**Universidade do Minho**
Escola de Psicologia

Jarina Gabrielle Aquino Oliveira

# The Impact of Covid-19 Hygienic Measures on Food Choice and Food Behavior in a University Sample in Portugal

Outubro de 2021

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# The Impact of Covid-19 Hygienic Measures in Food Choice and Food Behavior in a University Sample in Portugal

Dissertação de Mestrado
Mestrado em Psicologia Aplicada

Trabalho efetuado sob a orientação da
**Doutora Olivia Morgan Lapenta**

Outubro de 2021

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## STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

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Universidade do Minho, 15/10/2021

Assinatura: 

O Impacto das Medidas de Higiene do Covid-19 nas Escolhas de Alimentos e Comportamento Alimentar em Universitários de Portugal


## Resumo

A pandemia Covid-19 provocou mudanças de estilo de vida, inclusive no comportamento alimentar. Portanto, avaliamos se a apresentação de pistas sanitárias relacionadas à pandemia, apresentadas em um vídeo de alimentos, impactam na apreciação de alimentos, diminuindo a atratividade e o desejo de comer. Em dois dias, participantes completaram um protocolo online no qual um vídeo e imagens contendo alimentos deveriam ser avaliados quanto ao aspecto visual, cheiro e sabor esperados e desejo de comer. Os vídeos diferiam apenas quanto à presença/ausência de elementos sanitários compondo as condições Covid/Não-Covid. Comidas doces e altamente calóricas receberam avaliações significativamente superior comparadas a comidas salgadas e de baixa caloria, sendo a apreciação das comidas doces maior na condição Não-Covid. O vídeo Não-Covid aumentou o desejo de comer, e em ambos os dias esta avaliação foi maior ao final em comparação ao início da tarefa. Os dados sugerem ainda que sintomatologia depressiva e ansiosa reduziram a apreciação de expectativa do odor dos alimentos no cenário pandêmico. Em suma, a percepção de alimentos parece ser afetada pela presença de pistas sanitárias relacionadas à pandemia, reduzindo o desejo de comer e a apreciação hedónica da comida, sendo esses efeitos potencializados por sintomatologia depressiva e ansiosa.



Palavras-chave: comportamento alimentar, Covid-19, percepção multissensorial do alimento, priming

The Impact of Covid-19 Hygienic Measures on Food Choice and Eating Behavior in a University Sample in Portugal


## Abstract

The Covid-19 pandemic led to several lifestyle changes including on eating behavior. Therefore, we sought to evaluate if depicting pandemic-related sanitary cues in a food video would impact food appraisal, decreasing food attractiveness and the desire to eat. In two different days, participants performed an online protocol in which a food video and food pictures should be evaluated regarding visual aspect, expected smell and taste and desire to eat. The videos presented each day differed regarding the presence/absence of sanitary elements adopted during the pandemics, composing the Covid/Non-Covid conditions. Sweet and high calorie foods received significantly higher evaluations compared to salty and low-calorie foods, being the sweet food evaluation higher in the Non-Covid condition. The Non-Covid video increased the desire to eat, and in both days, it was higher at the end of the task when compared to baseline. Further, our data suggests that depression and anxiety may reduce smell appreciation of foods presented in the pandemic scenario. In sum, food perception seems affected by the presence of the pandemic-related sanitary cues, reducing the desire to eat and food hedonic appreciation with such effects being further potentiated by depression and anxiety symptoms that arise from the pandemics.



Keywords: Covid-19, food behavior, multisensory food perception, priming

## INDEX

**Introduction** ..... 9

Food Perception ..... 9

Food Perception and Covid-19 Pandemic ..... 11

Priming Effect in Food Perception ..... 12

**Methods** ..... 13

Participants ..... 13

Questionnaires and Scales ..... 14

Priming Video and Visual Stimuli ..... 15

General Procedure ..... 15

Data Analysis ..... 16

**Results** ..... 17

Food Pictures Evaluation ..... 17

Video Evaluation ..... 21

Desire to Eat Evaluation ..... 22

**Discussion** ..... 23

**Conclusion** ..... 25

Study Limitations and Future Directions ..... 26

**References** ..... 27

**Appendix** ..... 34

Ethics Committee Approval ..... 34

## FIGURES INDEX

Task Design for both Covid and Non-Covid Conditions ..... 16

Panel Depicting Main Effects on Visual Aspect Ratings ..... 18

Panel Depicting Main Effects on Smell Expectation Ratings ..... 19

Panel Depicting Main Effects on Taste Expectation Ratings ..... 20
Interaction Effect on Taste Expectation Ratings ..... 20
Panel Depicting Main Effects on Desire to Eat Evaluation ..... 21
Panel containing T-test plot for Video ..... 22
Desire to Eat in the Different Time-Points of Evaluation ..... 23

# Introduction

## Food Perception

Perception begins when the body receives a stimulus, which can be of different natures, such as: chemical, mechanical and thermal (Kendal et al., 2000). Once the stimulus is captured by specialized receptors scattered throughout the body, it is transformed into electrical energy by means of transduction converting it into neural information which is passed on to different brain areas (Goldstein, 2010).

Each sense, i.e., taste, smell, vision, somatosensory and audition, are initially separately processed by specific brain structures and then integrated into a unified perceptual experience (Kendal et al., 2000). Regarding food perception, all senses provide cues about food structure, flavor, temperature and others thus inhibiting or enhancing food expectations and final appreciation. Therefore, texture, color, irritants, temperature and other sensorial experiences interact with each other and account to flavor perception (Delwiche, 2004). Thus, different specialized areas of the brain work serial and parallel generating flavor perception (Verhagen & Engelen, 2006).

One question of interest is: how senses interact when generating food perception and how they impact food behavior. One could say that the mouth receptors simply decode the five known tastants, i.e. sweet, sour, bitter, salty and umami, allowing recognition of what one is consuming, including nutritional and spoiled/poisoned food information. However, this process is more complex and involves the integration of all senses (Spence, 2016; Spence, 2017). Therefore, it is important to remark how each sense contributes unically and how they are integrated during food experience.

The first contact by means of sight, smell or touch, sends valious information that generates expectations and impacts the experience towards food. The sightenables identify color, size, organization and all other features related to appearance. Such characteristics provide cues about the flavor before the mouthfeel sensations (Spence & Piqueras-Fiszman, 2016). The manual touch, before taking the food into the mouth, provides cues about the weight, temperature and texture. Once in the mouth, the taste receptors information joins oral-somatosensorial information, such as texture and temperature (Spence & Piqueras-Fiszman, 2016). The sounds heard before, while and after eating, such as opening a package of chips and chewing the crunch, also provide food information regarding texture and freshness (Zampini & Spence, 2004), and those will be processed along with other sensory modalities during food perception (Spence, 2016). The smell has been cited in literature as playing a major role on flavor assimilation, being responsible for cues about the quality (e.g., if a food is rotten or not) and playing a main role on flavor elaboration, which can be noticed by the simple impression of loss of taste when we have impaired smell capacity, as when one has a flu (Boesveldt & Graaf, 2017; Spence, 2017).

Such multisensorial integration, tested in several studies, provides evidence of the impact of each and every sense in food perception. For instance, it has been demonstrated that high- and low-calorie visual food cues are differently processed in the brain and promote different perceptions of a neutral electric taste (Ohla et al., 2012). Specifically, the metallic taste resulting from the electrical stimulation is perceived as

more pleasant after seeing a high-calorie food. Further, round shapes are more associated with sweet and jagged shape, to bitter chocolate taste (Wang et al., 2017).

Slocombe and associates (2016) showed that food rugosity affects flavor appreciation, showing that smoother versus textured shapes are perceived as sweeter and sourest, respectively. In turn, auditory stimuli of the biting action have been shown to modulate how participants perceive crispness and freshness of food. Zampini and Spence (2004) demonstrated that potato chips are perceived as being both crisper and fresher when the auditory feedback of the biting action is increased, or when just the high frequency sounds are amplified.

Once food perception has its multisensory character established, the next step is to explore how components of the environment might be relevant to the construction of the food experience. In this sense, it has been demonstrated that cues that provide information about the food but are not part of the food itself, such as plateware, packages, cutlery or the environment where the food is presented are known as extrinsic cues and have an important influence on our perception as the intrinsic food characteristics, i.e., dimension, color, texture of the food itself (Acebrón & Dopico, 2000; Carvalho & Spence, 2018; Piqueras-Fiszman & Spence, 2014 ).

Zellner and collaborators (2011) have suggested that the appearance of the food and its organization on plates could influence the eater's perception of food safety. A subsequent study from the same researchers showed that an attractive presentation has more positive effects, i.e. is better evaluated by the consumer than a tradicional one, even when the food is equally neat (Zellner et al., 2014).

Piqueras-Fiszman and collaborators (2011) tested three different weights of dishes (light, medium and heavy) that were handled to participants with the same food product and amount. They found that participants provided greater evaluations on liking, flavor intensity, expected price and density on mouth as the weight of the dish was increasing.

