the marketing expenditure, and on children's media use. The persuasive power of marketing depends on the actual content, design and performance of the marketing messages. As so, marketing campaigns focus on delivering frequent persuasives messages to the audience (41). Consequently, children's perceptions, attitudes, and decisions, are not simply influenced by the exposure to a brand, but mainly by the highly sophisticated advertising techniques used to deliver that message, such as rewarded video advertising and humour (42, 43). Another popular strategy among children, and particularly designed for them, is advergimes² which can induce unhealthy eating behaviour (39).

There are several mechanisms that can explain the effects of screen media exposure on obesity. The increased screen time may lower physical activity, impair sleep patterns and increase energy intake both from eating while viewing and from the effects of advertising itself (44). Evidence from systematic reviews demonstrates that advertising impacts children's eating behaviour, preferences for HFSS products, nutrition knowledge and, ultimately, food intake and weight-related outcomes (10, 11, 45-47). Exposure to food advertising increases snack food consumption, especially among overweight children who seem to be more sensitive to food marketing influence (48). Kelly et al. developed a logic model of the impact of children's exposure to unhealthy food marketing, establishing a sequenced set of effects that associates food marketing exposure to several outcomes, such as children's attitudes and behaviours, as well as to weight gain and other related outcomes (46). This model explains that exposure to

² Advergimes are company-sponsored video games in which brand images and messages are embedded in the content.

marketing leads to change in attitudes (i.e., normalization of products and desire of product) and awareness of products and brands. After this, when exposed to cues at point of sale, children and young people either intent to purchase or influence their parents to do so. The acquisition is followed by consumption but no compensation for extra energy intake is made, resulting in a sustained energy imbalance. Consequently, ultimately exposure to marketing lead to weight gain and another outcomes diet related.

2.2 Current trends in food marketing

Television is one of the leading platforms for food advertising with overwhelming evidence supporting that unhealthy foods are the most promoted products, being associated with children's eating behaviours (49, 50). In 2013, in the USA, children and adolescents were still exposed to 12–16 advertisements of HFSS products per day, from TV, followed by a 50.7% increase in new media marketing expenditures (51). In fact, there have been considerable changes in advertising, with a substantial rise in the global spending on digital advertising plus the shift to mobile devices (52). European countries have now 87.7% of internet penetration (53). For younger ages, a study from OECD demonstrated that a typical 15-year-old uses the Internet since the age of 10 and spend more than two hours online after school every weekday (which represents an increase of over 40 minutes since a previous study from 2012), and more than three hours every weekend day (54).

Children and adolescents use of the internet is increasing rapidly, exceeding television watching time, and they are among the most active users of cell phones, social media and internet, raising concern from parents and governments (55). In the UK, according to the Ofcom 2018 report (55), 52% of mostly 3 to 4-year-olds go online for almost 9h a week and 48% use YouTube. In addition to this, 82% of 5-7-year-olds go online for around 9½h a week and 70% use YouTube. Regarding older children, Ofcom report demonstrated that 18% of 8-11-year-olds, and 69% of 12-15-year-olds have social media profile. 93% of 8-11-year-olds go online for nearly 13½ hours per week, while 99% of 12-15-year-olds go online for nearly 20½ hours per week.

2.2.1 Digital marketing

Digital Marketing is defined as “promotional activity, delivered through a digital medium, that seeks to maximize impact through creative and/or analytical methods” (56). Internet

and other forms of digital marketing enable immersive, interactive and integrated marketing strategies (57). Upward evidence reveals that food marketing on new media is increasing and influences children's food preferences and choices (56-58). Digital marketing has not replaced other forms of more traditional food marketing but complements and amplifies the effects of it. This increases brand presence across a greater and more diverse range of media, resulting in a greater brand and product awareness (48). Companies are shifting their ad spending in favour of digital marketing, where young people can be reached and engaged, particularly on social media platforms (51). Therefore, and once their cognitive abilities are still developing, children need special protection from digital marketing exposure (33, 40, 59). However, parents are often not fully aware of the risks their children face when online, considering that they are not affected (60). In Portugal, a 2016 survey indicated that only 13% of the respondent parents agreed that their child can easily access inadequate content on the internet (61).

Once the time spent online is increasingly shifting to social media and mobile devices, personalized and targeted advertising predominates (62). Market research firms, advertising agencies, trend analysis companies, and digital strategists are continually monitoring children engagement with new media. Digital media allows the delivery of unprecedented volumes of information in real-time, often using artificial intelligence-enabled tactics (63). Such possibility of collecting, analysing and using extensive volumes of information - the so-called 'Big Data' - has also contributed to digital marketing changes. Due to the rise of new sources of data and sophisticated data analytics, it is possible to target individual consumers with personalized advertising on their digital devices in real-time, based on detailed information about their behaviour from both online and offline sources (64).

Media agencies use technical bidding tools called demand side platforms (DSPs) to conduct out their strategies of buying, operating and tracking advertisements (31). The DSP ensures that the advertisement is sent solely to users who are likely to have an interest in buying. When a person clicks through to a publisher's website, as it loads, a request (known as "ad impression") is sent from the website to one of the publisher's supply side platforms (SSPs). This request ("ad impression") carries an advertising identifier that allows the programmatic ecosystem to identify the person or device by which the ad impression is generated. This identifier is later used by the media agencies through the DSP bidding tools to match against databases of information about particular individuals or devices collected over time (stored within Data Management Platforms (DMPs) by various parties to better enable the targeting of advertising and,

consequently, target the ad to the person’s interest. The DSP checks the identifier embedded in the ad tag against data from the DMPs about consumers to ensure that the best match is made (31).

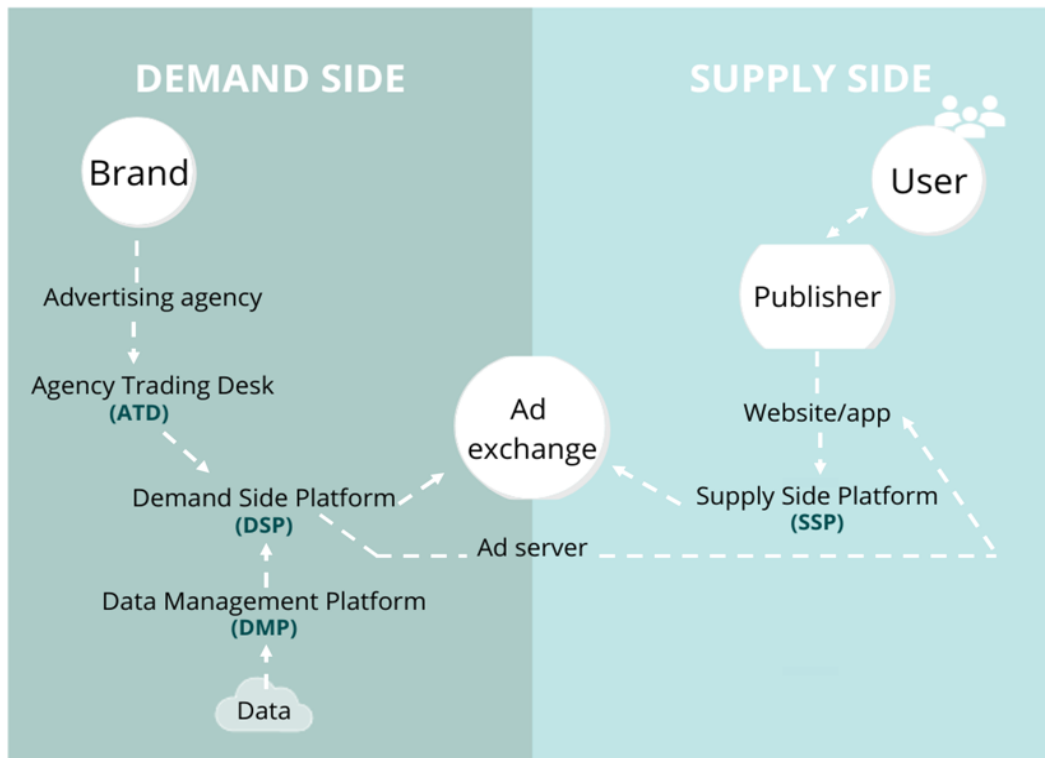


FIGURE 1. Programmatic advertising

(Adapted from *Monitoring and restricting digital marketing of unhealthy products to children and adolescents*. WHO/Europe, 2019.

The collection of large amounts of personal data, its power and the advancements in real-time analytics and algorithmic decision making, results in high engaging marketing (65). Dynamic content is produced through several strategies. *Identity information* is valuable to identify individual customers, as age, sex, home and work location, education level and family size. Geotargeting, enables *location targeting*, which allows marketers to target people in specific geographic locations – major food and beverage companies use this as their interactive marketing strategies, which is particularly dangerous to adolescents (66). Another strategy fostered by technology, is *event tracking*, that keeps track of where the user is and help to create customized web pages, according to the preferences of users, due to the occurrence of cookies (small meta files stored in users’ browsers).

Other strategies that build upon the user behaviour and preferences are also common. *Behavioural targeting* creates user affinity profiles based on the history of apps downloaded, web pages visited, and general content consumed, allowing for displaying only the relevant ads and improve the impact of campaigns. As for *profile targeting*, this strategy builds profiles based on how an individual agrees to engage in a certain activity and provide personal information. *Viral marketing* is built upon abundant data sets on social media users through the identification of influential individuals who are likely to create and share user-generated marketing messages and, consequently, promote the proliferation of this type of brand promotion. Within social media, *influencer marketing* is another common strategy, where individuals with a significant online presence promote a product, brand or service in exchange for financial or in-kind compensation – known as influencers. Influencers have thrived on social media platforms, such as Facebook, Instagram, and YouTube, which is particularly relevant to children. Lastly, *advergaming*, is another strategy particularly appealing to children, that is not clearly recognized as marketing. The advergaming are specifically designed to promote a product or a brand, by including the brand logos, images and messages in the content of the game itself. In addition to the methods mentioned above, there are various other techniques, programs and gadgets involved in achieving impact, influencing consumption of and familiarity with products appealing in more or less subtle way.

Food companies are increasingly using social media to market children (67). Advergaming, viral features to encourage children to share brand-related information to their friends, extras to continue the “brand experience” after logging off, such as screen savers or desktop logos are some of the strategies used for targeting this age group (35). Additionally, influencers, as well as social media marketing, are recognised to considerably influence the dietary choices and subsequent intake of children and young people (27, 68, 69).

2.2.2 Social media influencers

Children’s immediate brand choice and intake can be impacted by their exposure to HFSS food and beverages marketing from influencers’ social media content (68, 70). It could be argued that advertising on social networks, as YouTube and Instagram, are not also targeting children, once most of these platforms request users to be 12-years old and over. Yet, a considerable number of children are actively engaged on these platforms by accessing through their parents’ accounts or by creating their own accounts

using false date of births (30, 56). For accessing YouTube content, no age verification is required. Consequently, children are being exposed to marketing strategies and content while navigating on social media platforms. According to the Reactivity to Embedded Food Cues in Advertising Model (REFCAM) by Folkvord et al, the level of processing a food cue influences the effect of the exposure to that cue (13). In media content, food cues are usually more integrated on it, which results in a minimum cognitive process to perceive the exposure to the cue (13). Therefore, there is a lesser recognition of the advertisement by the child, being more difficult to resist marketing of this nature (13, 71).

In several social media platforms, influencer marketing impact children's immediate intake of unhealthy foods (68). Children and adolescents are exposed to unhealthy food and beverage marketing on social media apps from multiple sources including advertisements, user-generated and celebrity-generated content as well as other entertainment content (30). On Instagram, HFSS brands don't usually post "healthier" products, but sometimes imply that their products are part of a balanced diet (29). On social media, user-generated content is also very prevalent. For instance, food and beverage marketing shared by peers is considered to have a greater influence on young people, than the marketing published by the brand itself (58). HFSS products are often presented in this type of content, with brand names evident (29, 72). However, whereas this content is generated by members of the general public, is not considered to be explicitly part of a marketing campaign. Due to the methodological encounters in quantifying and analysing targeted marketing in social media (24), there are limited studies exploring this problematic.

