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Nudging toward sustainable diets: exploring strategies to reduce meat consumption through dynamic norms messages

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1. Introduction

Climate change is a complex issue with far-reaching consequences for human health and the environment. Since pre-industrial period (1850-1900), temperatures have increased approximately 1.54°C. this temperature rise is reflected in changes in climate events, leading to increased intensity of heavy precipitation around the globe, the frequency and intensity of droughts increased in some regions, the desertification in some dryland areas and the frequency and intensity of dust storm (Ebi et al., 2021). These phenomena disrupt the planet's balance and human living conditions within it.

The rise in temperatures is caused by the concentration of greenhouse gases (GHG) in the air. Prior industrialization, the concentration of carbon dioxide in the atmosphere ranged approximately 260 to 280 parts per million, however, the widespread utilization of fossil fuels has rapidly increased this concentration. Deforestation exacerbates this issue further by releasing significant amounts of CO₂ into the atmosphere, while the combustion process intensifies the problem. Over a 25-year period starting from 1958, the concentration of carbon dioxide surged from 315 to 340 parts per million (Nashier & Lakra, 2020).

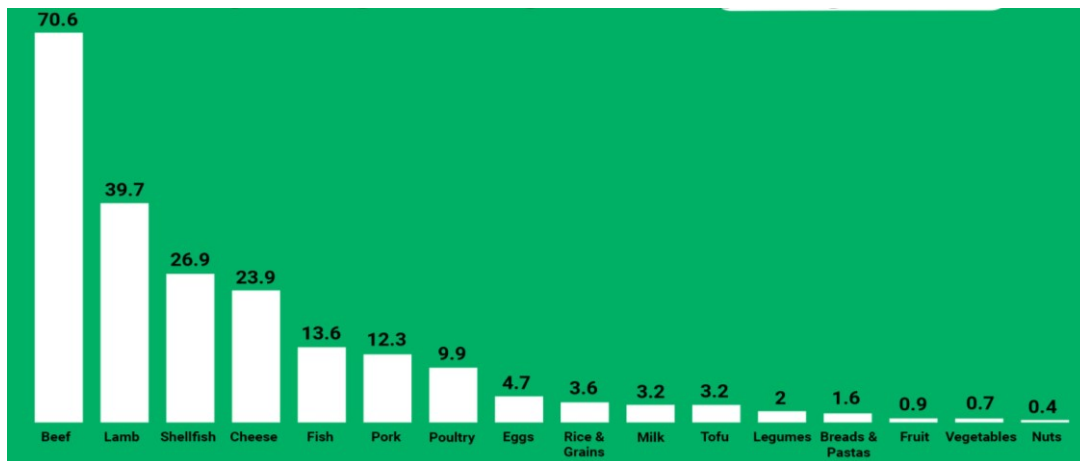
Meat consumption has been identified as a major contributor to climate change. This is due to the significant greenhouse gas (GHG) emissions associated with its production and due to the negative impact it has on the water footprint, water pollution and water scarcity (González, Marquès, Nadal & Domingo, 2020). Among agricultural practices, livestock industry contributes between 12% and 18% to the total GHG emissions (Gomez-Zavaglia, Mejuto, & Simal-Gandara, 2020; Allen & Hof, 2019), which according to the World Health Organization (2023) increase to 55% of total global agriculture GHG emissions when combined with dairy milk. This is more than the emissions from all transportation combined, and the excessive demand for meat is leading to the expansion of livestock farming, which further contributes to deforestation and loss of biodiversity. Information about the kilograms of GHG emissions per kilograms of food can be found in Figure 1.