Moreover, not only intrinsic and extrinsic food features can evoke preliminary perceptions about the eating experience. Previous memories related to the food and personal beliefs interfere with individual expectations, appreciation and therefore the ongoing perception and final evaluation of a food (Spence, 2017). For instance, Zellner and collaborators (2004) demonstrated that food rates of pleasantness vary according to the interaction between expectancy and real food taste. Moreover, memory processes play an important role on smell/odor perception (Algom & Cain, 1991), which can be observed in flavor perception by taste/odor associative congruence (Delwiche, 2004). Thus, the individual multi-integrated experience is the beginning of a person's relationship with food. Then, social factors, the cultural context and environmental cues will build, over time, complex and dense relationships between people and food (Wansink, 2004).

Foroni and Rumianti (2017), assessed new understandings about food perception pointing to the significant function of recognizing, conceptualizing and classifying different ingredients or food that underwent processes influencing nutritional and dietary habits. Such processes are directly linked not only to external and internal food cues or the environment where the person and food interact, but also personal cues such as hunger and body mass index.

In sum, while evaluating food, different sources of information are concomitantly accessed providing

the perception and influencing food choices, preferences and consumption. Moreover, even with similar preferences, the perception of food is not equal across populations as the response to a certain stimulus is influenced by the knowledge from previous experiences, and also by features such as duration, intensity and timing of the received stimuli (Kendal et al., 2000; Goldstein, 2010).

Given the interference of various factors in the relationship of human beings with food, it is essential to highlight the importance of knowing the environment in which an individual is inserted in order to better understand how new eating habits arise and how old habits can be modified. Thus, the exposure of living in a moment that triggers consequences for mental health and reorganizes society with new modes of relationship, as is the case with the Covid-19 pandemic (Paredes et al., 2021), is a field that should be explored in terms of its influences on food perception.

## Food Perception and Covid-19 Pandemic

After the beginning of the infections by SARS-CoV-2 virus, social rules differ considerably from those applied before the onset of the pandemic. In turn, more than one year after patient zero has been infected, different countries are still struggling to stop the increased number of new infections and further consequences of the Covid-19 pandemic (World Health Organization, 2020).

Different dimensions of society have been impacted by the several measures applied, such as social distancing, curfews and quarantine, to break out the spread of Covid-19 infections; daily use of protective tools such as face masks and face shields; exacerbation of hygienic habits, as constantly washing hands and using hand sanitizer to eliminate the virus.

The world experiences what is called a new normal, a way of life in which health depends on several individual and social behaviors to overcome a pandemic. Individuals and society behavior are regulated in different instances, including beliefs, liderships, socio demographic characteristics, amongst others. The large changes in society models of interaction also provoke habits changes and new behavioral outcomes to previously known situations (Bavel et al., 2020).

Eating habits are susceptible to change, among other things, due to sensitivity to environmental cues. Studies conducted in France (Marty et al., 2021) and Netherlands (Poelman et al., 2021) during the lockdown, established in the first semester of 2020, indicated changes in quality of food intake, food preference and also purchasing food during the social isolation. According to Marty and collaborators (2021), the nutritional quality has decreased in spite of the higher caloric intake. The major changes in the Netherlands were observed in individuals with overweight and obesity.

Likewise, other countries made remarkable discoveries about food behavior during the pandemics. In Italy, Renzo et al. (2020) enlightened the influence of psychological factors on food choice, reporting hardship on controlling good dietary habits and that changed eating habits during the pandemics are correlated to the highly prevalence of different self-reported psychological symptoms.

Higher rates of food intake were also reported in the United Kingdom by Buckland and collaborators (2021). In China (Jia et al., 2021) the detected dietary changes include a switch onto less healthy behaviors, such as the preference for non-fresh food instead of fresh ones. In turn, in Spain (Martinez-de-

Quel, 2021) reductions of physical activities and well being along with weight gain were reported after the outbreak of Covid-19 pandemics. Finally, Faour-Klingbeil et al. (2021) ran a study in the Arab region, namely in Lebanon, Jordan and Tunisia, and the outcomes showed a high concern of the population of getting infected by Covid-19 through food.

Portugal faced its third wave of Covid-19 at the beginning of 2021, which is even more fiercefull than the first one. In March, 2021, a year after the first infections in the country, the number of infections and deaths started decreasing after two months of restrictive lockdown, which included curfews, social distance and mandatory use of face protection outside (Direção-Geral da Saúde, 2021).

Therefore, the Covid-19 pandemic is a threat to public health and it also challenges society's adaptation to virus mitigation measures. The behavioral impacts of such influence are seen in different dimensions. Importantly, the ability of the social context to imprint new behaviors may be related to the possible behavioral modification of eating habits (Dijksterhuis, 2007) due to the influence of the pandemic.

## Priming Effect in Food Perception

In order to comprehend how food perception can be primed by environmental circumstances, one must understand the concept of priming itself.

According to Loersch & Keith (2016), the development of priming is characterized by the modulation of a perceptual process due to a previous exposure of an individual to a stimulus that following affects the assimilation and responses towards the target stimulus, thus modulating perception.

Once priming can alter perception, it is speculated that it will also influence behavior. In 1996, Bargh and collaborators (1996) found important behavioral responses in three classical priming experiments where subjects were exposed to different stereotypes in several activity conditions. Without being noticed of the priming intention of each activity, the participants' behavioral responses confirmed that priming effects can provide associated perceptual responses in individuals behavior, once in each different experiment the outcomes were modulated by what condition the subjects were primed to (Bargh et al., 1996).

Two years later, Dijksterhuis & Van Knippenberg (1998), corroborated such findings and added information about the relationship of priming versus time. Specifically, long lasting primed effects are proportional to the exposure time of priming. Lastly, in Horner and Henson (2008) experiments, four groups of images -smaller and bigger than a shoebox natural, and smaller and bigger than a shoebox man-made- were presented to subjects in its complete form or degraded, and participants had to answer about if it was bigger or smaller than a shoebox and if it was man-made in the current study and test time. When asked the same question both times, they were in Same condition; if questioned by contrast, Reverse condition and if they were asked if it was man-made, Orthogonal condition. The same procedure was applied using fMRI recordings. As results, less priming effects were found after task changes (Orthogonal condition) modifying the stimulus-response presented by participants in previous known images; such effects were evidenced in the Prefrontal Cortex (PFC) region, demonstrating associations between PFC and behavioral priming responses (Henson, 2003).

Regarding eating behavior, Papies and Hamstra (2010) used a behavioral experiment with one hundred

and fifty-six subjects where half of the participants were passively primed with a low-calorie diet poster before all participants being exposed to free food that could be eaten according to the individual's desire. The study also collected data about subjects' diet regarding it being restrained or unrestrained. As the main outcome of the experiment, self regulation in eating volume was shown to be primed by the poster, particularly in individuals who were considered restrained eaters. Further, important data priming impacts on eating behavior were found for both children and adults regarding food advertisements. Specifically, both populations presented significantly more food intake when primed by snacks publicity compared to non-food or healthy food priming, once more confirming that primed perception can modulate perception and thus food behavior (Harris et al., 2009).

In sum, due to Covid-19 new hygiene measures have been highly recommended. Beyond the social changes which covered the introduction of New Normal in daily life, individuals have experienced changes in their emotional and psychological well being, and further in eating behavior. The present investigation hypothesized that Covid-19 hygienic measures could impact food choices and eating behavior provoking decreasing food attractiveness and the urge to eat.

Further, since food perception is influenced by environmental cues and subjective beliefs, two dimensions affected by living during a pandemic, we also aimed to clarify if hygienic measures adopted on Covid-19 mitigation can influence expected food appraisal and willingness to eat by using priming conditions of Covid and Non Covid scenarios. As previously cited, priming studies have achieved important behavioral outcomes regarding food experiments. Further, the understanding of how the pandemic hygienic measures have been impacting the food behavior in Portugal is a pathway that has to be explored in order to evaluate the different influences that Covid-19 provoked in non-medical social dimensions. Such investigation could provide unprecedented data in an unprecedented situation within food perception studies and contribute with existing literature focusing on how contexts influence food preferences.

# Methods

## Participants

University students currently living in Portugal were recruited through the institutional website of Universidade do Minho. Inclusion criteria were: male and females with 18 to 59 years old, normal or corrected-to-normal vision.

All participants signed an informed consent previous to providing any data. The study was conducted in accordance with the Declaration of Helsinki and approved by the local Ethics Committee for Research in Life and Health Sciences (CEICVS 129/2020). Further, anonymity has been preserved due to a personal code created for each individual using the combination of their birth date and name initials.

## Questionnaires and Scales

### *Socio demographic and health data*

After signing the informed consent, participants provided socio demographic and health information, collected during the first day. The questionnaire was designed to collect personal data such as age, birth date, nationality, educational level, professional occupation, gender, weight and height. Following, participants answered questions about dietary habits and food allergies. Regarding medical information, participants were required to answer about past or current Covid-19 infection, loss or impairment in olfact/taste (during past or current infection) and also about their food consumption during the pandemic compared to before the Covid-19 pandemic.

### *Psychological Data*

Two different self-administered questionnaires were answered by the participants once, at the first testing day.