In a 2019 study from the UK, YouTube was found to be the most popular platform amongst children and young people (73). It adapts rapidly in response to what users watch, making it easier for people to find and discover content that appeals to them. Furthermore, children usually watch content produced by YouTube video bloggers with whom they feel connected to (55, 73). 'Social media influencers' are digital personalities that by their generated content have an influence on their large numbers of followers, across one or more social media platforms (e.g. YouTube, Instagram...) (74). Food and beverage cues featured in the videos uploaded by YouTube influencers have been demonstrated to influence children's eating behaviour (70). Coates et al. analysed almost 120 hours of YouTube videos from popular UK influencers, and only less than 10% of the videos did not include any food or beverage cues, with cakes (9.4%) and fast foods (8.9%) being the most frequently featured products (28). These influencers can reach more than 15 million subscribers in the UK and more than 3 million subscribers in Portugal, impacting considerable numbers of children (75).

2.3 Strategies to reduce marketing of unhealthy products to children

Protecting children from harmful marketing practices is a human rights issue and governments that are a party to the United Nations Convention on the Rights of the Child have a duty to protect, respect and fulfil children's right to health (76). The marketing of unhealthy food to children impacts the children's core rights to health; food, survival and development; education; information; rest, leisure, recreation and cultural activities; privacy; as well as non-discrimination right (76). The right to health, for example, is related to the prevention of diseases, including non-communicable diseases, and this is effectively addressed when the environments where children live is promoting healthier choices. Therefore, food marketing is jeopardizing this type of environments, impacting the child right to health. Unhealthy food marketing towards children also involves the child's right to privacy, exceeding in different means the fundamental concept of this right. Thereafter, marketing should be considered as a form of economic exploitation, particularly the marketing that depends on the collection and analysis of children's data to target and profile children online (as digital marketing). Additionally, the General Data Protecting Regulation (GDPR), followed by the EU Member States since 2018, requires the informed and explicit consent for protecting and using data (77). Therefore, parents and guardians have the legal right, under the GDPR, to set permissions for collecting, storage and use of children's online data, specifically including data used for advertising targeting. In 2018, the Council of Europe recommended that it should be made illegal the involvement of children's personal data in automated processing, for predicting their personal preferences and behaviours (78).

The World Health Assembly adopted unanimously the WHO Set of Recommendations on the Marketing of Foods and Non-alcoholic Beverages to Children, in May of 2010 (17). These recommendations encourage Member States to take action to reduce the impact on children of unhealthy and inappropriate marketing. These recommendations have been reinforced, by the Global Action Plan for the Prevention and Control of NCDs 2013-2020 (79), by the WHO Commission on Ending Childhood Obesity (1), and recently by the WHO-UNICEF-Lancet Commission (80).

There is an indisputable need to regulate and restrict children's exposure to persuasive promotions of unhealthy foods and beverages, and the evidence reinforces the implementation of government-led and comprehensive restrictions (17). As marketing is a very broad concept, that includes broadcast and non-broadcast advertising, as well as sponsorships, food labelling claims, and several other techniques, establishing

regulatory mechanisms should be a matter for policy makers (17, 81). In fact, experts agree that stricter regulatory measures are urgently required to combat the increasingly sophisticated marketing practices which children are exposed to and that aims to increase their preference and consumption of HFSS products (82). Some efforts in regulating the use of children's data for targeted advertising are being made, however, these are not yet covering most of the companies that advertise restricted products to children (31).

There are two major potential approaches for protecting children from marketing, such as an upstream and mid-stream approach (41). The upstream policies aim to shape the economic, social and physical environments, which in relation to food marketing intend to change the media environment, reducing children's exposure to the marketing of unhealthy products, as well the power of those messages. Regarding the mid-stream approach, this aims to act on behaviours, to reduce the impact that marketing has on individuals through, for example, increasing literacy.

To support upstream regulatory approaches, in 2010 the World Health Organization released a set of recommendations to guide countries to restrict children's exposure to unhealthy food marketing and its power, in order to protect children from the harmful effects of such exposure, therefore applying a socio-environmental approach (17). Additionally, the recommendations emphasise the important leadership role of governments in policy implementation and evaluation.

However, the predominant responses to this issue are not government-led, but self-regulatory codes of practice instead, which are developed and enforced by the food and advertising industries (83). The evidence shows that these codes are not limiting effectively the children's exposure to unhealthy food and beverage advertising (25, 84). Even though these codes may reflect good corporate responsibility, they tend to be relatively vague and permissive, suggesting that are not designed to be effective (41, 84). Between the multiple factors that can contribute to this ineffectiveness, the following are underlined: voluntary enrolment (which means that the companies may withdraw or violate the initiatives without being punished), tolerant nutrient criteria for acceptability of the products to be promoted, and inadequate definitions for when and where food marketing to children can occur (84). Additionally, and given that most of social media do not meet the thresholds settled (as age limit and target audience), some self-regulatory pledges may not apply to these platforms (30).

Research has been demonstrating that the impact of self-regulation is more variable and alone has not succeeded in preventing children from being exposed to marketing of

unhealthy products (31, 85). On the other hand, considering the specifics and comprehensiveness of the legislation, statutory regulation can effectively reduce the consumption of unhealthy foods and should be broadly adopted (85, 86).

2.4 Monitoring of digital marketing of unhealthy products to children

In addition to restrict the children's exposure to unhealthy food digital marketing, it is essential to monitor such exposure, both to support the development of new measures and to ascertain the effectiveness of the restrictions already in place.

Programmatic advertising, as the automate buying and selling of targeted advertising, increases the barriers to accurately measure and access the real exposure of children to digital marketing, highlighting the need to monitor and aggregate data on children's interaction with some websites and social media itself. Several international studies, applying manual methods, have been exploring different aspects of this exposure, especially regarding adolescent's interaction with advertising on social media and with influencer marketing. The proportion of HFSS foods and beverages was analysed on websites popular among children (25) and on social media, both content generated by adolescents (26) and by social media influencers (27, 28), as well as by brands (29). In Portugal, the advertisement featured on websites and social media of the most popular food brands among children was similarly analysed (23). Broader analysis, by recording children's interaction during 10 minutes with some social media apps (through video recording glasses), has also been performed in Canada (30). All these studies demonstrate that children are exposed to unhealthy food and beverage marketing on social media, through multiple sources as advertisements, peer-generated and influencers-generated content, as well as other entertainment content, providing crucial information. With similar methodologies, the World Health Organization Regional Office for Europe has developed a training unit that includes protocols and tools (87). This training unit provides manual methods, for a smaller-scale, relatively simple and low-cost analysis, but that may also be time- and resource-consuming.

Nonetheless, such methodologies provide solely information on a specific segment, exploring some of the marketing strategies in small samples and specific contexts. Since digital marketing is brought programmatically and the advertisement is targeted, to have a deeper and comprehensive understanding of the nature and extent of the digital marketing that is actually reaching children, other approaches must be carried out. Technology and artificial intelligence play a major and fundamental role in developing

such methods and tools. Firstly, to measure the actual and own interaction of children with advertising. Secondly, to collect and analyse the data automatically. Also, such comprehensive methods are necessary to support the formulation and implementation of restrictions by governments. The World Health Organization Regional Office for Europe developed in 2019, the CLICK monitoring Framework, in order to support Member States in monitoring digital marketing of unhealthy products to children (31). The Framework includes different approaches for each country to understand its digital marketing ecosystem and major marketing campaigns, but also to identify the extent and nature of children's exposure to digital marketing of unhealthy products, by collecting information from their own devices and activity. Despite less comprehensive, some of the protocols and tools from the WHO/Europe training unit, may support countries in fulfilling several of the goals of the CLICK monitoring framework.

The CLICK Framework's combines public health approaches, both researcher- and technology-led, to monitor unhealthy content delivered to children, being a reference for data-collection and analysis on such challenging topic (88). It allows for accurately and efficiently monitor such exposure, working on country- and resource- solutions to enable adaptation to each national context. Innovative methods and protocols for both manual and automated solutions have been developed and few countries are beginning to test such approaches, including Portugal.

3. STUDY HYPOTHESIS AND OBJECTIVES

Study Hypothesis

In this study, we hypothesized that Portuguese children are being exposed to digital marketing of HFSS foods from different sources.

Main objective

This study aims to collect insights regarding the exposure of Portuguese children to digital marketing of HFSS products.

Specific objectives

- Provide an analysis of the digital marketing ecosystem in Portugal.
- Investigate the prevalence and content of food and beverage cues presented in YouTube videos of two popular Portuguese social media influencers.
- Evaluate the food and beverage cues featured, based on the Nutrient Profile Model developed by the Portuguese Directorate-General of Health.
- Test the performance of a novel software and assess the exposure of a sample of Portuguese children, to paid-for advertisements³.

³ Paid-for advertisements: paid advertisements by the brands to publish in websites

4. METHODOLOGY

4.1 Study design

This is a cross-sectional observational and exploratory study based on the WHO Regional Office for Europe monitoring Framework. In this study three steps on this Framework were piloted.

4.2 The CLICK Monitoring Framework

The CLICK Monitoring Framework is a five-step tool to monitor food digital marketing to children (Figure 2).



FIGURE 2. The CLICK Monitoring Framework

(Source: *Monitoring and restricting digital marketing of unhealthy products to children and adolescents*. WHO/Europe, 2019.)

The first step, *Comprehend the digital ecosystem*, aims to assess and map the main stakeholders and understand the digital marketing ecosystem, namely the media platforms and agencies involved; understand and analyse the investment in digital and food-related advertisement; and understand the children's online habits. The second step, *Landscape of campaigns*, intends to evaluate the media campaigns carried out by the main national brands and their viewers. The third step, *Investigate exposure*, purposes research on youth users and their parents through focus groups and technological tools to measure paid-for digital marketing. The fourth step, *Capture on-screen*, through a screen-capture software aims to identify and assess various techniques used to target young people. The CLICK Framework also offers recommendations for information sharing, public education, and advocacy for further policies.

In the present study, three steps of CLICK – *Comprehend the ecosystem*, *Landscape of Campaigns* and *Investigate exposure* – were piloted to begin understanding the context and children's exposure to digital marketing in Portugal.

4.2.1 Comprehend the ecosystem

The starting point for applying the CLICK monitoring Framework involves developing a comprehensive understanding of the structure of the digital marketing ecosystem. Even though there are some global aspects of the structure and behaviour of the ecosystem, it's important to analyse and map each market due to the meaningful national differences. A review of published-available data for Portugal was performed, analysing the following reports from relevant and reliable sources – *Reuters Institute Digital News Report 2019* (89) and *EU Kids Online Portugal. Usos, competências, riscos e mediações da internet reportados por crianças e jovens (9-17 anos)* (90).

Additionally, the report *This Year Next Year (TYNY) Global Media Forecasts* from WPP was accessed (In an email from WPP in May 2019). This report presents comprehensive and consistent data available on global media markets, every year. The World Health Organization Regional Office for Europe has been granted permission to access the data sheets for the completion of this CLICK step. Once TYNY accesses the best-estimates from each country, the data collected is not precisely equal between all countries but allows for future comparison. The TYNY report provides total marketing spend by the leading brands in the beverage, food/fast-moving consumer goods, and restaurant

sectors. Data is available for 33 relevant markets, but in this study data from Portugal, from 2017 and 2019, was analysed. The size of total media market was analysed and then compared in terms of percentage of digital, advertisement categories related to food (retail, food and drinks), as well as top advertisers that are related to food (such as supermarkets or fast-food chains).

4.2.2 Landscape of Campaigns

The second step, *Landscape of campaigns*, intends to assess the content of media campaigns carried out by the main national brands and identify their viewers. One of the approaches to understand different campaigns and the popular content is to analyse the social media content, namely YouTube videos. In order to perform this step of CLICK, it was followed the protocol, from the World Health Organization Regional Office for Europe training unit, which aims to explore prevalence and context of food and beverage cues featured in YouTube videos of social media influencers (87, 91). A content analysis of the videos uploaded by two popular Portuguese social media influencers, in their YouTube channel, was performed.