Engaging in a vegetarian diet behavior can contribute in lowering GHG emissions. For instance, Scarborough et al. (2014) conducted a study comparing GHG emissions associated with various diet styles. They found that a high-meat diet emitted

7.19 kilograms of carbon dioxide equivalents per day (kgCO₂e/day), whereas a vegetarian diet emitted 3.81 kgCO₂e/day. The reduction is even more significant when adopting a vegan diet, with emissions as low as 2.89 kgCO₂e/day. Similarly, Sabaté, Sranacharoenpong, Harwatt, Wien and Soret (2015) investigated the environmental costs of producing 1 kilogram of protein from different plant- and meat-based sources. Their findings revealed that producing 1 kg of protein from beef required 18 times more land, 10 times more water, 9 times more fuel, 12 times more fertilizer, and 10 times more pesticides compared to obtaining the same amount of protein from kidney beans. However, in 2020 only about 5% of the global population considers themselves as vegetarian, while between 14% and 60% of the population define themselves as flexitarian (Kemper, 2020). This is not enough since globally, the production and consumption of all types of meat is predicted to increase by a further 50% by 2050 (World Health Organization, 2023).

Figure 1

Kilograms of greenhouse gas emissions (GHG) per kilogram of food



Note. United Nations, <https://www.un.org/en/climatechange/science/climate-issues/food>

Furthermore, data demonstrates that meat consumption is also associated with health risks. The World Health Organization's International Agency for Research on Cancer (IARC, 2018) has classified processed meat as carcinogenic to humans due to its link to colorectal cancer, while red meat is classified as probably carcinogenic to

humans, primarily based on evidence of its association with colorectal cancer. Additionally, high intake of processed meat may increase the risk of stomach cancer (Godfray et al., 2018). A review published in the “*Journal of internal medicine*”, drawn from at least six cohorts, shows varying levels of risk associated with the consumption of unprocessed red meat at 100 g per day. Results ranged from insignificant to statistically significant increases in risk, including an 11% increase for stroke and breast cancer, 15% for cardiovascular mortality, and 17% for colorectal cancer, along with a 19% increase for advanced prostate cancer. While, consumption of 50 g per day of processed meat showed statistically significant increases in risk for most of the diseases studied. These included a 4% increase for total prostate cancer, 8% for cancer mortality, 9% for breast cancer, 18% for colorectal cancer, and 19% for pancreatic cancer. Additionally, risks were elevated for stroke (13%), total (22%) and cardiovascular mortality (24%), and diabetes (32%) (Wolk, 2017).

From a psychological perspective, it is crucial to understand people’s attitude towards meat consumption to promote their engagement in more sustainable behaviors. As an example, Sleboda, Bruine de Bruin, Gutsche and Arvai (2024) investigated the impact of different labels on promoting the consumption of meat and dairy-free food baskets. Participants were more likely to choose the meat and dairy-free food basket when the labels emphasized the benefits of the food (“healthy”, “sustainable” or “healthy and sustainable”) instead of focusing on the food’s content (“vegan” or “plant-based”). Another online study focused on the importance of tailoring menu design to individual’s dietary background. Participants were randomly assessed participants to four different scenarios: control (all dishes presented in the same manner), recommendation (vegetarian dish presented as chef’s recommendation), descriptive (more appealing description of vegetarian dish) and vegetarian (vegetarian dishes placed in a separate section). Those change in the menu design showed that the recommendation and descriptive scenarios increased the likelihood of vegetarian dishes choices for infrequent vegetarian food eaters. Whereas, the effect tended to be reverse for those who eat vegetarian dishes more often (Bacon and Krpan, 2018).

In light of the increasing urgency to combat climate change, there is a growing need for a large-scale transition towards healthier and more sustainable food systems. Policies and interventions that target consumer choices and motivations can play a

crucial role in promoting sustainable behaviors. The aim of this study is to investigate if it is possible to influence the food choice on a menu by introducing little changes in the interface. Specifically, by promoting a dynamic norm message about the effort that an increasing number of people is making to change their dietary behavior to a more sustainable one. Moreover, we want to see if this impact is emphasized when combined with the exposure to a traffic light system which indicate the healthiness or the sustainability of every dish.