The validated Portuguese version of Patient Health Questionnaire - 9 (PHQ-9) (Kroenke, K., & Spitzer, R. L. et al., 2002) adapted by Monteiro et al., (2013), a short instrument idealized to assess data about the presence and grade of depression symptomatology. Its structure contains nine questions of 4-point Likert scale in which subjects can score from 1 to 27 points meeting different criteria with the progression of values (1-4: none, 5-9: mild, 10-14: moderate, 15-19: moderate/severe, 20-27: severe).

Following the same self-reported structure, the validated Portuguese version of General Anxiety Disorder - 7 (GAD-7) (Spitzer, R. L. & Kroenke, K. et al., 2006) adapted by Sousa et al., (2015), is an instrument of seven questions idealized to assess the severity of anxiety disorder. Using a 3-point Likert scale and a total range of 0 to 21 points per individual, the classification criteria increase in severity as the score increases (0-4: minimal; 5-9: mild, 10-14: moderate, 15-21: severe).

### *Loss Of Control over Eating Scale*

The Loss Of Control over Eating Scale (LOCES) (Latner et al., 2014), validated to the Portuguese population (Marques, 2018) was used to measure events and attitudes related to loss of control over eating in populations with eating disorders.

We applied the LOCES, in its 24-questions version, as an online questionnaire. The scale has strong psychometric properties, largely explained by its subscales that are responsible to measure behavioral, cognitive/dissociative and positive/euphoric aspects of the loss of control over eating by self-report in a 5 points scale ranging from never (1) to always (5).

## Priming Video and Visual Stimuli

Participants were presented on each day with either a Covid or Non-covid context video priming; thus generating two experimental conditions. Videos were recorded using an Iphone 7 (Copyright © 2021 Apple Inc. All rights reserved) in frontal view and edited using the Adobe Premiere Rush application for iOS (Copyright © 2021 Adobe. All rights reserved). All videos used in this protocol were saved in high quality, 1080p of resolution and disabled audio to avoid any unwanted auditory interference on perception.

The scene shown on both videos depicted the sames cenario: a white background, a table revested with a checkered in white and red fabric, a white plate, cutlery when necessary and napkins, recorded in frontal view, in which a woman consumes food from different categories, namely: Low-Calorie Sweet and Salty, and High-Calorie Sweet and Salty foods.

The video of Covid condition had the following additional elements: a hand sanitizer tube, a medical face mask in light-blue color and plastic film to pack the cutlery and napkin. The presentation regarding food on Covid protocol also presented folded food, in case of those which have pre-package. The tableware as a fork, knife and spoon were folded in plastic wrap together with the napkin. Thus, differing consumer behavior presented in both videos, since in Covid condition many hygienic measures were adopted, i.e, at the beginning of the video the woman is wearing a face mask that is only removed after hand cleaning with alcohol gel 70% and prior to food intake.

For our visual food stimuli, depicted in the food evaluation task, forty pictures were selected from the Full4Health Image Collection (Smeets, 2019) and categorized as depicted in the videos. Therefore, ten pictures of each of the four categories (Low-Calorie Sweet, Low-Calorie Salty, High-Calorie Sweet and, High-Calorie Salty foods) were presented sequentially and in pseudo-random order to be evaluated by the participants.

## General Procedure

The experimental protocol consisted of an online assessment performed in two days. The tasks were built online using Qualtrics software (Qualtrics, Provo, UT). Likewise, the data collected were extracted from Qualtrics.

Prior to the experiment itself, and only on the first day, participants took the socio demographic questionnaire, the brief inquerit of food related questions, and answered to the three scales described above. Further, in both testing days, a Covid-19 questionnaire assessed if there was a current or previous infection by SARS-CoV-2 and if so, if there was any associated loss/ impairment of taste and smell. Participants were also asked if any increase or decrease of food intake quantity was perceived during the pandemics and also to report in case they had any special dietary or food allergy.

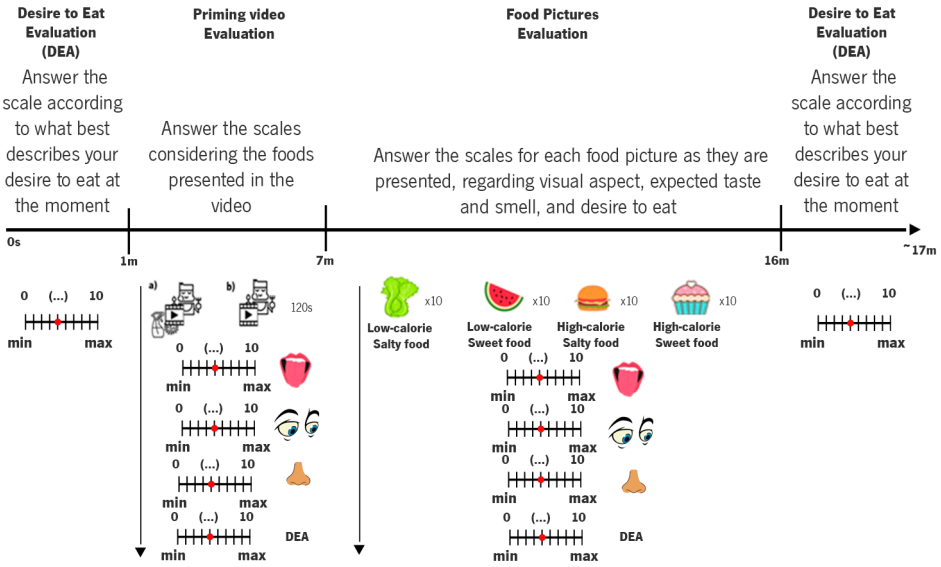
Following these initial questionnaires, participants performed, on different days, the Covid and Non-Covid conditions, as described below. Importantly, the order of conditions were randomized and counterbalanced between participants. The food pictures presentation was also pseudo-randomized between

conditions and were shown one at a time followed by the evaluations. Each picture was shown once at each testing day.

The present investigation used the Visual Analogue Scales (VAS) tool to evaluate the perception of participants about different features of food presented and also their urge to eat in distinct moments during the task. All the VASs presented in this study consisted of scales ranging from 0 to 10, where zero always represented the most negative/lower answer about the topic, and ten was always related to the positive/higher ones. The VAS tool has been chosen due to its capacity to reach results from subjective topics that usually cannot be measured with direct instruments (Nahler, G. & Nahler, G., 2009).

**Figure 1**

*Task Design for both Covid and Non-Covid Conditions*




*Note.* Task design, containing steps and total task duration.

## Data Analysis

Analyses were performed with Jamovi software (The jamovi project, version 1.6.16).

In order to analyse the data, we computed each individual mean VAS evaluation of such dimensions according to the calories (high versus low calorie) and the primary taste (sweet versus salty) of the presented food pictures. A repeated measures ANOVA was conducted considering as dependent variable each of the perceptual dimensions, i.e. taste, smell, visual, and the desire to eat, considering priming (Covid vs Non-Covid video), taste (Sweet vs Salty) and calories (High vs Low calorie) as within subjects factors.

As secondary outcomes, we evaluated the desire to eat during the experiment and also the subjective perception of food in the different types of videos. For the desire to eat we performed a rmANOVA considering priming (Covid vs Non-Covid) and time-point (baseline vs after video vs after task) as within-subjects

factors. Regarding perception of video foods, we performed a paired-sample t-test on each feature (Visual, Taste and Smell) considering the type of video (Covid vs Non-Covid).

Finally, Pearson correlations were performed between the two psychological scales (i.e., PHQ-19 and GAD-7) and further between the scales and the subjective evaluations of food pictures and priming videos (visual aspect, smell, taste and desire to eat).

# Results

126 individuals assigned and participated in the first day of the study, however, 41 dropped-off by not engaging in the second day of the experiment and were therefore excluded from analysis. The final analysed sample was composed by eighty-five university students (10 male, 75 female) with an average age of 20.8 years old (SD = 4.5). Participants' average weight and height were 60.3 kg (SD = 9.8) and 163 cm (SD = 0.07). Moreover, participants average body mass index (BMI) was of 22.55 kg/m2 (SD = 3.18) being three obese individuals (BMI > 30).

Psychological self-reported data pertaining to depression and anxiety symptomatology were sorted by its severity. Concerning depression symptomatology, assessed with PHQ-9, twenty-five participants did not fit in the diagnosis; three fit in severe, four in severe/moderate, eighteen in moderate and thirty-five in mild diagnoses. As for anxiety, assessed with GAD-7, fourteen scored in severe, twenty-two in moderate, twenty-eight in mild and twenty-one in minimal diagnoses.

The LOCES analysis showed that the average total score of our sample was 1.8 (SD = 0.56). Regarding the instrument subscales, participants' mean scores were 1.3 (SD = 0.53) for cognitive/dissociative factor, 1.9 (SD = 0.86) for positive/euphoric factor and 2.1 (SD = 0.71) for behavioral factor. Such numbers indicate that the participants' loss of control over eating are proportional to the low scores, being closer to 1 which is the minimum value of the scale (five being the higher), thus indicating low potential for loss of control over eating.