Food and Beverage Cues Presented in YouTube Videos from popular Portuguese Influencers

The videos uploaded by two Portuguese influencers on their YouTube channels were assessed and applied a content analysis, adapted from similar studies (28). This study did not aim to thoroughly cover all influencer content that children are exposed to, and, therefore focused on the influencer content that children are expected to view – selecting two popular YouTube influencers and assessing all the videos uploaded in the past year.

Both influencers were considered popular among Portuguese youth, according to Forbes Portugal (92) and to the analysis performed (Appendix 1). One male (24 years old) and one female (20 years old) were selected, to ensure gender balance - male considered obese and female considered normal weight by the authors. The female influencer had approximately 245 thousand subscribers, and the male influencer 3.7 million subscribers. Videos uploaded by these two Portuguese social media influencers over the course of one year (between July 2019 and July 2020) were analysed. A one-year period ensured the capture of a representative sample of products, since some evidence indicates that marketing of food and beverage may vary accordingly to the season (93). Since this study did not involve human subjects, ethical approval was not required.

All the food and beverage cues featured in these videos were assessed. A food or beverage cue was considered as the appearance (visual or/and verbal) of a food or beverage product or brand. This definition was in accordance to similar studies (94). The nutritional information of the displayed products was obtained by consulting company websites, supermarket's website (Continente, one of the largest supermarket chains in Portugal) and the Food Composition Database from the National Health Institute (INSA). When nutritional information was not available on these platforms, it was performed a search on the data base *Nutrition Data* (95) and on the food composition table from ANSES-CIQUAL (96).

The coding scheme was established for food and beverages featured in adverts, defined by WHO Protocol (91) and previous studies (28, 93) (Appendix 2). Multiple cues within a scene, or within a meal (e.g., McDonalds Menu), were coded individually if clearly visible. Cues that were featured multiple times in the same video were only recorded once. Prominent cues were coded or not, accordingly to the importance and emphasis given by the influencer. Peripheral cues that were not verbally referenced by the influencer were coded when the food product was clearly visible, as in the influencer hand or placed in the table next to the influencer. However, other peripheral cues were not coded, as when the product was not the main focus (e.g., the food products placed on a supermarket shelf behind the influencer or the products randomly shown in pictures/memes/videos during the YouTube video). Cues that were verbally referred to by the influencer but that were not visually present, as the influencer talking about going to McDonalds after, were also not coded due to a considered lack of prominence.

The coding of the brands featured in the cues was also performed in line with the WHO Protocol (91) and previous studies (28). When a food or beverage had an identifiable logo and/or a product name, it was coded as “branded”. The cues were categorized into one of the five mutually exclusive groups in terms of branded status – “food brand”, “food retail establishment brand”, “supermarket brand”, “unbranded” or “miscellaneous” (Appendix 2). If a food brand logo was presented even without a product, it was coded as a branded cue. For the nutritional information of this type of cues, only a food brand logo, the average values of five products of that brand were calculated. At last, the appearance of the food and beverage cues was coded in accordance to the WHO Protocol (91) and previous studies (28), within the following categories - the context in which the cue was presented, the cue description and presentation, as well as the reason why the cue was being featured (Appendix 2).

The products were initially categorised according to the Portuguese Nutrient Profile Model (PT-NPM), from the Directorate-General of Health (21), which is based on the

WHO Regional Office for Europe Nutrient Profile Model (22). The products were categorised according to the 20 food categories considered in the PT-NPM (Appendix 3). In the Portuguese NPM, if products comply with the nutrient profile defined for each category, the marketing of that product is permitted. Otherwise, marketing is not permitted. However, and according to the WHO definition, it's considered marketing when the communication is designed to increase the perception, interest and intake of that product. Since this study focused on assessing food and beverage cues, that may be included in the videos as part of the influencers' daily activities, and not with the intent of marketing that product, the cues were classified as "less healthy" and "healthy". The classification as "less healthy" included the products initially classified as "marketing not permitted" and the classification as "healthy" included the products which marketing is permitted, accordingly to the PT-NPM. This classification, as "healthy" and "less healthy" is also in line with previous studies (28).

Another category was added – "combined" – that included combination of products belonging to more than one category and that were not considered ready-made or convenience foods. Cues as "yoghurt with granola" or "crepe with chocolate and ice cream", are some of the examples of cues that were categorised as "combined". For these food cues, each of the products was classified accordingly to its PT-NPM category (i.e., in "yoghurt with granola", classification was made for both the yoghurt and the granola). If one of the products was classified as "less healthy" for food marketing to children, the whole cue was classified as "less healthy".

When the nutritional content was not available because, for example, the product was not clearly identifiable from the video, the cues were categorized as miscellaneous. Though, for statistical analysis, these cues were integrated in one of the other classifications ("less healthy" or "healthy"), accordingly to the most common classification of that category. Since the 7 cues initially classified as "miscellaneous" were in the categories "ready-made and convenience foods", "cakes, cookies and pastries" and "soft drinks and juices", all these 7 cues were classified as "less healthy".

Regarding the statistical analysis, cue categories (brand, context, description presentation and reason why cue was featured) were compared using Fisher's Exact test. The values for saturated fat, total sugars, salt and energy were compared through Mann-Whitney Test. The PT-NPM categories were not compared through a statistic test, since it's directed associated with the classification of healthy or less healthy and because it's a variable with a lot of categories (and some with small sample) which

compromises the inferential analysis. Statistical significance was set at $p < 0,05$. For the statistical analysis, it was used the IBM SPSS software (version 26.0 for Mac OS).

4.2.3 Investigate exposure

The third step of the CLICK Framework, *Investigate exposure*, comprehends the operation of technological tools to measure paid-for digital marketing. In order to do so, a pilot study was conducted to study the potential of a software, provided by the WHO Regional Office for Europe, to assess paid-for digital marketing.

Exploring the exposure of children to paid-for advertisements in Portugal

To test the software that assess children's exposure to paid-for advertisements, an application was installed on the mobile devices of a small pilot sample of 16 Portuguese children. After consent, this app monitors and collects information about paid-for digital advertising to which children are exposed. In order to monitor and collect this information, the software (*Reality Meter*) from the company RealityMine was used. The app will remain installed for 4 weeks (from 07/11/20 until 28/11/20) for collecting data on exposure to paid digital advertising, however for this dissertation only 4 days – 2 weekend days and 2 weekdays – were included for analysis (07/11/20; 08/11/20; 09/11/20; 10/11/20). This step targeted a sample of 16 children with ages between 6 and 17 years old, with 17 devices, however only the devices, and consequent data, of 11 children were included for analysis since only these devices were active and correctly installed during this period (11 devices of 11 children).

An informed consent form was given to participants and guardians with detailed information on the project. Both the consent from parents and from participants were mandatory. In these documents it was highlighted and clarified that no personal information, such as passwords or bank information, is collected. The data collection software is designed to only collect specific information from websites and applications, such as advertisements. This way, no passwords were detected or collected. Additionally, in the informed consent terms it was asked which device was most used by participants so that the app was installed on it. If there was a difference in the choice of the device between the parent and the child/youth, was given priority to the device identified by the child/youth. If the participant did not have his or her own device, we asked the parents to install the app on their device. RealityMine allows the creation of a

user for this purpose, collecting only information about the child/youth's use of the device and not regarding any other family members. If this is the case, instructions were sent at the beginning of the study on how to activate this feature.

RealityMine software remotely collects data about how children and young people use their device, transposing this coded information into a spread sheet. All advertisements were collected, not just those related to food products. The aim was to collect information on the most used platforms by children, identify usage patterns and the total exposure to paid-for advertisements. The number, nature and content of the advertisements and thereafter the food products, collected during the entire month, will be afterwards categorized and classified accordingly to the Portuguese Nutrient Profile Model, from the Directorate-General of Health (21).

This study was approved by the Ethics Committee of the Faculty of Nutrition and Food Sciences of the University of Porto (Parecer no. 03/2020/CEFCNAUP/2020).

5. RESULTS

5.1 Comprehend the Portuguese Digital Ecosystem

A slight increase in the size of the total media market in Portugal, between 2009 and 2019, was described in the *This Year Next Year Global Media Forecasts* report, from WPP (In an email from WPP in May 2019). Moreover, during this 10-year period it was possible to record a significant increase in the investment and percentage of the digital media (Table 1). In the 2016 report, the number and percentage of advertisements and advertisers were analysed, particularly the ones related to food. The categories of advertisements considered included “retail”, “food” and “beverage”. As for the advertisers, were included the following companies: *Unilever*, *Jerónimo Martins*, *Modelo Continente Hipermercados* and *Lidl Companhia*. The advertisements and advertisers related to food represented a considerable percentage of the total marketing, 35% and 36%, respectively (Table 1).

TABLE 1. Size of total media market and percentage of digital and of food-related marketing.
Source: *This Year Next Year Global Media Forecasts* report, from WPP

Size of total media market (EURm)	2009	731	↑
	2019	809	
% digital (= “internet”)	2009	6.4	↑
	2019	22.8	

Size of total media market

Advertisements of food related categories (food + retail + drinks)	2016	2173	35%
Advertisers that are related to food (brands)	2016	655	36%

According to the *Digital News Report*, from Reuters Institute, in 2019 Portugal had 78% of internet penetration, i.e., the proportion of the population that had access to Internet (89). Regarding the leading social media in Portugal, the same Report showed that Facebook was the most popular, with 77% of the Portuguese using it. Facebook was followed by YouTube (70%), Facebook Messenger (61%), WhatsApp (47%) and Instagram (40%). The same studied reflected that television is being increasingly challenged by online and social media as the most important source of news. WhatsApp

now reaches almost half of our sample (47%) and is used by five times more people for news than in 2015. On the other hand, Instagram is growing fast among the youth (89). Regarding children's access and use of internet, since 2010 it has been reported a notable growing in these habits (90). In Portugal, in 2018, 1974 Portuguese children, with 9-17 years old, participated in the EU Kids Online Survey (90) (Table 2).

TABLE 2. Online activities of Portuguese children. Source: EU Kids Online Portugal, 2019.

Online activities	Percentage of children		9 – 12 years old		13-17 years old		Total
	♂	♀	♂	♀	♂	♀	
Listen to music (N=1925)	64	73	83	90	80		80
Watch Videos (N=1919)	76	68	85	77	78		78
Social Media (N=1906)	44	59	81	88	73		73
Online Games (N=1922)	63	33	69	26	48		48
Communicate with family and friends (N=1918)	60	68	80	83	75		75
Homework (N=1902)	21	26	28	30	27		27

According to this study, the participants spent an average of 3 hours per day on the internet. The time spent on internet tend to increase as children get older - 9-10 years old spent 1,8 hours/day, while 15-17 years old spent 4 hours/day. 87% access internet frequently through a smartphone, and 41% through a laptop. Girls (90%) and older children (94% and 95%) were the main users of smartphone to access internet. About 80% of the participants using the internet every day for listening to music and watching videos and 73% to access social media (Table 2). Facebook has become less popular and used, being replaced by other apps that allow for communication and media sharing, as WhatsApp, YouTube and Instagram. Considering older children, 81% of the 13-14-years-old and 89% of the 15-17-years-old access social media daily. Younger ages access less to social media, although an increase has been observed since 2014 – 11% vs 27% (9-10 years old) and 38% vs 65% (11-12 years old), in 2014 and 2018, respectively. Such results demonstrate clearly the increased popularity and use of social media among all children. As for online gaming, boys access more internet to play than girls.

5.2 Landscape of campaigns

Food and Beverage Cues Presented in YouTube Videos from popular Portuguese Influencers

A total of 68 YouTube videos were analysed, which equalled almost 13.5 hours of content – eight hours and fifty minutes from the male influencer and four and a half hours from the female influencer (Figure 3). Within the videos analysed, 182 food and beverage cues were featured, which represents an average rate of 13.5 cues per hour. The female influencer had an average rate of 20.9 cues per hour and the male influencer an average rate of 9.9 cues per hour. Almost 40% of the videos (n=27 videos) did not feature any food or beverage cues.