1.1 The mediterranean diet

The Mediterranean diet is widely renowned for its numerous health benefits and sustainability, making it a popular choice among health-conscious individuals. Originating from the Mediterranean region, this diet primarily consists of plant-based recipes, incorporating whole foods such as fruits, vegetables, legumes, and whole grains, while also including moderate amounts of lean proteins, healthy fats, and low-fat dairy products (Guasch-Ferr & Willett, 2021).

One of the key benefits of the Mediterranean diet lies in its positive impact on overall health. Research has consistently shown that adhering to this dietary pattern can help reduce the risk of various chronic diseases. For instance, Estruch et al. (2013) found that individuals who followed the Mediterranean diet experienced a 30% lower risk of major cardiovascular events compared to those on a low-fat diet. Another example can be found in the Lyon Diet Heart Study (De Longiril, Salen, martin, Monjaud, Delaye & Mamelle, 1999), which demonstrated a remarkable reduction in mortality and cardiovascular events in patients who followed a Mediterranean diet compared to a control group. Moreover, in a medical review on the role of Mediterranean diet emerged that among all the studies considered, there was a consistent association between higher adherence to the Mediterranean diet and a lower risk of CVD in various populations, including both healthy individuals and those with existing cardiovascular conditions (Sofi, Macchi, Abbate, Gensini and Casini, 2013).

Through a meta-analysis research, Sofi, Cesari; Abbate, Gensini and Casini (2008) highlighted that a greater adherence to a Mediterranean diet is associated with a significant improvement in health status, as seen by a significant reduction in overall

mortality (9%), mortality from cardiovascular diseases (9%), incidence of or mortality from cancer (6%), and incidence of Parkinson's disease and Alzheimer's disease (13%).

The main source of fat in the mediterranean diet, olive oil, offers a wealth of health benefits that go far beyond a delicious drizzle on your salad. Olive oil is packed with monounsaturated fatty acids, particularly oleic acid, which plays a key role in protecting your heart. Olive oil's anti-inflammatory properties further combat heart disease risk by reducing blood pressure and preventing harmful blood clots. But the benefits extend beyond the heart. Rich in antioxidants, olive oil shields your cells from damage, potentially reducing the risk of certain cancers and promoting brain health. Moreover, it may improve insulin sensitivity, aiding in blood sugar control and potentially benefiting those with type 2 diabetes (Covas, Konstantinidou & Monsterrat, 2009).

Overall, the Mediterranean diet offers a multitude of health benefits while being environmentally sustainable. Its emphasis on plant-based recipes, coupled with the ample scientific evidence supporting its positive impacts on health, make it a highly recommended dietary pattern (Guasch-Ferr & Willett, 2021, Burlingame & Dernini, 2011). By adopting this lifestyle, individuals can contribute to their own well-being while supporting sustainable practices that have a positive impact on the planet. For those reasons, in this research, we decided to use the principles of the mediterranean diet as a standard of comparison for the health of the dishes proposed on the meus.

1.2 From social norms to dynamic norms

Berkowitz and Perkins (1987) in a study on student's perception of alcohol used by peers found out that students regularly tended to overestimated the extent to which their peers were supportive of permissive drinking behaviors, and that this overestimation could predict the amount of alcohol consumed by each individual. These findings support the social norms approach, which suggests that individuals perceive social norms and tend to conform to them, even if those norms are misperceived. In this case, students overestimated the acceptance of drinking, leading them to drink more themselves.

Berkowitz (2003) pointed out the assumption of social norms theory, highlighting that:

1. Actions are often based on misinformation about or misperceptions of other's attitudes and/or behavior
2. When misperceptions are defined or perceived as real, they have real consequences
3. Individuals passively accept misperceptions rather than actively intervene to change them, hiding from others their true perceptions, feeling of beliefs
4. The effects of misperceptions are self-perpetuation, because they discourage the expression of opinions and actions that are falsely believed to be nonconforming, while encouraging problem behaviors that are falsely believed to be normative
5. Appropriate information about the actual norm will encourage individuals to express those beliefs that are consistent with the true, healthier norm, and inhibit problem behaviors that are inconsistent with it
6. Individuals who do not personally engage in problematic behavior may contribute to the problem by the way in which they talk about the behavior. Misperceptions thus function to strengthen beliefs and values that are the "carriers of the misperception" do not themselves hold and contribute to the climate that encourages problem behavior
7. For a norm to be perpetuated it is not necessary for the majority to believe it, but only for the majority to believe that the majority believes it