Regarding Covid-19 infection, twelve participants reported being infected by Covid-19 at the moment of participation or before it. Amongst these twelve, eight subjects communicated being affected, in the past or currently, by symptoms associated with loss of taste and/or smell. Finally fifty-one participants reported no changes in food consumption during the pandemic, whereas twenty-three reported increased and eleven reported decreased food consumption in the same period.

## Food Pictures Evaluation

### *Visual aspect*

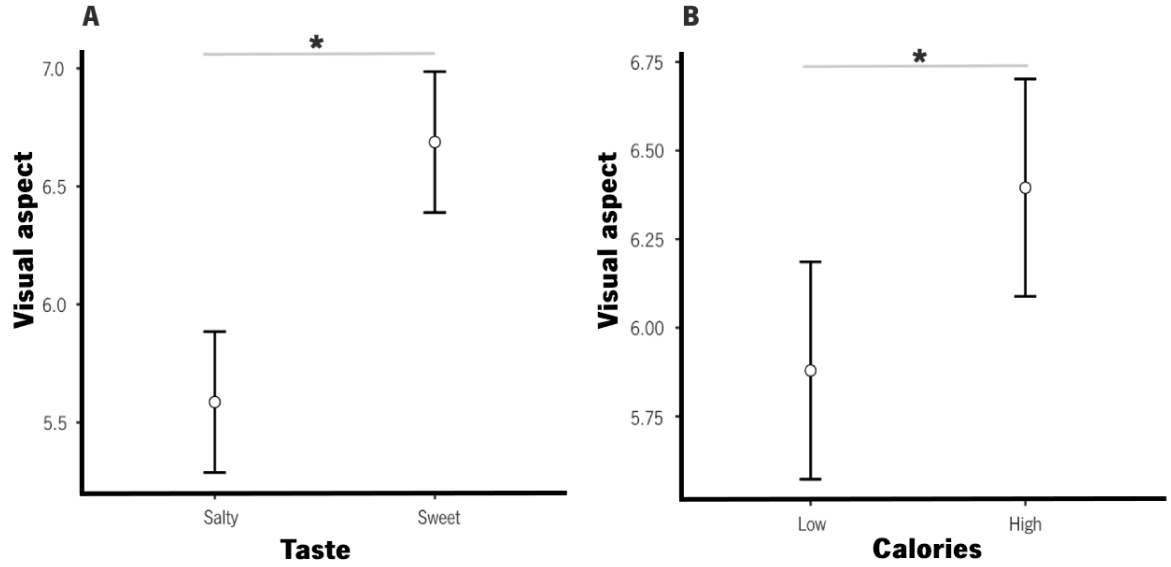
The rmANOVA for the evaluation of visual aspect showed main effects for Taste ($F_{1,84}$ = 83.521, p < 0.001, $\eta$2p = 0.499) and Calories ($F_{1,84}$ = 13.39, p < 0.001, $\eta$2p = 0.137). Specifically, Sweet foods (SwF)

received higher scores when compared to Salty foods (SaF), and High calorie foods (HCF) received higher scores when compared to Low calorie foods (LCF) (see Figure 2). We found no main effect of priming ($F_{1,84}$ = 0.541, p = 0.464, $\eta$2p = 0.006).

Further, we found interaction effects for Priming*Calories ($F_{1,84}$ = 10.826, p < 0.001, $\eta$2p = 0.114) and Priming*Calories*Taste ($F_{1,84}$ = 7.019, p < 0.010, $\eta$2p = 0.077). Bonferroni post hoc analysis on Priming*Calories effect showed that LCF received lower ratings when compared to HCF in both Covid (p = 0.072) and Non-Covid conditions (p < 0.001). However, the post hoc on Priming*Calories*Taste showed the same interactions observed in the main effects. Due to the variables independence, the effects were repeated on Covid and Non-Covid conditions.

**Figure 2**

*Panel Depicting Main Effects on Visual Aspect Ratings*




*Note.* Panel depicting main effects for visual aspect evaluation regarding (A) taste and (B) calories. Bars indicate confidence intervals (95%). * p < 0.001

## *Smell*

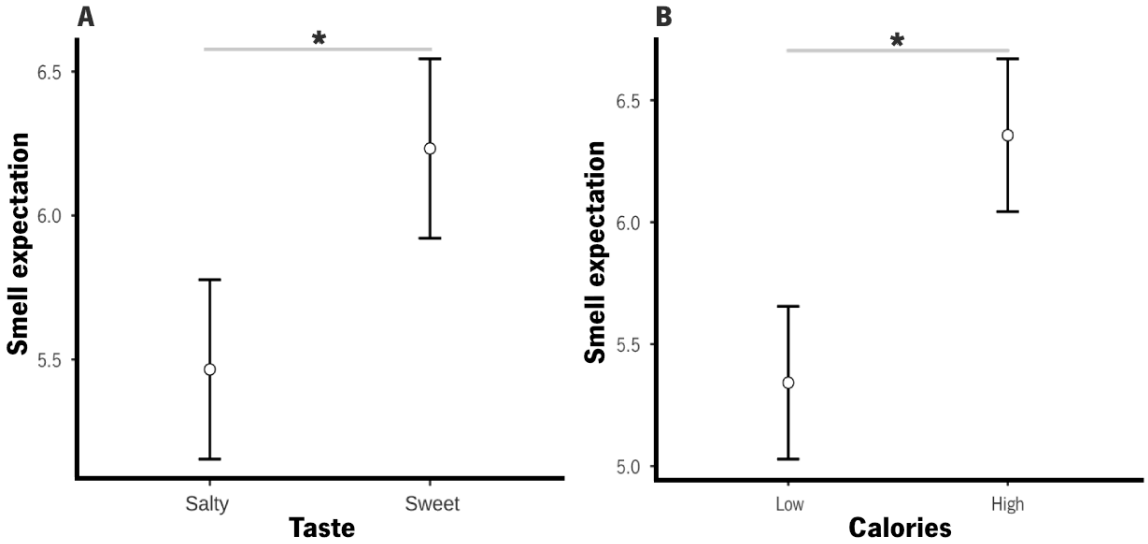
Concerning the expected smell evaluation, the rmANOVA showed main effects of Taste ($F_{1,84}$ = 30.534, p < 0.001, $\eta$2p = 0.267) and Calories ($F_{1,84}$ = 50.647, p < 0.001, $\eta$2p = 0.376). SwF and HCF obtained higher rates when compared to SaF and LCF, respectively (Figure 3). No main effect was found for Priming ($F_{1,84}$ = 0.116, p = 0.733, $\eta$2p = 0.001).

Interaction effects were found for Taste*Calories ($F_{1,84}$ = 24.410, p < 0.001, $\eta$2p = 0.225) and Taste*Calories*Priming ($F_{1,84}$ = 6.417, p = 0.013, $\eta$2p = 0.071). Bonferroni post hoc on Taste*Calories demonstrated that High calorie-Sweet (SwHCF) scored higher compared to Low calorie-Sweet foods (SwLCF) (p = 0.012) and High calorie-Salty (SaHCF) food had the same interaction when compared to Low calorie-Salty ones (SaLCF) (p < 0.001).

Regarding Bonferroni post hoc analysis on the triple interaction, Taste*Calories*Priming showed that SaLCF presented in the Covid condition received lower ratings when compared to SaHCF ($p < 0.001$) and SwLCF ($p < 0.001$). SwLCF had lower ratings when compared to SwHCF in Covid condition ($p = 0.022$). The triple interaction showed results also presented on main effects. Due to the variables independence, the effects were repeated on Covid and Non-Covid Conditions.

**Figure 3**

*Panel Depicting Main Effects on Smell Expectation Ratings*




*Note.* Panel depicting main effects for smell expectations evaluation regarding (A) taste and (B) calories. Bars indicate confidence intervals (95%). * $p < 0.001$

## *Taste*

For taste expectation, the rmANOVA showed main effects for Taste ($F_{1,84} = 21.438$, $p < 0.001$, $\eta 2p = 0.203$) and Calories ($F_{1,84} = 35.762$, $p < 0.001$, $\eta 2p = 0.299$). SwF and HCF received higher scores when compared to SaF and LCF (Figure 4). No main effect was found for Priming ($F_{1,84} = 3.614$, $p = 0.061$, $\eta 2p = 0.041$).