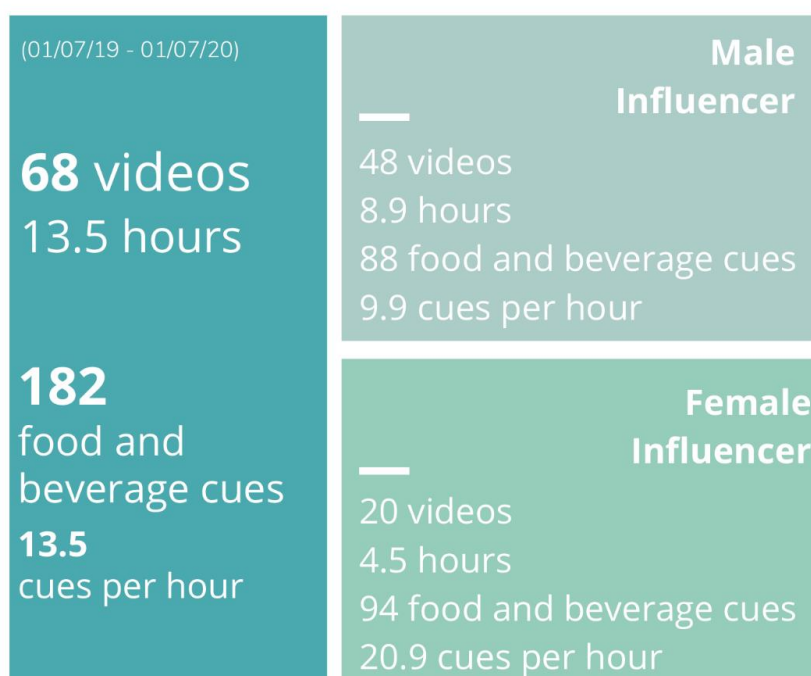


FIGURE 3. Videos analysed and food and beverage cues, per influencer.

The food and beverage cues were characterised accordingly to the 20 categories of the Portuguese NPM from the Directorate-General of Health, plus the category “combined”, and classified as “healthy” and “less healthy”.

Ready-made and convenience foods (23.1%) were the most frequent featured product, followed by cakes and cookies (12.1%), savoury snacks (11.0%), soft drinks (7.7%) fresh fruit, vegetables and legumes (6.6%), as well as chocolate and confectionary (6.0%), among others (Table 3). Of these 6 most featured categories, only the cues within fresh

fruit, vegetables and legumes were considered as healthy. The featured cues categorised as cakes, cookies and pastries, savoury snacks, soft drinks, as well as chocolate and confectionary, were classified as less healthy. Within the category of ready-made and convenience foods, most of the cues featured (76.2%) were considered less healthy.

TABLE 3. Frequency of food and beverage categories in the influencers' YouTube videos analysed. Divided by the classification of the Portuguese Nutrient Profile Model (as "less healthy" and "healthy" for food marketing to children).

	Overall (n=182)	Less healthy (n=133)	Healthy (n=49)
Ready-made and convenience foods	42 (23.1%)	32 (76.2%)	10 (23.8%)
Cakes, cookies and pastries	22 (12.1%)	22 (100%)	0
Savoury snacks	20 (11%)	20 (100%)	0
Soft Drinks	14 (7.7%)	14 (100%)	0
Fresh fruit, vegetables or legumes	12 (6.6%)	0	12 (100%)
Chocolate and confectionery	11 (6%)	11 (100%)	0
Meat, poultry, fish and eggs	9 (4.9%)	0	9 (100%)
Ice creams	9 (4.9%)	9 (100%)	0
Combined	8 (4.4%)	7 (87.5%)	1 (12.5%)
Juices	7 (3.8%)	7 (100%)	0
Pasta, rice and grains	5 (2.7%)	0	5 (100%)
Others	5 (2.7%)	0	5 (100%)
Milk drinks	4 (2.2%)	3 (75%)	1 (25%)
Processed fruit, vegetables and legumes	3 (1.6%)	3 (100%)	0
Breakfast cereals	3 (1.6%)	3 (100%)	0
Yoghurts	3 (1.6%)	2 (66.7%)	1 (33.3%)
Processed meat	2 (1.1%)	2 (100%)	0
Bread	1 (0.5%)	1 (100%)	0
Canned fish	1 (0.5%)	0	1 (100%)
Sauces, dips and dressings	1 (0.5%)	1 (100%)	0

*Value presented are frequencies. The percentages (%) in the overall column correspond to the percentage of each category. The percentages (%) of each cue category "less healthy" and "healthy" were computed within each cue category. *p<0.05.*

A great prevalence, and consequently rate, of the less healthy cues (73%; 9.9 per hour), was recorded, comparing to the cues classified as healthy (27%; 3.6 per hour) (Figure 4).

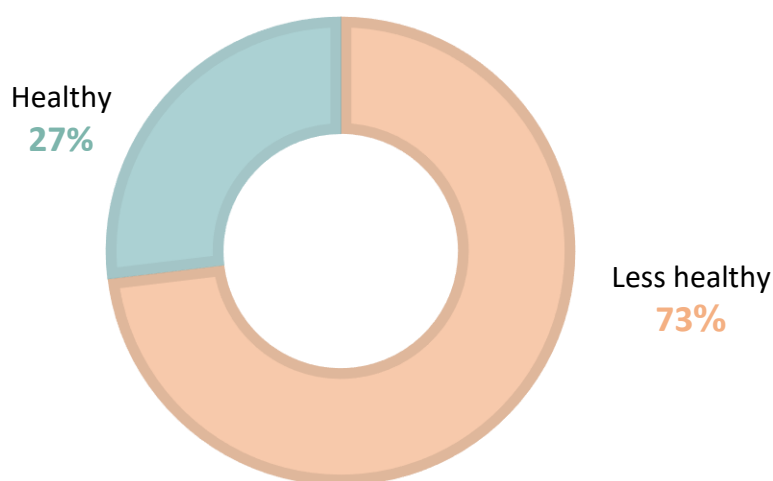


FIGURE 4. Proportion of food and beverage cues classified accordingly to the thresholds of Portuguese Nutrient Profile Model (as "healthy" and "less healthy").

There was a significant difference between food and beverage brand categories (Fisher's Exact Test = 31.68; $p < 0.05$). 53.3% of the food and beverage cues were unbranded, followed by cues with a recognizable brand (28% branded and 11% with food retail establishments brands). Cues without a recognizable brand (miscellaneous – 4.9%) and with a supermarket own-brand (2.7%) were the less featured cues. The majority of the healthy cues were unbranded (42 unbranded cues of the 49 healthy cues – 85.7%). Among the branded cues (categorized as branded and FRE), most were less healthy cues (67 less healthy cues of the 71 branded and FRE cues – 94.4%) (Table 4).

Almost half of the food and beverage cues were presented in "other" context (46.2%), followed by "eating-out" (28%) (Table 4). A large proportion of the cues presented in these contexts were classified as less healthy (77.4% and 74.5%, respectively). There were no significant differences among this group (Fisher's Exact Test = 4.875; $p = 0.183$).

Most cues (56,6%) were positively described (e.g., "I love this"). 72.8% of these cues were classified as less healthy. 13.2% of the cues were described negatively ("I would rather not eat this") and 30.2% neutrally. There were no significant differences among this group ($\chi^2 = 1.731$; $p = 0.418$).

TABLE 4. Frequency of food and beverages cues in each group and divided by the classification based on the thresholds of the Portuguese NPM (as "less healthy" and "healthy").

		Overall	Less healthy	Healthy	p ^a
FOOD AND BEVERAGE CUES		182	133 (73.1%)	49 (26.9%)	
CUE BRAND STATUS	Branded	51 (28%)	48 (94.1%)	3 (5.9%)	<0.05*
	FRE	20 (11%)	19 (95%)	1 (5%)	
	Supermarket	5 (2.7%)	4 (80%)	1 (20%)	
	Unbranded	97 (53.3%)	55 (56.7%)	42 (43.3%)	
	Miscellaneous	9 (4.9%)	7 (77.8%)	2 (22.2%)	
CUE CONTEXT	Eating-out meal	51 (28%)	38 (74.5%)	13 (25.5%)	0.183
	Supermarket	11 (6%)	9 (81.8%)	2 (18.2%)	
	Home	36 (19.8%)	21 (58.3%)	15 (41.7%)	
	Other	84 (46.2%)	65 (77.4%)	19 (22.6%)	
CUE DESCRIPTION	Positive	103 (56.6%)	75 (72.8%)	28 (27.2%)	0.418
	Negative	24 (13.2%)	20 (83.3%)	4 (16.7%)	
	Neutral	55 (30.2%)	38 (69.1%)	17 (30.9%)	
CUE PRESENTATION	Consumed and verbal reference	51 (28%)	36 (70.6%)	15 (29.4%)	0.828
	Consumed and no verbal reference	24 (13.2%)	19 (79.2%)	5 (20.8%)	
	Not consumed and verbal reference	100 (54.9%)	72 (72%)	28 (28%)	
	Not consumed and no verbal reference	7 (3.8%)	6 (85.7%)	1 (14.3%)	
REASON CUE FEATURED	Non-explicit marketing	176 (96.7%)	127 (72.2%)	49 (27.8%)	0.148
	Gift endorsement	0	0	0	
	Paid endorsement	6 (3.3%)	6 (100%)	0	

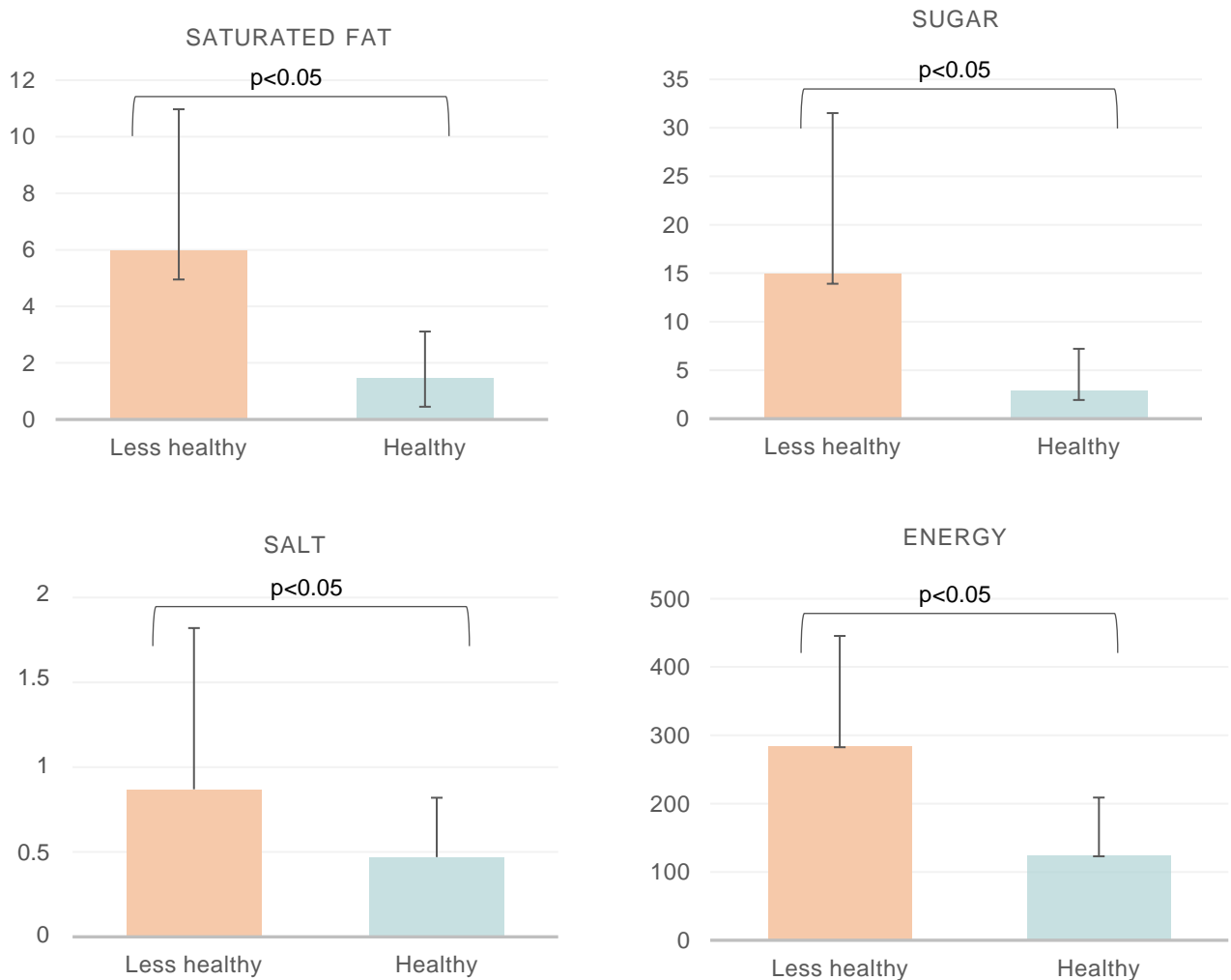
Value presented are frequencies. The percentages (%) in the overall column correspond to the percentage of each category. The percentages (%) of each cue category "less healthy" and "healthy" were computed within each cue category.