According to this theory, our behavior is shaped by inaccurate perceptions of how fellow members within our social groups think and behave. This explains how overestimating problematic behaviors will lead to an increase in such behaviors, while underestimating healthy behaviors will discourage individuals from adopting them. Consequently, correcting misperceptions of group norms is likely to lead to a reduction in problematic behavior or an increase in the prevalence of healthy behaviors. So, the social norms approach can be essential in offering a behavioral theory with significant implications for health promotion and prevention.

Several types of misperceptions are susceptible to change through social norms interventions (Berkowitz, 2003). The phenomenon for which individuals incorrectly perceive the attitudes and/or behaviors of peers and other community members to be different from their own when, in fact, they are not, has been called “*Pluralistic ignorance*” (Miller & McFarland, 1987). Pluralistic ignorance leads individuals to change their own behavior to approximate the misperceived norm. An example of pluralistic ignorance can be found in the opinion that college students have on drinking behavior, most of them drink moderately or not at all, but still incorrectly assume that other peers drink more than themselves and also more than they do in reality. Another type of misperception has been called “*False consensus*” (Ross, Greene & House, 1977) and it consist in the incorrect belief that others are like one-self, when they are actually not, leading the individual to deny that their attitude or behavior are problematic or at least unusual. This misperception is, for example, common between heavy drinkers, smokers or gamblers that think their unhealthy behavior is more common than it actually is, this misperception is even described as “*self-serving bias*” (Miller & Ross, 1975). Moreover, when individuals who are in the minority assume that the difference between themselves and others is greater than it actually is, we talk about “*False uniqueness*” (Suls & Wan, 1987), an example could be the feeling of extraordinary struggle that parents can feel in raising a child, that could make them feel isolated in their challenges, while many parents share similar obstacles.

Social norms interventions can address misperceptions about common behaviors. In cases of pluralistic ignorance, they can communicate to the majority that their behavior aligns more closely with the one related to the norm. In a field study about the effect of education about pluralistic ignorance on drinking behavior, entering

college students were divided in two random conditions where they had to discuss about alcohol use during their first week on campus. The first condition is the peer-oriented condition, in which students were presented with information showing that they systematically overestimated how comfortable other students were with drinking on campus. This means they thought their peers were more comfortable with drinking than they actually were. They were then encouraged to discuss this misunderstanding and how it affects the social aspects of drinking in general. The second condition is the individual-oriented condition in which students participated in a discussion focused on making good personal choices when faced with drinking situations. This discussion aimed to equip them with individual strategies for responsible decision-making. Students in the first group were more comfortable with drinking and didn't feel pressured to conform, proving that education about pluralistic ignorance can help in reducing the social influence (Shroeder & Prentice, 1998).

For false consensus, interventions can provide information about the actual number, or the characteristics of the general population to dispel inaccurate beliefs about how common a behavior is. This normative feedback not only permits the adjustment of behavior to be more in line with personal attitudes but also encourages values of moderation or non-use. Furthermore, it reduces the anxiety associated with the fear of embarrassment stemming from actions perceived as deviating from the norm (Berkowitz, 2005). Moreover, in the second study presented on their paper, Bauman and Geher (2002) aimed to reduce the false consensus effect by addressing the availability heuristic, a mental shortcut that biases judgment. To intervene on the availability heuristic, the authors created information packets presenting both sides of two chosen issues: animal testing for medical purposes and drug legalization. Two versions were created, with the order of pro and con arguments reversed to control for potential bias. Participants could accede to the information by reading them or by watching a video debate between college students on the issue. The combination of the topic and the method used to get informed, united with the control condition generated five conditions in which students were randomly assigned. The analysis showed that the video presentation, compared to the control group, successfully brought people's estimates of the average opinion (both for and against the issues) closer together, supporting researcher hypothesis. Furthermore, the control group displayed strong

evidence of the false consensus effect with large effect sizes, while the video condition had significantly smaller effect sizes, indicating a substantial reduction in the false consensus effect compared to the control.