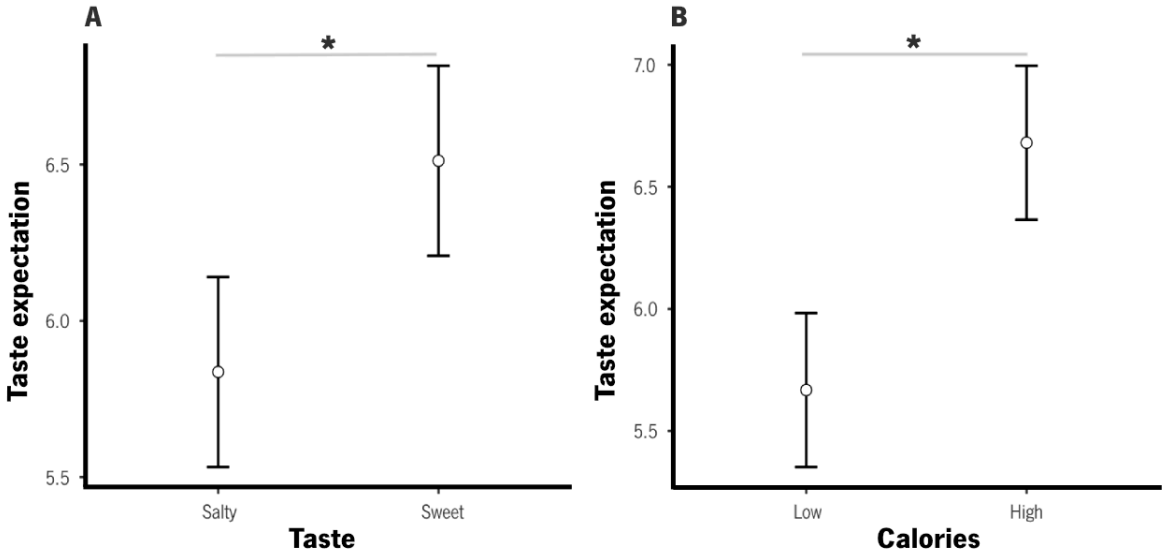
There were also interaction effect of Priming*Taste ($F_{1,84} = 7.969$, $p = 0.006$, $\eta 2p = 0.087$), Priming*Calories ($F_{1,84} = 7.668$, $p = 0.007$, $\eta 2p = 0.084$), Taste*Calories ($F_{1,84} = 18.601$, $p < 0.001$, $\eta 2p = 0.181$) and a trend for Taste*Priming*Calories ($F_{1,84} = 0.584$, $p = 0.447$, $\eta 2p = 0.007$). Bonferroni post hoc analysis on interactions showed that in Priming*Taste effect demonstrates that Non-Covid SaF received lower rates when compared to SwF in the same condition ($p < 0.001$). In the same interaction, SwF were higher rated compared to SaF in Covid condition ($p = 0.004$). SwF in Non-Covid condition were higher rated compared to Covid ($p = 0.013$) (Figure 5).

Regarding Priming*Calories interaction, Bonferroni post hoc showed that HCF were scored higher

when compared to LCF both in Covid ($p < 0.001$) and Non-Covid conditions ($p < 0.001$). Considering Taste*Calories, SaLCF were scored less compared to SwLCF ($p < 0.001$) and SaHCF ($p < 0.001$).

**Figure 4**

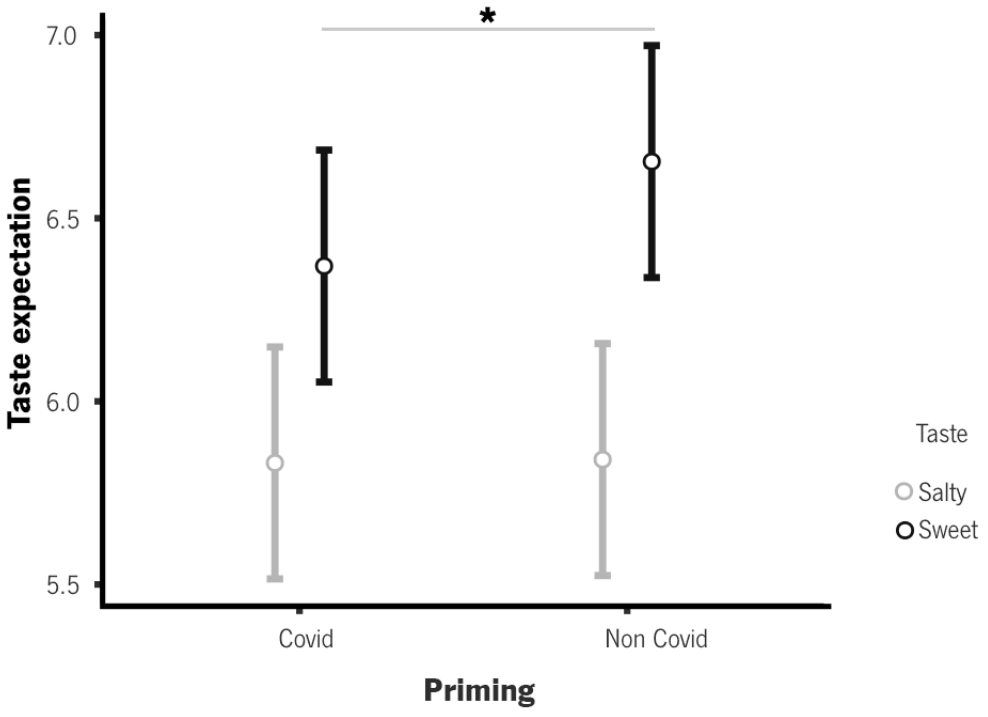
*Panel Depicting Main Effects on Taste Expectation Ratings*




*Note.* Panel depicting main effects for taste expectation evaluation regarding (A) taste and (B) calories. Bars indicate confidence intervals (95%). * $p < 0.001$

**Figure 5**

*Interaction Effect on Taste Expectation Ratings*




*Note.* Bars indicate confidence intervals (95%). * $p < 0.001$

## *Desire to Eat*

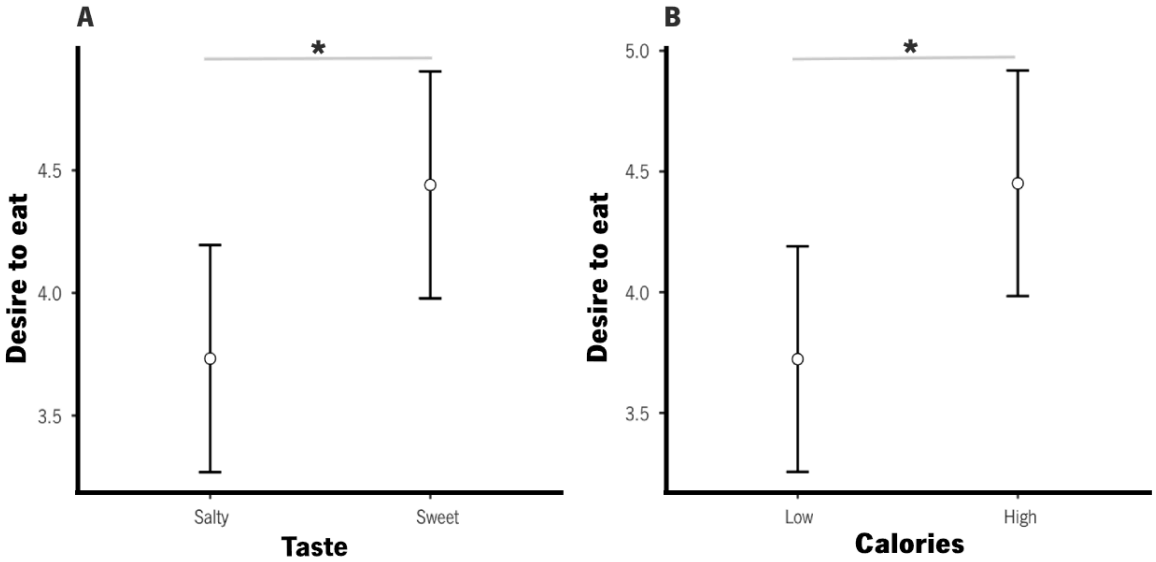
The rmANOVA evaluation revealed main effects for Taste ($F_{1,84}$ = 18.317, p < 0.001, $\eta$2p = 0.179) and Calories ($F_{1,84}$ = 16.729, p < 0.001, $\eta$2p = 0.166). HCF and SwF presented higher scores compared to LCF and SaF, respectively (Figure 6). No main effect was found for Priming ($F_{1,84}$ = 1.109, p = 0.295, $\eta$2p = 0.013).

Interactions effects were found for Taste*Priming ($F_{1,84}$ = 7.381, p = 0.008, $\eta$2p = 0.081) and Taste*Calories ($F_{1,84}$ = 18.086, p < 0.001, $\eta$2p = 0.177). Bonferroni post hoc analysis in Taste*Priming demonstrated for both Covid and Non-Covid conditions that SwF received higher scores compared to SaF (p = 0.038; p < 0.001, respectively). Taste*Calories showed SaLCF scored less when compared to SaHCF (p < 0.001 ) and to SwLCF (p < 0.001).

Finally, Pearson correlational analysis between PHQ-9 and food picture subjective evaluations showed significant negative correlation relative to depression symptomatology and Visual (r = -0.24, p = 0.025) and Taste (r = -0.25, p = 0.023) and Smell (r = -0.25, p = 0.021) of SaLCF in Covid condition. No significant correlation was found in Pearson correlations performed between the instruments PHQ-9 and GAD-7 and desire to eat.