*a: P-value of Chi-square test (for variables under "cue description") or Fisher's Exact Test (for the other nominal variables). *p<0.05 with statistical significance*

Overall, cues were more likely to not be consumed during the video. The majority of these cues were presented with a verbal reference (54.9%), as "Look at this hamburger". Cues that were consumed were usually also complemented with a verbal reference (28%), as "We are now having this snack, with granola". Less healthy cues were more frequently not consumed and verbally referenced (54.1%). There were no significant differences among this group (Fisher's Exact Test = 0.984; p = 0.828).

Food and beverage cues were mainly not explicitly featured as a marketing promotion (96.7%). The 6 cues presented due to explicit paid marketing collaborations between the brand and influencers were classified as less healthy, and therefore marketing was not permitted. There were no significant differences among this group ($p = 0.148$).

FIGURE 5. Average values of food and beverage cues for saturated fat, sugar, salt and energy.



Average values, as well as standard deviations, for saturated fat, sugar, salt and energy were calculated (Figure 5; Appendix 4). Values for products which marketing is not permitted were higher than for products which marketing is permitted, for all the criteria, accordingly to the PT-NPM cut-offs used to classify these cues. The differences between the average values were statistically significant for all the criteria ($p < 0.05$).

5.3 Investigate exposure

Evaluating the exposure of children to paid-for advertisements in Portugal

This step targeted a sample of 16 children with ages between 6 and 17 years old, with 17 devices, however only the devices, and consequent data, of 11 children were included for analysis (Table 5). The usage patterns and the daily exposure to paid-for advertisements were collected during 4 days – 2 weekend days and 2 weekdays (07/11/20; 08/11/20; 09/11/20; 10/11/20) – for the devices which were active and correctly installed during this period (11 devices of 11 children).

TABLE 5. Sample characterisation by age group, device and operating system.

		6-12 years old	13-17 years old
OVERALL		5	6
DEVICE	Phone	4	6
	Tablet	1	0
OPERATING SYSTEM	iOS	0	1
	Android	5	5

The average time spent on each type of applications by the participants was calculated (Table 6). For the communication apps it was used mainly WhatsApp, but also e-mail. The participants spent more time on total on Sunday (1 hour) and Monday (1 hour and a half) on these apps, being the adolescents the main users (76 and 90 minutes). As for media and video, the predominant platform visited was YouTube, but some participants used also on-demand services (i.e., Netflix). Sunday was the day which adolescents spent the majority of their time watching media and videos (3 hours). As for the younger children, they spent more time (almost 4 hours) on these platforms on Saturday. As for social networking, applications as Instagram and Pinterest were considered. The adolescents were the main users of social media, with a maximum average of 100 minutes per day on Tuesday.

TABLE 6. Average time (in minutes) spent by the participants in different applications, by day.

		Total	(n)	6-12 years old	(n)	13-17 years old	(n)
COMMUNICATION	Saturday	5	4	7	1	4	3
	Sunday	59	5	42	1	76	4
	Monday	90	7	-	3	90	4
	Tuesday	8	5	23	1	4	4
MEDIA & VIDEO	Saturday	166	6	296	3	100	3
	Sunday	183	6	-	2	183	4
	Monday	2	9	2	4	2	5
	Tuesday	77	6	43	2	105	4
SOCIAL NETWORKING	Saturday	63	4	11	-	89	4
	Sunday	6	3	14	-	4	3
	Monday	83	6	59	2	95	4
	Tuesday	100	4	-	-	100	4

TABLE 7. Exposure to paid-for advertisements by the participants during the analysed days.

		Total	6-12 years old	13-17 years old
YOUTUBE	Overall	162	25	127
	(n)	(9)	(4)	(5)
INSTAGRAM	Overall	670	95	575
	(n)	(6)	(2)	(4)
	Unhealthy food	24	3	21
	Fast food	7	0	7
	Soft drinks	13	3	10
	Chocolates and cakes	4	1	3
	Alcohol	15	2	13

As for the amount of marketing that children were exposed to during the four days of the analysis (07/11/20; 08/11/20; 09/11/20; 10/11/20), the number and category of the advertisements were assessed (Table 7). On YouTube, 9 of the 11 participating children were exposed to a total of 162 advertisements. Of these, only half (n=83 ads) had information on the content of the advertisement (title and/or brand). Among these advertisements, 12 were promoting food – 7 were from food-delivery services, 3 from food retail establishments, 1 from an energy drink and 1 from a supermarket chain. At least 1.9% of these advertisements (food retail establishments) are from HFSS foods. As for the social media platform Instagram, the participating children were exposed to a total of 670 advertisements in the four days included for the analysis. Of these, 67 advertisements were related to food and 9 were promoting supermarket chains. Of the food-related advertisements, at least 24 were promoting unhealthy products (7 to fast food products or brands, 13 soft drinks brands, as well as 4 to products as chocolates and cakes). Therefore, around 3.6% of these ads were promoting HFSS foods. There were also captured 15 advertisements promoting alcoholic beverages, reaching both age groups.

6. DISCUSSION

The increasing digital media usage and the time people spend online results in a shift of advertising being now bought programmatically. The programmatic digital media allows individual targeting of ad impressions, which can have a stronger effect on children's behaviours (62). The closed nature of digital data (also described as "black box") presents a significant challenge (24). This analysis aimed to take the first step towards a better understanding of the digital ecosystem in Portugal. It was verified that between 2008 and 2018 the size of total media market increased, as well as the investment and percentage of digital media. This is in accordance with global trends, where internet-related advertising is now unequivocally the most important medium, with \$326 billion in ad revenue during 2020 comparing to the \$294 billion in 2019 (97). It has been reported an increase in internet penetration and use of internet among all Portuguese population (89). The striking growth of digital media and the resultant growth of targeted advertising reinforces the need to cover digital marketing in the national and regional legislation and that restrictions covering digital marketing are essential.

Furthermore, it was observed an important investment in food related advertising, with 35% of advertising promoting food and beverages and with an important percentage of advertisers being related to the food market. According to the TYN data, Portugal was one of the countries with greater proportion of food and beverage advertising (Finland 49% and Norway 31%) (98). Regarding the main advertisers related to food, other countries, as Finland, Estonia and Norway, had higher proportions than Portugal (98). Particularly the UK, had multinational food companies, responsible for promoting unhealthy products, among the major advertisers of their market. Recognising both national and international advertising sources is relevant due to the internet's borderless nature. Even countries with national food marketing restrictions, may receive marketing from beyond their borders, and they may find difficult to address it (83, 99). The WHO encourages for international cooperation and cross-border regulation to tackle this challenge (81).

There is global data available, nevertheless it's very difficult to understand national players and properly map the digital marketing ecosystem. However, such assessment is essential and necessary to develop or adapt national measures. Although global and regional tech platforms can be identified from desk research, further actual analysis is necessary at a country level to access local agencies, DSPs, DMPs, SSPs and publishers, in order to map out the local advertising ecosystem. To comprehend each country's digital marketing ecosystem, it is essential to identify which organizations supply and distribute digital advertisements locally and to understand the national

ecosystem, which will include a mix of global, regional and national participants (88). Publicly available global data is insufficient to properly map national digital marketing ecosystems. Furthermore, Portugal is a small market with very few publicly available data, which does not allow for breaking down the market. However, a high proportion (60/80%) of digital media advertising worldwide is concentrated on main social and video platforms – Google/YouTube, Facebook/WhatsApp/Instagram, Twitter, Snapchat, TikTok and Pinterest (65). Major platforms do not regularly publish usage and revenues at a country level and have little commercial incentive to do so. The remaining fragmented portion of the media ecosystem is supported by a large ecosystem of independent global and national publishers and ad technology companies (DSPs, SSPs, DMPs), reinforcing the need for a better understanding of the ecosystem on a national level.

Regarding Portuguese children's online habits, the analysis of the study EU Kids Online Portugal permitted to have a broader perception of the time children spend online and what are their main online activities. Portuguese children spend on average three hours per day on the internet, which was just slightly higher than the European average (178 minutes vs. 167 minutes) (100). 87% of the Portuguese children access internet frequently through a smartphone, mainly to watch videos, access social media and to communicate with their families and friends. Regarding these online activities, Portuguese children watched videos and accessed social media more frequently than the European average (100).

As stated, the need for future research to strengthen the body of evidence is clear. It is essential to map the national stakeholders and understand the concentration of unhealthy food and beverages advertising by brand and agency to consumers. To continue exploring the ecosystem and understand the actual digital marketing exposure, data on the main media campaigns and on children's experience and interaction with different marketing strategies and advertisements is necessary. Therefore, following the subsequent steps of CLICK, this study explored children's exposure to influencer marketing and to paid-for marketing.

The second step of CLICK - Landscape of campaigns - comprehends assessing campaigns run by leading national brands through the collection of information from advertising agencies and by sampling whole-country social media for relevant content to ascertain what is viewed by different age groups (31). To access a major amount of information, metadata on social media could be acquired, such as the main hashtags

used on Facebook, Twitter and Instagram. However, such data is expensive and difficult to access. Therefore, to explore popular content and what is viewed by children and adolescents, YouTube videos by two popular social media influencers among Portuguese children were analysed. Results demonstrated that less healthy cues were more common than healthy cues. Overall, cues were mostly unbranded, presented in other contexts and in the eating-out context, positively described, and not explicitly presented with a marketing intent.

As this study was analysing food and beverage cues, these were classified as “healthy” and “less healthy”, following the PT-NPM criteria used to classify the permission of a product to be marketed or not. For instance, social media influencers post content generated by themselves that is highly engaging and appealing and that, generally, showcase their lifestyles as a whole (101). Therefore, children simply watch these videos for entertainment reasons. As part of sharing their daily activities, influencers may also inform their viewers about their consumption decisions, as which brands and products they prefer and which they don’t like, talking or presenting them in their videos (102). Research has been demonstrating that participants feel similar to influencers, identify with them and trust their content (103, 104). Therefore, although in this study 97% of the food and beverage cues were not classified as part of a marketing campaign, this content has a clear impact in children’s preferences and choices.