Among the social norms, a major differentiation that has been made under static social norms concerns the distinction within static norms between “*Descriptive norms*” and “*Injunctive norms*” (Cialdini, Reno & Kallgren, 1990). Descriptive norms describe what is commonly done or considered normal in a particular social group, they are based on the belief about what most people typically do. For example, if people commonly throw trash on the ground in a particular area, others might observe this behavior and perceive it as the norm, making them more likely to engage in littering as well. This type of norms motivates individuals by providing evidence of what is likely to be effective and adaptive behavior. The assumption is that if everyone is doing something, it must be a sensible thing to do; Cialdini et al. (1991) note that this presumption offers an information-processing advantage and a decisional shortcut when individuals are deciding how to behave in a given situation. Descriptive norms have been used in an observational study on a university campus to encourage people in choosing a healthier behavior as choosing the stairs instead of the elevator. The experiment took place in three different buildings, on the second week in one building the authors put, next to the elevator, a sign that said “Did you know? Taking the stairs instead of the elevator is a good way to get some exercise. Why not try it?”. In the second building the sign referred “Did you know? More than 90 percent of the time, people in this building use the stairs instead of the elevator. Why not you?”, while the third building was used as the control condition. Results reported a 46% decrease in elevator use after displaying one of the signs compared to the control group. Moreover, the effect persisted even after the sign was removed, suggesting a lasting change in behavior (Burger & Shelton, 2011).

Instead, injunctive norms specify what ought to be done and represent the moral rules of the group, they are based on beliefs about what is socially approved or sanctioned (Cialdini, Reno & Kallgren, 1990). So, if a community, for example, strongly emphasizes the importance of wearing seat belt and disapproves of not using them, individuals might be more likely to conform to the injunctive norm and buckle up. This type of norms motivate action by promising social rewards and punishments,

such as informal sanctions; conforming to the norm of helpfulness may lead to social approval. In a study about the effectiveness of different messages in deterring visitors from stealing petrified wood in the Petrified Forest National Park, researchers have used four different messages: "Please don't remove petrified wood" (injunctive and negatively worded), "Please leave petrified wood in the park" (injunctive and positively worded), "Many past visitors have removed petrified wood" (descriptive and negatively worded) or "The vast majority of past visitors have left petrified wood" (descriptive and positively worded). Results show that, when strongly worded (negatively phrased), injunctive messages like "Please don't remove petrified wood" led to the least amount of theft compared to other conditions. This suggests that clearly stating what is not permitted can effectively discourage visitors from engaging in prohibited behaviors within a specific context, supporting the power of injunctive norms in influencing individual choices (Cialdini, Demaine, Sagarin, Barret, Rhoads & Winter, 2006).

Another type of norms consists of "personal norms" (Schwartz, 1973), which are standards we set for ourselves based on our own values. These guidelines shape our behavior, and we reinforce them by anticipating either a positive or negative emotional response to our actions. Some individuals, for example, may hold a strong personal norm of honesty and strive to be truthful in their interactions even in situations where they might not face immediate consequences for dishonesty, as a reflection of their personal values. Harland and Wilke (2007) wanted to understand the role of personal norms in motivating people to act in an environmentally responsible way. In Study 1 it emerged that believing one's actions can make a difference (efficacy) and feeling capable of taking action (ability) were the strongest predictors of pro-environmental intentions, with personal norms acting as a mediator. While, in Study 2, using an experiment, confirmed these findings, highlighting the crucial role of personal norms. While personality traits and awareness of the problem influenced intentions, it was the sense of moral obligation that ultimately bridged the gap between external cues and environmental action. These studies emphasize that fostering personal responsibility and empowering individuals with a sense of agency are crucial for promoting sustainable behavior.