**Figure 6**

*Panel Depicting Main Effects on Desire to Eat Evaluation*




*Note.* Panel depicting main effects for desire to eat evaluation regarding (A) taste and (B) calories. Bars indicate confidence intervals (95%). * p < 0.001

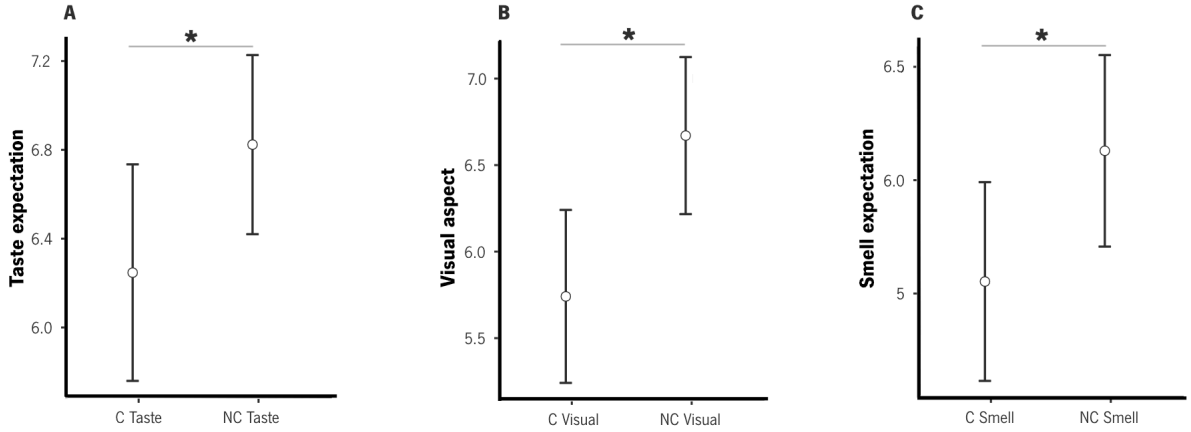
## Video Evaluation

Student's t-test evaluation (Figure 7) showed higher scores at Non-Covid compared to Covid-condition for visual aspect (t = -3.56, p < 0.001, d = -0.386), smell (t = -2.26, p = 0.026, d = -246) and taste

expectation (t = -2.50, p = 0.015, d = -271).

**Figure 7**

*Panel containing T-test plot for Video*




*Note.* Bars confidence interval (95%) and (*) = <0.05. (A) Taste expectation, compared between Covid (Mean = 6.25, SD = 2.29) and Non-Covid (Mean=6.82, SD = 1.90) conditions, showed higher scores on Non-Covid condition; (B) Visual aspect between conditions showed higher rates to Non-Covid (Mean = 6.67, SD = 2.13) condition compared to Covid (Mean = 5.77, SD = 2.35) and (C) Smell expectation, comparing Covid (Mean = 5.55, SD = 2.06) to Non-Covid (Mean = 6.13, SD = 1.99) conditions showed higher scores to Non-Covid condition. The letter C on the plots stands for Covid-condition whereas the letters NC stands for Non-Covid condition.

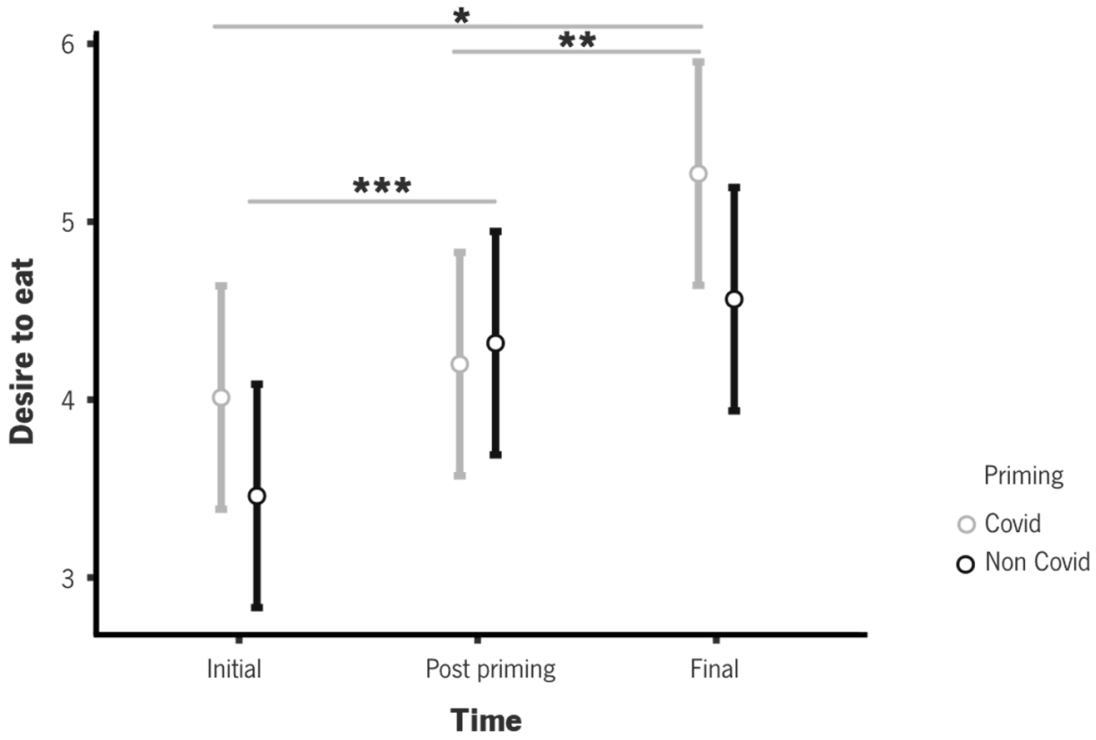
## Desire to Eat Evaluation

The rmANOVA evaluation of Desire to eat showed a main effect for Time (F2.168 = 17.11 , p < 0.001, $\eta$2p = 0.169) showing an increase of the desire to eat as the experiment progress, i.e., Final desire to eat was higher when compared to the Initial assessment (p < 0.001) and Post-priming evaluation (p = 0.004) and further, Post-priming evaluation received higher rates compared to Initial evaluation (p = 0.032) (Figure 8). There was no main effect of Priming ($F_{1,84}$ = 1.28, p = 0.262, $\eta$2p = 0.015).

Further, an interaction effect was found for Time*Priming (F2.168 = 5.17 , p = 0.007, $\eta$2p = 0.058). Bonferroni post hoc analysis showed that the Final desire to eat at Covid-condition was higher when compared to the Initial (p < 0.001) and also the Post-priming desire (p < 0.001). Whereas for Non-Covid condition, Final evaluation was only greater when compared to the Initial one (p < 0.001).

**Figure 8**

*Desire to Eat in the Different Time-Points of Evaluation*




*Note.* Bars indicate confidence interval (95%).

* $p < 0.001$. Final assessment, after the end of the task showed higher desire to eat when compared to the assessment before the procedures on both Covid and Non-Covid conditions.

** $p < 0.001$. Post priming evaluation at Covid condition showed higher desire to eat when compared to the after video evaluation.

*** $p < 0.001$. Post priming at Non-Covid condition compared to baseline assessment on the same condition.

# Discussion

Our study explored hedonic responses through participants' subjective appreciation of food visual attractiveness, expectancy of taste and smell and craving by presenting food pictures. Moreover, we aimed to evaluate how the context of Covid-19 pandemic impacts such appreciation by comparing, in the same sample, the effects of visual priming using Covid and Non-covid video scenarios. Because food visual appearance plays an important role in its perception (Santagiuliana et al., 2020), which is corroborated by physiological responses of heart rate and skin conductance (Verastegui-Tena et al., 2017), we expected to observe differential evaluations regarding high versus low calorie and sweet versus salty foods. Further, because of the negative psychological factors associated with the pandemics (Paredes et al., 2021), we expected lower food appraisal in the Covid compared to Non-covid conditions.

The main outcomes concerning food pictures evaluations were the salience of sweet over salty foods evaluations and of high-calorie over low-calorie foods in all categories, i.e., smell and taste expectation, visual aspect and desire to eat. Such results are in accordance with our primary hypothesis regarding

preference for high caloric and sweet food amongst other food categories, and it is supported by the concept that perception of high-calorie food enhances hedonic response in brain areas related to the reward system (Ohla et al., 2012). Further, preferences for high density caloric foods are aligned with the increased craving and consumption of snacks of both sweet and savory food categories associated with Covid-19 pandemic (Buckland et al., 2021), as well as the higher volume of calories consumption that can be also related to impoverished coping strategies during the pandemic (Tribst et al., (2021); Poskute et al. (2021)).

Furthermore, different behavioral outcomes were expected according to the priming condition. Considering the exposition of an external event, specifically the Covid-19 pandemic, that has provoked a negative impact on psychological, social and health aspects of life (Paredes et al., 2021), and knowing that priming effects are proportional to duration of exposition (Dijksterhuis & Van Knippenberg, 1998), we expected that food hedonic appreciation and desire to eat evaluation, for both the actual video and the following presented pictures, to be lower in Covid-19 compared to the Non-Covid video due to the negativity of pandemic cues. The study results are partly in accordance with the initial hypothesis. In fact, sweet foods on Non-Covid condition received higher scores for taste expectation when compared to Covid-condition. Sanitary cues primed along food exposure have been previously shown to diminish unhealthy choices (Werle & Cuny, 2012).