The majority of the influencers’ videos featured food and beverage cues (60%), which was equivalent to an average rate of 13.5 cues per hour. The male influencer’s videos were mostly composed by him analysing humorous videos and photos (“memes”), with 22 videos not featuring any food and beverage cue. On the contrary, the female influencer’s videos conveyed her day-to-day activities, where food and beverage cues were more likely to be presented. This has resulted in distinctive average rates for each of the influencers - female influencer with an average rate of 20.9 cues per hour and male influencer with an average rate of 9.9 cues per hour. The prevalence of the food and beverage cues found in the current study was lower than similar studies (26, 28). These studies, that evaluated food and beverage cues featured on YouTube videos and on Instagram posts shared by adolescents, presented a higher prevalence of cues (92.6% and 85%, respectively). This was expected due to the nature of the content assessed, once cues were embedded in user-generated content in which exposure may possibly be continuous (28). Additionally, it’s highly likely that these cues can be featured in video blogs, once it’s captured the user’s everyday life, where food and beverage are integrated into many social activities (105). Once most of the videos analysed on the current study were not video blogs, and therefore did not captured the influencer’s

everyday life, food and beverage cues were less featured. Nevertheless, as children admire influencers, trusting and valuing their content, the children's exposure to these cues may impact their relationship with food and beverages (105). The higher proportion of less healthy cues which marketing is not permitted, comparing to healthier cues which marketing is permitted, may give children the impression that influencers regularly consume these items and promote similar behaviours (29, 102). In fact, previous research has demonstrated that the exposure of unhealthy products, as HFSS foods, on social media plus via influencers-generated content, impact young's people attitudes towards these products, increasing their immediate intake (68, 69, 105, 106). Even though the amount of time that Portuguese children spend watching YouTube video bloggers is not accessible, from the EU Kids Online Portugal study it was possible to recognise that a significant proportion of children go online to watch videos (90). Consequently, the high prevalence of unhealthy cues on these videos present a major challenge and it must be addressed. On the other hand, healthy cues were only featured in 27% of these YouTube influencers' videos. These findings were more similar to previous studies that explored YouTube videos and Instagram photos shared by adolescents (26, 28). For instance, previous research that have explored the impact of digital marketing of healthy food and beverages on children's immediate intake of these items, found either no effect or a smaller effect than for unhealthy products (68).

Most of the featured food and beverage cues were unbranded, with almost a third being branded, similar to the content analysis performed on influencer's YouTube videos popular among UK children (28). Former research has demonstrated that food and beverage brand marketing can impact children's food intake and preferences, both by the brand and by the food category advertised (12, 47, 50). Consequently, it is expected that exposure to branded food and beverage cues via influencers' YouTube videos may impact children's food brand preferences, as well as their subsequent intake.

The context where food and beverages are obtained and consumed may influence children's attitudes towards these products. In the current study, the most frequent context where cues were presented was categorised as "other". This is explained by the type of videos presented by the male influencer, which included humorous videos and photos ("memes"), that were most of the times classified as "other" context, even though the context of the picture or video itself was different. In these cues, if the product was not the focus, cues were also described as "neutral". Nevertheless, almost a third of the cues were featured in the context of eating out (in restaurants or coffee shops). In previous studies, this context was usually the most common (28). Most of the cues consumed in this context were less healthy cues (74.5%). In fact, the female influencer

meals were mostly consumed in the context of eating out. This reflects a less healthy dietary pattern and it's important to consider the impact that it might have on children's attitudes and lifestyle.

Average values, as well as standard deviations, for saturated fat, sugar, salt and energy were calculated. These nutritional values are the cut-offs of the PT-NPM that define if the product can or cannot be marketed to children. As expected, unhealthy cues had average values higher than the cut-offs established for a product to be classified as eligible to be marketed to children.

Digital marketing techniques, especially influencer marketing, is usually less recognised as a form of advertising, even by adults, due to its nature that make the post look like an influencer's normal post (107). In the UK, influencers have to "clearly state when a product, brand or service is tagged, linked or endorsed in any way" (108). Evidence demonstrates that children's (9–11-years) exposure to influencer marketing of HFSS product, even with the presence of an advertising disclosure, have an immediate effect of increasing intake of these products compared with those in a control group (70).

In the current study, only 3% of the food and beverage cues were explicitly marketed. Nevertheless, the enormous exposure to food and beverage cues impacts children's preferences and, consequently, intake. Also, the results presented in this study derive from the content analysis performed, which was limited to the YouTube social media platform, to two influencers and to the analysis of their videos from the past year. Consequently, the content of social media influencers should be explored, as well as considered and analysed from a different perspective, because it may be imposing several risks to the health and well-being of children. Additionally, the extent of the problem appears to be much wider and children may be exposed to more unhealthy content, and marketing, through other social media influencers platforms and through different marketing strategies.

In order to assess paid-for digital marketing and comply with the third step of CLICK, *Investigate exposure*, a pilot study was conducted to test the potential of a software, provided by the WHO Regional Office for Europe. An application was installed in the devices of the 11 participating children to assess their exposure to paid-for advertisements. For this study only 4 days – 2 weekend days and 2 weekdays – were included for analysis (07/11/20; 08/11/20; 09/11/20; 10/11/20). This preliminary analysis of the four days was the possible analysis to include in this dissertation due to the delays on the implementation of the pre-pilot, caused by the COVID-19 pandemic.

The participating children spent considerable amount of time online in apps for communicating (average time ranging from 5 to 90 minutes per day), watching videos (average time ranging from 2 to 183 minutes per day) and social networking (average time ranging from 6 to 100 minutes per day). During the weekend, children spent more time (at least one hour) on, mainly, WhatsApp and YouTube. According to the study EU Kids Online, Portuguese children (9-16 years old) are one of the main users of internet (via mobile phone) and have the highest number of online activities (almost 10), comparing to the other 18 participating countries (100).

The main used apps were especially YouTube and Instagram, similar to other studies that evaluated children's interaction with social media apps (30). Regarding the quantity of marketing that children were exposed to, 162 and 670 advertisements were recorded in total on YouTube and Instagram, respectively. Of these, at least 80 advertisements were related to food, of which unhealthy products were featured. At least 5.5% of the advertisements were promoting HFSS food. All the advertisements that were captured by the software had an advertising disclosure, however previous studies demonstrated that this type of notice does not reduce the effect of the marketing exposure on children (70). Furthermore, as discussed, the advertisements that children are being exposed to online may be targeted and personalised, according to the data collected on their usage, which poses higher risk since allows for more engaging marketing strategies (64, 65).

With the complexity of the digital ecosystem characterised by automate and targeted advertising, it was impossible to identify who was being exposed to the marketing campaigns of unhealthy products. Such software is fundamental to understand the exposure of the participants to paid-for advertising and it provides information that was not possible to collect before. Even though the nutrient profile of the products could not be assessed in this preliminary analysis, children were exposed to inappropriate content, through the promotion of HFSS foods and alcohol.

The compliance of the participants varied along the days, being lower in certain days, which reflects the difficulty of ensuring full compliance in a study of this kind. The installation of an application in the participant's devices it's needed to accurately measure children's interaction online and with social media and to assess their real exposure to advertising. Nonetheless, this imposes significant concerns regarding the privacy and safety of the information. Especially among the participating adolescents, there was verified a valid feeling of insecurity and intrusion. This resulted in considerable difficulties in the recruitment, enrolment, and subsequent compliance of the participants.

Even though this software enables the collection of data from children's own devices, which is crucial to assess content resulting from programmatic and targeted advertising, this may impose difficulties in adopting this strategy for a representative sample and for the long term.

Albeit the software automatically collects the advertisements that children are exposed to, it is still very time- and resource-consuming due to the requirement of a significant amount of manual-processing and analysis, which compromises the operationalisation of this process in a larger scale. Additionally, it has an inherent cost that may also compromise its adoption on a national and international scale and for the long term.

While similar research is still scarce, the experiment and study of these innovative approaches and technologies are critical to develop a continuous monitoring strategy. Though these novel and technological tools are a great step towards a better monitoring, there is still adaptations and improvements to be made, so that these tools can integrate evaluating and monitoring systems and, therefore, supporting the control of existing measures and restrictions.

6.4 Strengths and limitations

The present dissertation was an exploratory study of three steps of the WHO CLICK monitoring Framework for digital marketing aimed at children, which presents an innovative approach to address and tackle this challenge. Therefore, the approaches applied in each step were being explored and tested for the first time in the national context. The innovation brought through the implementation of the CLICK monitoring Framework limits the comparison to similar studies in other countries, since no data is yet available within the same framework.

Regarding the first step, *Comprehend the ecosystem*, data available from public sources is scarce, which resulted in a limited understanding of the Portuguese digital ecosystem, especially regarding the identification of the key platforms that are actively distributing advertising content to children and the share of media impressions delivered by the main social and video platforms. Another limitation of this analysis was related to the advertisements and advertisers considered for analysis within the *This Year Next Year Global Media Forecasts* report. Advertisements in the categories of food, retail and beverages were included, and as for the advertisers, both food and beverages companies, but also supermarket chains were considered. Consequently, the results are

an estimation of the percentage of food advertising that the Portuguese population were exposed to on that period, even though the content can be extremely diverse. For the second step of CLICK, *Landscape of campaigns*, the analysis of YouTube videos by two popular social media influencers among children resulted in a limited understanding of the main media campaigns run in Portugal. Influencers were selected based on popularity, especially among adolescents, which can limit the generalization of the results. As it was analysed the video content of only two influencers, the findings of this study do not represent how food and beverage cues are featured by other influencers. In addition, the influencers were not targeting younger children and so, for future research, content of YouTube Kids and from influencers popular among these age groups should be explored. Lastly, cues that were considered as not prominent were not coded which may result in an underrepresentation of the prevalence of food and beverages in these videos. Regarding the last step of CLICK, *Investigate exposure*, a more comprehensive and detailed analysis was compromised due to the delays on the implementation of the pre-pilot, caused by the COVID-19 pandemic. Therefore, it was only possible to include four days in the analysis from the 11 active and correctly installed devices. This software is dependent on the children maintaining the app installed and on their compliance. However, the software raises privacy concerns, which may impact the enrolment and compliance of the participants. Since there were some difficulties in installing the app in some devices, besides the lower compliance in some days from certain devices, less data was possible to collect and, consequently, analyse. The software has also some limitations that resulted in fewer data to include for analysis. If an advert is playing but no information of the advert (as title or description) is provided, the advertisement is identified as an event in the report, but no information is available in order to classify and categorise the advertisement. Additionally, for iOS devices, the software is only able to identify advertisements presented on YouTube, but not on the other social media platforms. The smaller volume of data collected compromised the classification and evaluation of the products advertised, accordingly to the Portuguese Nutrient Profile Model.

Nonetheless, this study has also strengths. This study was the first step to test and understand the methodologies to begin understanding the Portuguese digital ecosystem, as well as children's actual exposure to different types of advertising. The analysis of the influencers' YouTube videos provides the first assessment of the extent and nature of food and beverage cue presentation in this type of content among Portuguese children. Since it was followed the same approach and methodology as previous research, this

study allows for multi-country comparison. As for the assessment of paid-for advertising, it allowed for testing a software and identify its limitation, so that improvement and reformulation can be made in order to scale-up this analysis for a national representative sample after.

6.4 Implications for public health and children's well-being

The present dissertation provided insights on the digital marketing of unhealthy products to children in Portugal. Such analysis is particularly relevant since the current Portuguese legislation encompasses the restriction of unhealthy food digital marketing to children.

Findings highlight the need to include social media in regulations and policies designed to limit children's exposure to unhealthy food marketing. The high prevalence of unhealthy cues on the influencers' YouTube videos present a major challenge and it should be addressed. According to The Portuguese Advertising Code, "The use of subliminal images or other content exploiting the possibility of advertising without the recipients noticing the advertising nature of the message is prohibited " (art. 9, 1) and "Advertising must respect the truth, not distorting the facts" (art. 10, 1), however influencers may promote products, and don't disclosure the advertising since they don't considered it paid advertising (109). In fact, content that it is not explicitly labelled as marketing should not always be considered as not featuring marketing (30). The Portuguese law that restricts food marketing does not address directly influencer marketing, thus, considering the findings of this study, adaptation of the Portuguese legislation should be considered.

Additionally, even as very preliminary, and incomplete analysis, the assessment of the paid-for advertisements in the small sample of Portuguese children, demonstrated that they are noticeably exposed to unhealthy food marketing. The restrictions imposed by the Law no. 30/2019 of 23 of April, may allow for ambiguity in the interpretations of the concept of "advertisements to children" – if the content has to be intended at children or if the children is being exposed to the advertising, with content aimed at them or not, should be considered for the restrictions. Some companies, to avoid being object of these restrictions, changed the targeted audience to families, when the content of the advertisement is visibly aimed at children (23). Furthermore, restricting digital marketing is extremely challenge due to the considerable barriers in afterwards measuring and controlling the actual exposure. Which, consequently, may lead to non-compliance with the law. The present study tested an innovative software that while being a major progress in assessing the actual exposure of paid-for marketing, does not yet cover the

full range and different techniques used in digital marketing. Taking into consideration all these ambiguities, the UK Government is now proposing a total restriction of online advertising for products high in fat, sugar and salt (HFSS), currently open for consultation (110). While approving such a restriction on a national context may pose significant challenges, it may also overcome the challenges that the current law faces in terms of monitoring and control.

7. CONCLUSION

This exploratory study investigated novel methodologies to evaluate children's exposure to digital food marketing, resulting in an indication of the current situation in the national context. This study aimed to provide an analysis to the digital marketing ecosystem in Portugal, perform a content analysis to the YouTube videos of two popular Portuguese social media influencers and test a software that measures the exposure of a small sample to paid-for marketing.

Even though the results of this study present a preliminary and limited understanding of the actual exposure of the Portuguese children to food digital marketing, we can conclude that, currently, children are being exposed to paid for unhealthy food marketing on social media, which reflects the need for better monitoring and control solutions to ensure full compliance with the imposed restrictions in Portugal. Additionally, from the content analysis of the YouTube videos of the social media influencers, we conclude that children are exposed to a considerable amount of food and beverage cues, mainly from products that don't incorporate a healthy dietary pattern. Considering the growing body of evidence regarding the impact from influencer food marketing on children's eating behaviour, these results provide an important insight for future research and for developing measures to protect children from all sorts of unhealthy food promotion.

Nevertheless, more research is undoubtedly needed in this area. Future studies should replicate these methodologies in larger and national-representative samples, but also explore further aspects of children's exposure to digital marketing on unhealthy food, such as other marketing strategies.

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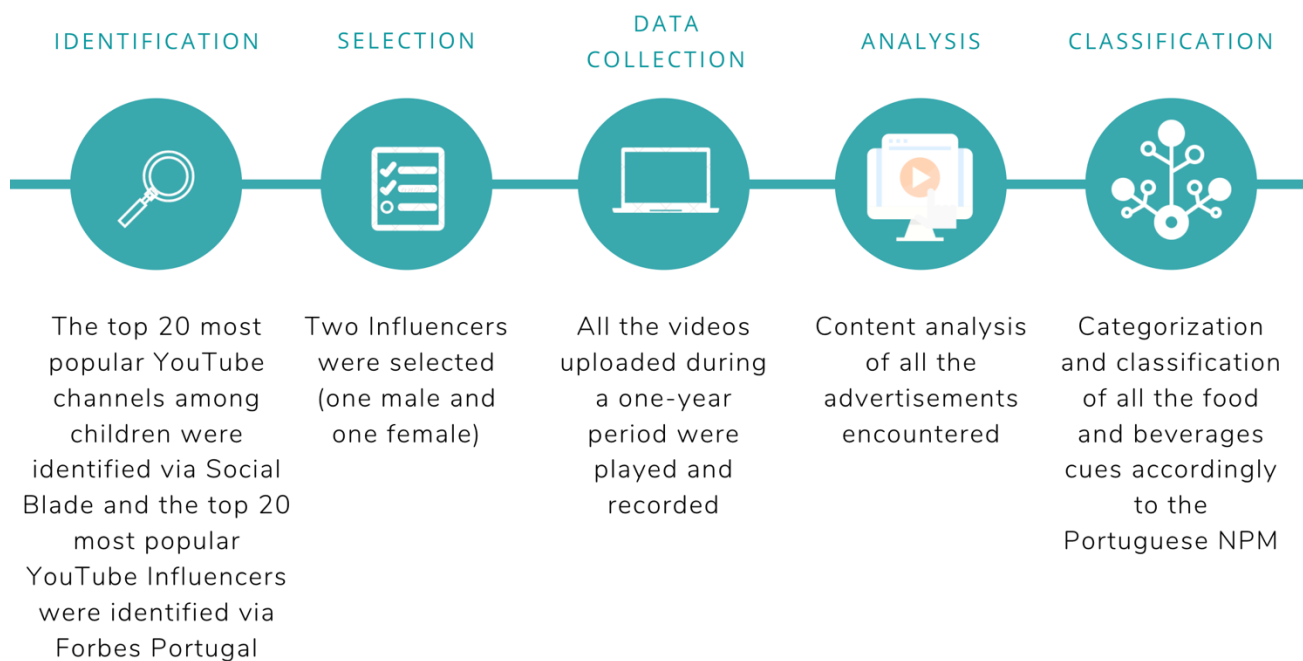
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9. APPENDICES

Appendix 1



Appendix 2

Summary of details to be coded for all food or beverage cues appearing in the videos, according to WHO Protocol.

	Category	Description of Category
PRODUCT INFO	Product Name	Name of product and brand (if applicable), e.g. chocolate bar
	Detailed description of the product	A milk chocolate bar in branded packaging
NPM ASSESSMENT	Food or beverage cue type	Portuguese NPM food category code
	Nutritional information per 100 g of product	e.g. 1,2g of salt
	Permitted to be marketed to children?	0 = no | 1 = yes
CUE BRAND STATUS	Branded	Product brand is recognizable (i.e. brand icon is visually apparent/brand name is verbally stated).
	Food Retail Establishment (FRE)	FRE brand is recognizable (i.e. brand icon is visually apparent/brand name is verbally stated).
	Supermarket	Supermarket own-brand is recognizable (i.e. brand icon is visually apparent/brand name is verbally stated).
	Unbranded	Product is an unbranded item (e.g. bag of loose oranges).
	Miscellaneous	Product brand is not recognizable (e.g. hamburger with packaging removed).
CUE CONTEXT	Eating-out meal	Product presented in/purchased as a take-away item in FRE (e.g. fast-food restaurant, coffee shop, café)
	Supermarket	Product presented in a supermarket (including market, convenience store)
	Home	Product presented in the home
	Other	Product presented in a context outside the above categories (e.g. park, car, beach)
CUE DESCRIPTION	Positive	Product described using positive adjectives or tone
	Negative	Product described using negative adjectives or tone
	Neutral	Product described using neutral adjectives or tone (e.g. equal use of positive and negative adjectives, no adjectives)
CUE PRESENTATION	Consumed and verbal reference	Product consumed and verbal reference made
	Consumed and no verbal reference	Product consumed and no verbal reference made
	Not consumed and verbal reference	Product not consumed, and verbal reference made (i.e. visual and verbal presentation)
	Not consumed and no verbal reference	Product not consumed and no verbal reference made (i.e. visual presentation only)
REASON CUE FEATURED	Non-explicit marketing	No explicit indication that influencer was gifted or paid to feature product in YouTube video
	gift endorsement	Gifted endorsement of product (influencer indicated they have been gifted product)
	paid endorsement	Paid endorsement of product (i.e. on-screen advertising disclosure, influencer indicated they were paid to feature product in YouTube video)

Appendix 3

The Portuguese Nutrient Profile Model by the Directorate-General of Health

Category	Description of Category	
1	<p>Chocolate and sugar confectionery, energy bars, sweet toppings and desserts (Includes chocolate and other products containing cocoa; white chocolate; chocolate snacks; jelly, sweets, boiled sweets; chewing gum and bubble gum; caramels; liquorice sweets; spreadable chocolate and other sweet sandwich toppings; peanut butter; cereal, granola and muesli bars; marzipan; chocolate powder. Does not include chocolate flavoured breakfast cereals; cakes and pastries; biscuits and other bakes goods covered in chocolate)</p>	<p>Saturated FA – 1,5g Total Sugar – 5g Salt – 0,3g Energy – 40 kcal</p>
2	<p>Cakes, sweet biscuits and pastries; other sweet bakery wares, and dry mixes for making such (Includes pastries; croissants; sponge cakes; fruit pies; cookies/biscuits; chocolate or sweet-covered/filled biscuits; wafers; sweet buns; cake mixes and batters. Does not include bread and bread products)</p>	<p>Saturated FA – 1,5g Total Sugar – 5g Salt – 0,3g Energy – 40 kcal</p>
3	<p>Savoury snacks (Includes sweet and savoury popcorn; seeds; sweet and savoury snacks/biscuits; other snacks made from rice, maize, potato or other cereals)</p>	<p>Saturated FA – 1,5g Total Sugar – 5g Added sugar – 0g Salt – 0,3g</p>
4	<p>Nuts and seeds</p>	<p>Total Sugar – 5g Added sugar – 0g Salt – 0,3g</p>
5a	<p>Beverages - Juices (Includes 100% fruit and vegetable juices; juices reconstituted from concentrate, and smoothies).</p>	<p>Total Sugar – 2,5g Added sugar – 0g</p>
5b	<p>Milk drinks (Includes milks; processed milks (milkshakes from milk, chocolate milk and flavoured milk); milk powder. Does not include cream)</p>	<p>Saturated FA – 2,5g Total Sugar – 5,5g Added sugar – 0g Salt – 0,3g</p>
5c	<p>Plant-based milk drinks</p>	<p>Saturated FA – 2,5g Total Sugar – 2,5g Added sugar – 0g Salt – 0,3g</p>
5d	<p>Soft Drinks (Includes carbonated and still beverages; cola, lemonade, orangeade; sweetened beverages, mineral and/or flavoured waters (including aerated) with added sugars or sweetener; energy drinks; other soft drinks)</p>	<p>Total Sugar – 2,5g Added sugar – 0g Energy – 20kcal</p>

6	Edible ices (Includes ice cream and sorbets, frozen yoghurt)	Saturated FA – 1,5g Total Sugar – 5g Energy – 40 kcal
7	Breakfast cereals (Includes cereal flakes; infant cereals with and without milk powder; cornflakes; chocolate breakfast cereals; oatmeal, mueslis and granolas)	Saturated FA – 1,5g Total Sugar – 15g Salt – 1g
8	Yoghurts, fermented milk, cream and other similar foods (Includes yoghurt; kephir; fermented milk and drinking yoghurt; fromage frais; cheese-based and other yoghurt substitutes; yoghurt products containing additional ingredients (such as fruit; muesli); cream; whipped cream. Does not include milks and sweetened milks; almond, rice and oat milks)	Saturated FA – 1,5g Total Sugar – 10g Salt – 0,3g
9	Cheese and similar products (Includes medium-hard and hard cheeses; soft cheeses; fresh cheese (such as ricotta, mozzarella); grated or powdered cheese; cottage cheese; processed cheese spreads; similar products made from non-dairy ingredients)	Saturated FA – 13g Salt – 1,3g
10	Ready-made and convenience foods and composite dishes (Includes pizzas; lasagne and other pasta dishes with sauces; quiches; ready meals; ready-made sandwiches; filled pastas; soups and stews (packaged or tinned))	Saturated FA – 5g Total Sugar – 5g Salt – 1g Energy – 225 kcal
11	Butter, other fats and oils (Includes butter; vegetable oils; margarines and spreads; olive oils)	Saturated FA – 13g Salt – 1,3g
12	Bread, bread products and crisp breads (Includes ordinary bread (containing cereal, leavens and salt); gluten-free bread; unleavened bread; crisp breads; rusks and toasted breads. Does not include sweet biscuits; pastries; cakes)	Saturated FA – 1,5g Total Sugar – 5g Salt – 1g
13	Fresh or dried pasta, rice and grains (Includes fresh and dried pasta; ordinary, whole-grain and wild rice; corn; buckwheat; quinoa; bulgur and oats. Does not include filled pasta and pasta in sauce)	Total Sugar – 5g Salt – 1g
14	Meat, poultry, fish and eggs	Not applicable
15	Processed meat, poultry and products meat (Includes sausage, ham, bacon; chicken nuggets; pre-prepared meat products)	Saturated FA – 1,5g Salt – 0,3g Energy – 40 kcal
16	Processed/canned fish (smoked and pickled fish; tinned fish in brine or oils; pre-prepared fish products; fish bars; pre-fried breaded fish fillets)	Salt – 1,3g

17	Fresh and frozen fruit, vegetables or legumes (Includes fruit and vegetables; legumes; starchy vegetables, roots and tubers. Does not include tinned fruits, vegetables and legumes; fruit in syrup; dried fruit; frozen fruit with added sugar)	Not applicable
18	Processed fruit, vegetables and legumes (Includes tinned fruit, vegetables and legumes; dried fruit; dried vegetables and legumes; marmalade; jams; pickled vegetables and fruit; stewed fruits; fruit peel; frozen French fries' frozen fruit with added sugar. Does not include fruit juice)	Total Sugar – 10g Added sugar – 0g Salt – 1g
19	Sauces, dips and dressings (Includes salad dressings; tomato ketchup; mayonnaise; soya sauce; mustard and mustard flour).	Saturated FA – 0,75g Total Sugar – 2,5g Salt – 0,3g Energy – 20 kcal
20	Others	Saturated FA – 1,5g per 100g/ 0,75g per 100ml Total Sugar – 5g per 100g/ 2,5g per 100ml Added sugar – 0g Salt – 0,3g Energy – 40 kcal per 100g/ 20 kcal per 100ml

For nutrients for which limit values are not defined, the following values should be considered:

1) salt - <0.3 g of salt per 100 g of product; 2) sugar - 5 g of sugar per 100 g for solids/2.5 g of sugar per 100 ml for liquids; 3) saturated fatty acids - 1.5 g of saturated fatty acids per 100 g for solids/ 0,75 g of saturated fatty acids per 100 ml for liquids and 4) trans-fatty acids - 2 g per 100g of fat the content of saturated fatty acids

Note: Whereas restaurant meals/menus consisting of 2 or more components, each of the components must meet the criteria specified individually.