Interestingly, our condition effect was observed only at the most salient category of sweet flavor, which was higher rated at the Non-covid condition. The video did not intend to show solely a sanitary measure of food consumption, but to provide the notion of the pandemic scenario that is likely to incite the negative burden on mental health caused by the economic, social and subjective aspects related to it. Different levels of triggering effects of psychological distress that can disruptively modify the individual's relationship with food (Coulthard et al., 2021; Santana et al., 2021; Brown et al., 2021). Effects of nonconsciously odoral, visual and auditory priming are observed in behavioral and lexical tasks towards food investigations (Papies and Hamstra, 2010; Gaillet et al., 2013; Chambaron et al., 2015), which corroborates the better evaluation of sweet foods by the participants who were primed with non-negatively associated situations.

Moreover, the video evaluations corroborates such interpretation as we found that smell and taste expectations and visual aspect on Non-Covid condition received higher scores compared to Covid condition. Importantly, both videos were built with the same food and eating actions differing only regarding the Covid and Non-Covid sanitary measures before the actor ate the foods. Thus, video evaluation findings are aligned to the above discussion on the food pictures priming, in which we explore the literature demonstrating that it is more likely to positively evaluate foods in the absence of negative events association once beliefs, memory and time to reflect about a food or food group influence the desire to eat and food choices (Muñoz-Vilches et al., 2020).

In addition, Choi and collaborators (2020) showed high prevalence of participants reporting symptoms of anxiety and depression in studies related to Covid-19 and although previous findings report higher consumption and greater food appeal for individuals with negative psychological burden (Landaeta-Díaz et al., 2021; Smith et al., 2021), our correlations between PHQ-9 and GAD-7 and the video subjective evaluations showed negative correlation between the smell evaluation and PHQ-9 only at the Covid con-

dition. Importantly, our study differs from investigations which presented real food (e.g. Lapenta et al. (2014); Lowe et. al. (2018)), since the foods were presented in the online format and thus, not allowing actual smell appreciation. Still, Covid-19 scenario recalled by the hygienic cues, i.e. hand sanitizing and face mask, can evoke negative triggers to one's mental health that, in turn, might affect food behavior negatively (Paredes et al., 2021).

Finally, the desire to eat over time assessed in video evaluations showed that the final urge to eat was higher in both conditions compared to baseline assessment, which is in accordance to our initial hypothesis and aligned with the concept that exposure to food or food cues induces an increase of craving, i.e. urge to eat, in humans (Sun & Kober, 2020).

However, when comparing the initial desire to eat with the post video desire to eat we observed that only the Non-Covid video led to increased ratings compared to baseline. Such effects likely arise from the aversive/negative priming of Covid condition which was also associated with lower hedonic appreciation of the foods. Therefore, the negative aspects of the video counterbalance the expected food cue effect of increasing the desire to eat. Our findings are corroborated by Dijksterhuis & Van Knippenberg (1998) data showing better efficacy of priming soon after exposure to the primed stimulus. Therefore, the final desire to eat evaluation, which was similar in both conditions, demonstrated a craving effect due to repetitive food exposure, including during the pictures evaluations, which provided no information regarding covid vs non-covid and thus, is expected to increase craving.

Summarizing our findings, the non-significant effects of priming for smell expectation, visual aspect and desire to eat evaluations on food image assessments may be related to the fact that priming may differently impact a population in accordance to other characteristics that facilitate or hinder the expected effects, such as dilution of priming effect, task durations or even different background experiences related to the primed stimuli (Forwood et. al., 2015). Still, we observed a modulation on the evaluation of both, low and high calorie, sweet foods on taste expectation on pictures evaluation and further, that the craving induction was, to some extent, reduced in the pandemic condition as demonstrated by our contrast of non-significant versus significant difference to baseline of craving evaluation post Covid and No-Covid videos, respectively.

Thus, our results on the video evaluation and the effect of video priming on the following food picture evaluations are partially aligned with our initial hypothesis and supports the idea that Covid-19 sanitary cues negatively interfere in the hedonic valuation of food.

# Conclusion

In conclusion, our data support previous findings of (i) sweet and high-calorie foods having greater attractiveness and better ratings when compared to salty and low-calorie foods, respectively, and that (ii) food exposure increases the desire to eat.In addition, the study provided (iii) new insights that hygienic measures of Covid-19 may elicit lower smell assessment and desire to eat, as demonstrated by our findings in the Non-Covid and Covid video evaluations. Furthermore, a (iv) priming effect was observed for sweet

food pictures evaluation, but not other food categories. This finding points to changes in food behavior although this might be observable only in more salient food categories.

When combined with previous findings, our results point to a possible ambivalence towards learned associations related to the Covid-19 pandemic. This statement comes from the possible effect that exposure to hygiene measures adopted in the pandemic may affect food perception and reduce the hedonic appreciation of foods and thus consumption, although some studies show that the psychological effects of the pandemics result in increased food intake. In fact, the symptoms for depression and anxiety were associated with increased negative effects of the hygiene measures adopted in the Covid-19 pandemic. Thus, further studies are needed to better understand how individuals' psychological states modulate food choices and consumption according to different scenarios of an experimental setting.

Finally, because the videos suggest a priming effect only for one food category, further studies must continue exploring this topic in order to clarify if this finding is due to the salience of sweet food stimuli or to a low sensitivity of our task and/or priming video.

## *Study Limitations and Future Directions*

This study, as most food researches performed along the pandemic, was conducted online which does not allow to assure that all participants are in the same controlled environment. Thus, despite the relevant findings reported herein, food evaluation is a multisensorial task that can be influenced by different sensory modalities and environmental cues (Wansink, 2004). Moreover, the online experiment permitted us to present food pictures, which has been used in several studies (Charbonnier et al., 2016; Liu et al., 2020) but does not allow us to investigate the robustness of the food category and priming effects towards real food, which would represent a more ecological setting and also the actual evaluation of smell and flavor beyond the evaluated expectation. Future studies, carried out in direct contact with participants in a laboratory or controlled environment would allow filling such gaps of an online data collection.

Our study is also limited for not verifying participants' explicit awareness of the priming since they were informed that the experiment would be carried out on two different days and that they would do the same task with different videos each day but were not informed about the purpose of the videos. Therefore, we used implicit priming and did not ask participants if they presumed that each video was supposed to affect the following task. Such information could be informative to control personal biases controlling how awareness could interfere in the final data.

Finally, our study is limited by having only behavioural data without any physiological assessment. Combining the behavioral assessments with neurophysiological data, such as brain activity, skin conductance and eye-tracking recordings, could provide additional information of different dimensions, affording a better understanding of which brain areas are involved with the observed effects, such as the level arousal provoked by different categories of stimuli, if the priming changes the way food is tracked, and if different brain areas are activated according to food-type and priming condition and therefore could add important information of the investigated questions.

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# Appendix

## Ethics Committee Approval



Universidade do Minho

Conselho de Ética

**Comissão de Ética para a Investigação em Ciências da Vida e da Saúde (CEICVS)**

**Identificação do documento:** CEICVS 129/2020

**Título do projeto:** *O impacto das medidas de higiene do covid-19 nas escolhas de alimentos e comportamento alimentar em universitários de Portugal ("The impact of covid-19 hygienic measures on food choice and eating behavior in a university sample in Portugal")*

**Equipa de investigação:** Jarida Oliveira, aluna do Mestrado em Psicologia Aplicada da Escola de Psicologia da Universidade do Minho; Professora Doutora Olivia Morgan Lapenta (orientadora), Escola de Psicologia da Universidade do Minho

**Unidade Orgânica Promotora:** Centro de Investigação em Psicologia da Escola de Psicologia da Universidade do Minho

**Outras Unidades:** n/a

**PARECER**

De acordo com a documentação apresentada, o projeto insere-se no âmbito do Mestrado em Psicologia Aplicada da Escola de Psicologia da Universidade do Minho.

Trata-se de um estudo prospetivo, observacional, descritivo e analítico, com o apoio institucional do Centro de Investigação em Psicologia da Escola de Psicologia da Universidade do Minho. É objetivo principal do estudo identificar a influência das medidas de higiene adotadas para a prevenção do Covid-19 no comportamento alimentar, e a sua possível relação com a atratividade de alimentos em estudantes universitários em Portugal, especificamente em estudantes da Universidade do Minho.

Após verificação e análise dos documentos associados ao processo de pedido de emissão de parecer ético sobre o projeto em apreço, a que reporta a respetiva "Análise e justificação do parecer", considera-se que (i) o processo está devidamente instruído, (ii) a análise dos documentos apresentados sobre o estudo a realizar obedecem às regras de conduta ética e requisitos exigidos para as boas práticas na experimentação com humanos e (iii) estão em conformidade com o Guião para submissão de processos a pedido de Parecer Ético na UMinho.

Face ao exposto, a Comissão de Ética para a Investigação em Ciências da Vida e da Saúde (CEICVS) nada tem a opor à realização do projeto, emitindo o seu parecer favorável, que foi aprovado por unanimidade dos seus membros.

Braga, 21 de dezembro de 2020.

A Presidente da CEICVS



(Maria Cecília Lemos Pinto Estrela Leão)

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## ANÁLISE E JUSTIFICAÇÃO DO PARECER

**Relatora:** Nadine Santos

**Grelha de verificação e de avaliação ética**
(Processo submetido em suporte eletrónico - documentos recebidos assinalados com X e respetiva avaliação ética)

| **Documentos** | **Sim** | **Não** | **Não se aplica** | **Avaliação Técnico-ética** |
|---|---|---|---|---|
| Pedido de apreciação de projeto enviado à CEICVS [a] | X | | | Adequado |
| Quando aplicável, identificação da Unidade Curricular (UC) no âmbito da qual se insere o projeto (designação do curso, designação da UC e respetivo ano curricular, identificação do/s coordenador/es da UC, nome e número mecanográfico do estudante) | X | | | Adequado |
| Carta de Apoio/Autorização da(s) Unidade(s) ou Serviço(s) onde decorrerá o projeto [a] | X | | | Adequada |
| Quando aplicável, informação do Orientador da Tese sobre apoio e/ou enquadramento do projeto | X | | | Adequado |
| Protocolo do estudo, incluindo, se aplicável, os instrumentos de recolha de dados e/ou informação para o participante [a] | X | | | Protocolo do estudo elaborado de acordo com os requisitos e normas éticas de boas práticas em experimentação com humanos.<br><br>Aconselha-se realização de calculo amostral. |
| Curriculum Vitae abreviado do Investigador Responsável e dos membros da equipa e/ou orientadores [a] | X | | | Presente |

| | | | | |
|---|---|---|---|---|
| Quando aplicável, documento de Consentimento Informado, elaborado e referenciado de acordo com a alínea [c] abaixo indicada | X | | | Aconselha-se revisão do português |
| Declaração de Compromisso de Confidencialidade (e/ou Termo de Responsabilidade) | X | | | Adequada |
| Quando aplicável, informação sobre financiamento para o cumprimento do projeto, incluindo, se aplicável, cabimento/inscrição no orçamento da Unidade/Serviço em que decorrerá e/ou com fonte de financiamento nacional/internacional | | | X | |
| **Conforme aplicável, o desenvolvimento de projetos de investigação está associado à emissão de Parecer/Autorização ética e de proteção de dados (DPO) de entidades locais ou nacionais.** | | | | |

[a] Documentos obrigatórios de acordo com as normas orientadoras para submissão de processos a apreciar pelo Conselho de Ética da UMinho.
[b] Documentos obrigatórios de acordo com o funcionamento da Comissão de Ética para a Saúde do Hospital de Braga (CESHB).
[c] Documento de Consentimento Informado, Livre e Esclarecido para Participação em Investigação de acordo com a Declaração de Helsinquia[i], a Convenção de Oviedo[ii] e o Regulamento Geral de Proteção de Dados (RGPD)[iii]. Guião na elaboração do consentimento informado é disponibilizado pela ARSN[iv] e através do "Documento CEIC sobre o Regulamento Geral de Proteção de Dados (RGPD) no contexto da Investigação Clínica"[v].

Acesso aos documentos da alínea c):
[i] http://portal.arsnorte.minsaude.pt/portal/page/portal/ARSNorte/Comiss%C3%A3o%20de%20%C3%89tica/Ficheiros/Declaracao_Helsinquia_2008.pdf
[ii] http://dre.pt/pdf1sdip/2001/01/002A00/00140036.pdf
[iii] https://eur-lex.europa.eu/legal-content/PT/TXT/?uri=celex%3A32016R0679
[iv] http://www.arsnorte.min-saude.pt/consentimento-informado/
[v] http://www.ceic.pt/documents/20727/0/Documento+CEIC+sobre+o+Regulamento+Geral+de+Prote%C3%A7%C3%A3o+de+Dados+%28RGPD%29_publica%C3%A7%C3%A3o/ced81411-5fe4-46f5-a613-c7c716abbb4b
[vi] https://dre.pt/home/-/dre/123815982/details/maximized

**Justificação do Parecer**

Trata-se de um projeto efetuado no âmbito no âmbito do Mestrado em Psicologia Aplicada da Escola de Psicologia da Universidade do Minho, com o apoio institucional do Centro de Investigação em Psicologia da Escola de Psicologia da Universidade do Minho, para a sua realização na(s) Unidade(s), com duração de 16 meses e com início previsto em maio de 2020.

O(a)(s) Investigador(a)(s) Responsável(eis) (IRs), têm formação clínica e/ou académica e/ou técnica e experiência solidificada nas áreas de base do projeto, e/ou o apoio de uma equipa de investigação com experiência.

O objetivo geral do estudo é identificar a influência das medidas de higiene adotadas para a prevenção do Covid-19 no comportamento alimentar e a sua possível relação com a atratividade de alimentos em estudantes universitários em Portugal; especificamente, em estudantes da Universidade do Minho. É objetivo específico do projeto um melhor entendimento do impacto e da influência das medidas preventivas do Covid-19 em contextos de consumo alimentar e perceção alimentar.

Trata-se um estudo prospetivo, observacional, descritivo e analítico. Será a população-alvo os estudantes da Universidade do Minho. Os participantes serão recrutados através do site institucional e da lista de email da

Universidade do Minho. Foram definidos critérios de inclusão. Não foram definidos critérios de exclusão. O protocolo experimental consiste em uma avaliação online que acontecerá em dois dias. No primeiro dia os participantes irão responder sobre dados sócio demográficos e pessoais (como peso e altura), também um breve inquérito sobre questões relacionadas à alimentação (como possíveis alergias, intolerâncias ou dietas especiais), e responderão sobre o interesse em comidas doces, salgadas, com alta e baixa densidade de calorias por meio de uma escala visual analógica (VAS). Por fim, um questionário sobre o Covid-19 a será aplicado para obtenção de dados sobre histórico de infecção e/ou possíveis sintomas que se relacionem com o tema do estudo, como alteração ou perda de olfato e paladar, assim como a perceção sobre alterações na qualidade e quantidade de alimentos consumidos durante a pandemia. Ainda, duas escalas serão aplicadas para acessar dados sobre estresse e saúde mental nos últimos 14 dias, nomeadamente GAD-7 e PHQ-9. A *Losses of Control over Eating Scale* (LOCES) será aplicada com a finalidade de obter dados sobre o comportamento alimentar dos participantes nos últimos 28 dias. Ao fim da avaliação inicial, os participantes irão experienciar, em dias diferentes, situações referentes ao "Covid" e "Sem-Covid". As situações serão randomizadas e contra balanceadas entre os participantes.

Os dados recolhidos incluem os obtidos através do protocolo supra descrito. Variável, tipo de variável e/ou categorias da variável e descrição da mesma foram enumeradas/descritas no protocolo de investigação e/ou foi fornecido em anexo o Formulário de Recolha de Dados e/ou Guião da Entrevista e/ou Metodologia Laboratorial.

O projeto não envolve a dádiva, e/ou colheita, análise laboratorial e/ou imagiológica e/ou oftalmológico ou afins, e/ou processamento, e/ou preservação, e/ou armazenamento, e/ou distribuição e/ou aplicação de tecidos e/ou células de origem humana.

Será salvaguardado o anonimato e a confidencialidade do participante (não haverá identificação nominal do titular, sendo aposto um código de participante no estudo).

Os participantes serão informados dos procedimentos, da garantia de confidencialidade dos dados e do seu direito de desistir em qualquer momento do estudo sem qualquer prejuízo.

Não estão previstos quaisquer abuso(s) de recursos institucionais, hospitalares e/ou outros, como aplicável, para a realização do projeto.

Não se declaram existirem conflitos de interesse.

Não se declara a investigação envolver diretamente indivíduos privados do exercício de autonomia (crianças, menores, pessoas com incapacidade temporária ou permanente do exercício de autonomia).

**Documentos recebidos no órgão institucional de ética da UMinho**

Foram recebidos os seguintes documentos:

- Protocolo de investigação e/ou caderno de recolha de dados e/ou guião da entrevista
- Curriculum vitae abreviado do(a) investigador(a) responsável(eis)
- Parecer do(a) diretor(a) do centro de investigação e/ou unidade
- Modelo de documento de consentimento informado
- Cópia do(s) formulário(s) de recolha de dados a utilizar e/ou enumeração dos dados que serão colhidos

Foram ainda recebidos (outros documentos):

- Curriculum vitae abreviado do(a)(s) aluno(a)(s)
- Modelo de declaração de compromisso a utilizar pelo(a) IR e por outros investigadores ou colaboradores na investigação destinado a documentar o seu envolvimento nas garantias de confidencialidade e boas praticas dadas pelo(a) IR (Termo de Responsabilidade)
- Declaração do orientador no compromisso na orientação e/ou Termo de Responsabilidade