Appendix 4

		Saturated fat (g/100g)	Total sugars (g/100g)	Salt (g/100g)	Energy (kcal/100g)	
Less healthy cues	Chocolate and confectionery	Mean	15,44	50,54	0,28	517,36
		N	11	11	10	11
		Std. Deviation	6,12	7,94	0,11	120
		Minimum	0	41,2	0,09	162
		Maximum	22,6	70	0,49	576
	Ready-made and convenience foods	Mean	4,89	3,77	1,38	246,42
		N	30	30	30	30
		Std. Deviation	2	2,2	0,60	37,63
		Minimum	0	0	0,008	75
		Maximum	10,8	10	3,2	290
Bread	Mean	0,6	2	1	284	
	N	1	1	1	1	
	Std. Deviation	.	.	.	.
	Minimum	0,6	2	1	284	
	Maximum	0,6	2	1	284	
Processed meat	Mean	4,4	0,05	4,55	213,5	
	N	2	2	2	2	
	Std. Deviation	5,52	0,07	3,18	183,14	
	Minimum	0,5	0	2,3	84	
	Maximum	8,3	0,1	6,8	343	
Sauces, dips and dressings	Mean	12	3,8	0,1	206	
	N	1	1	1	1	
	Std. Deviation	.	.	.	.
	Minimum	12	3,8	0,1	206	
	Maximum	12	3,8	0,1	206	
Cakes, cookies and pastries	Mean	7,49	27,79	0,63	408	
	N	20	18	19	18	
	Std. Deviation	3,82	13,1	0,28	81,07	
	Minimum	2,1	0,6	0,16	227	
	Maximum	18	45,2	1,1	525	
Savoury snacks	Mean	3,64	3,32	1	389,05	
	N	20	20	20	20	
	Std. Deviation	3,24	8,58	0,96	134,32	
	Minimum	1,25	0	0	227	
	Maximum	14	39	4,46	571	

Less healthy cues	Juices	Mean	0	9,92	0	44
		N	6	6	5	6
		Std. Deviation	0	0,83	0	2,97
		Minimum	0	9,5	0	42
		Maximum	0	11,6	0	50
	Milk drinks	Mean	1,4	9,7		77
		N	3	3		3
		Std. Deviation	0	0		0
		Minimum	1,4	9,7		77
		Maximum	1,4	9,7		77
	Soft Drinks	Mean	0,25	9,36	0,05	42,36
		N	2	11	2	11
		Std. Deviation	0,35	2,71	0	6,73
		Minimum	0	2,1	0,05	28
		Maximum	0,5	11,17	0,05	57
	Ice creams	Mean	7,04	23,76	0,13	226,91
		N	9	8	7	9
		Std. Deviation	1,98	4,021	0,05	60,58
		Minimum	3,9	20,98	0,098	111
		Maximum	10,5	30,1	0,2	323
	Breakfast cereals	Mean	1,6	31,75	0,40	379,67
		N	3	3	3	3
		Std. Deviation	0,61	6,83	0,32	9,24
		Minimum	1,2	24,8	0,2	369
		Maximum	2,3	38,46	0,77	385
	Yoghurts	Mean	10,45	5,85	0,115	188,5
		N	2	2	2	2
		Std. Deviation	4,78	3,04	0,02	96,87
Minimum		7,1	3,7	0,1	120	
Maximum		13,8	8	0,13	257	
Total	Mean	5,95	14,92	0,87	287,6	
	N	110	116	102	117	
	Std. Deviation	5,02	16,6	0,95	162,4	
	Minimum	0	0	0	28	
	Maximum	22,6	70	6,8	548	

Healthy cues	Ready-made and convenience foods	Mean	2,61	2,49	0,73	175
		N	9	9	9	9
		Std. Deviation	1,63	1,84	0,14	30,68
		Minimum	0,6	0,31	0,52	116
		Maximum	4,64	4,93	0,86	226
	Pasta, rice and grains	Mean	0,32	0,54	0,4	166,2
		N	5	5	5	5
		Std. Deviation	0,26	0,35	0,24	103,85
		Minimum	0,1	0,1	0	102
		Maximum	0,6	0,9	0,6	349
	Meat, poultry, fish and eggs	Mean	2,93	0,3	0,5	186,57
		N	7	6	7	7
		Std. Deviation	1,53	0,6	0,35	50,17
		Minimum	1,2	0	0,2	121
		Maximum	5,7	1,5	1,1	273
	Canned fish	Mean	1,8	0,9	1,2	227
		N	1	1	1	1
		Std. Deviation	.	.	.	.
		Minimum	1,8	0,9	1,2	227
		Maximum	1,8	0,9	1,2	227
	Fresh fruit, vegetables or legumes	Mean	0,12	7,73	0,28	48
N		6	6	4	6	
Std. Deviation		0,08	8,12	0,32	25,91	
Minimum		0	0,4	0	26	
Maximum		0,2	18	0,6	81	
Processed fruit, vegetables and legumes	Mean	0,01	4,4	0,29	46,67	
	N	3	3	3	3	
	Std. Deviation	0,02	1,91	0,51	35,8	
	Minimum	0	2,2	0	26	
	Maximum	0,04	5,5	0,88	88	
Others	Mean	0	0	0	1,33	
	N	1	1	1	3	
	Std. Deviation	.	.	.	2,31	
	Minimum	0	0	0	0	
	Maximum	0	0	0	4	

Healthy cues	Milk drinks	Mean	0,08	5	0,1	148
		N	1	1	1	1
		Std. Deviation	.	.	.	.
		Minimum	0,08	5	0,1	148
		Maximum	0,08	5	0,1	148
	Soft Drinks	Mean		2,4	0,05	12
		N		1	1	1
		Std. Deviation		.	.	.
		Minimum		2,4	0,05	12
		Maximum		2,4	0,05	12
	Yoghurts	Mean	1	5	0,2	54
		N	1	1	1	1
		Std. Deviation	.	.	.	.
		Minimum	1	5	0,2	54
		Maximum	1	5	0,2	54
	Total	Mean	1,45	2,93	0,47	124
		N	34	34	33	37
Std. Deviation		1,66	4,28	0,35	85	
Minimum		0	0	0	0	
Maximum		5,7	18	1,2	349	

Appendix 5

Published paper associated with this thesis

Bica M, Wickramasinghe K, Zhiteneva O, Boyland E, Tatlow-Golden M, Ireland T, Breda J. CLICK: The WHO Europe framework to monitor the digital marketing of unhealthy foods to children and adolescents. *UNSCN Nutrition*. 2020;45(Nutrition in a Digital World):69-74.

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INNOVATION 69

Innovation

CLICK: The WHO Europe framework to monitor the digital marketing of unhealthy foods to children and adolescents

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OVERVIEW

This paper presents CLICK, a monitoring framework developed by the World Health Organization European Office for the Prevention and Control of Noncommunicable Diseases (WHO NCD Office), to support countries in monitoring the digital marketing of unhealthy products to children (WHO NCD Office, 2019). We summarize its comprehensive and innovative approach, identifying the progress achieved and further measures required to strengthen the monitoring of digital marketing to children.

There is a "substantial, unequivocal" body of evidence that exposure to marketing of unhealthy food and beverages has a harmful impact on children's eating behaviour and body weight (WHO, 2018: 4; see also Boyland et al., 2016; Norman

et al., 2016; UNICEF, 2019a; WHO, 2016). In 2010, based on the strength of this evidence, the World Health Assembly unanimously adopted the WHO Set of Recommendations on the Marketing of Foods and Non-alcoholic Beverages to Children (WHO, 2010). A central recommendation of the WHO Commission on Ending Childhood Obesity (WHO, 2016) was that children's exposure to such marketing be reduced. Unhealthy food marketing infringes multiple rights under the United Nations Convention on the Rights of the Child (United Nations, 1989), including the rights to health and to freedom from exploitation (WHO Regional Office for Europe, 2016; UNICEF, 2018).

Yet, despite repeated calls to action and political commitments, policy development is patchy (WHO, 2018), and children and adolescents are frequently exposed to marketing of numerous unhealthy products, specifically, alcoholic

Appendix 6

Oral communications related to this thesis

Bica M, Wickramasinghe K, Ireland T, Zhiteneva O, Breda J. Measuring the proportion of digital market focusing on foods high in fat, salt and sugar: Need for urgent policy attention to protect children and young people. *Obesity Reviews*. 2020; 21(S1): e13118.

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EP-511 | Measuring the proportion of digital market focusing on foods high in fat, salt and sugar: Need for urgent policy attention to protect children and young people

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INTRODUCTION: Childhood obesity is one of the most serious public health challenges in the WHO European Region and beyond. The exposure to advertising of foods high in fat, sugar and salt (HFSS) is associated with children's preferences and, ultimately, with childhood overweight and obesity. Restricting marketing of HFSS foods is one important element in the context of the most cost-effective measures to undertake childhood obesity risk. Recently, most actions taken by authorities and stakeholders have been focusing on broadcast, newspapers and billboards advertising, while restrictions on digital marketing are extremely rare. The aim of this study is to illustrate the considerable size of digital media in several countries, within the WHO European Region.

METHODS: The first step of the monitoring tool (CLICK) published by the World Health Organization Regional Office for Europe is to map the digital marketing ecosystem. This step was completed by assessing the report *This Year Next Year Global Media Forecasts*, from WPP. Data from seven countries were analysed, namely, Estonia, Finland, Norway, Portugal, Russia, Slovenia, and the UK. The size of the total market was explored in terms of percentage of digital media, as well as advertisements and advertisers related to food.

RESULTS: A growing expenditure on digital media between 2008 and 2016 was observed in all of the seven countries. Some, such as Norway and the UK, had more than half of the media market assigned to digital (53.8% and 59.9%, respectively). Finland (49%), Portugal (35%) and Norway (31%) had the highest percentages of advertisements that can be associated with the promotion of food and beverages. With regard to the larger advertisers in 2016, Finland, Norway and Estonia had a considerable percentage of these that were related to food marketing (55%, 50% and 46%, respectively). However, countries like Russia and the UK had multinational food companies that can promote unhealthy products in the larger advertisers of their markets.

CONCLUSION: Albeit most countries have regulations on classical channels where marketing of foods targeting children is deployed, it seems clear that the proportion of digital media is increasing consistently, as highlighted in this study. In some countries, it already represents more than half of the total media marketing. It is not a small proportion and should be properly handled in terms of marketing restrictions frameworks. There is an urgent need to develop legislation and restrictions that cover digital marketing across all member states.