Each norm can be used for a specific purpose, for example Cialdini et al. (1991) highlighted that descriptive social norm focus is effective when most individuals

already behave in a socially desirable way, personal norm focus is advantageous when personal norms align with prosocial goals and injunctive social norm focus is likely to lead to beneficial social conduct across a variety of situations and populations.

Sometimes it is possible that more rules coexist simultaneously and are in conflict with each other; in that case individuals are likely to conform to the type of norm that is currently more salient (Cialdini et al., 1991). Burger and Shelton (2010) suggested an example of pedestrian that are waiting to cross a street. The injunctive norm states pedestrians should wait for the green light, while the descriptive norm is the act of seeing others cross while the red light is on. Some individuals can be particularly influenced by the first rule and other by the second one, leading them to act in different ways. To understand the salience of the norm, it is possible to refer to the six basic tendencies that could generate a positive response, exposed by Cialdini (2001):

- 1) Reciprocation: as an animal instinct, every culture subscribes to a norm that requires individuals to reciprocate in a manner consistent with what they have been given. This applies to things like gifts, favors, or even the way someone asks for something. For example, imagine someone starts by asking you for a big favor you're unlikely to agree to. If they then offer to do something smaller instead, you might be more likely to say yes to that smaller request, even though it wouldn't have been enough on its own. This is because you feel obligated to give something back after receiving something initially, even if it's not an exact exchange
- 2) Consistency: people are more likely to carry out a task or adopt a certain behavior if they first have to make a commitment, for example, by verbally stating their agreement to do something.
- 3) Social validation: people are more likely to conform to others, this, for example, leads to perceive an idea to be more valid or correct when many individuals decided in favor of that idea.
- 4) Liking: people are more likely to accept a request made by someone they like, this works even for similarity, cooperation and when compliments are involved.
- 5) Authority: when the message is told by an authority, like an expert in the field or just someone dressed in a specific way, people are more likely to listen to the message and follow the request.

- 6) Scarcity: people tend to desire more an item or an opportunity when they become less available.

Norms are not consolidated over time, they rather change over time, for various reasons. For example, a neighborhood might start being very diligent with recycling at one point, even if it hasn't cared about recycling for years. This example helps us understand that there is a difference between "Static norms" and another type of norms called "Dynamic norms". While static norms focus on the current state of the norm, dynamic norms draw "attention to the change of a norm over time" (Sparkman & Walton, 2017).

Dynamic norms are useful in case you want to draw attention to a behavior that is not yet consolidated in the society or in the reference group, but that is increasing and consolidating, highlighting the intentional, successful efforts at change of many other people. Sparkman and Walton (2017) conducted multiple experiments to explore how messages about social trends influence people's interest and intention to eat less meat. Participants were exposed to a static norm message or to a dynamic norm message. The static norm message conveyed information about the existing efforts of the American population to reduce meat consumption. This approach essentially tells what most people are doing right now. The dynamic norm message, however, goes beyond the present. The authors highlight the changing nature of a behavior and emphasize the trend towards it becoming more widely adopted. In these experiments, the dynamic norm message pointed out the increasing efforts of the American population to reduce meat consumption; telling what most people are starting to do more often. The key difference lies in whether the message emphasizes the current state (static) or the direction of change (dynamic) in a specific behavior. This distinction proved crucial in the studies, as participants exposed to the dynamic norm showed a greater interest in reducing their meat intake and a stronger intention to do so compared to those exposed to the static norm. This suggests that highlighting the growing trend towards a behavior can be more effective in motivating people to adopt it, even if the behavior itself may not yet be the norm.

The power of dynamic norms is connected to the idea that learning about collective change can facilitate various inferences about that particular change.

Specifically, an inference people could make is that they could feel that the change is not possible, or it is too hard to make, so learning that other people are actually changing can motivate the person in that direction (Sparkman & Walton, 2019). However, individuals may perceive the new behavior as insignificant and thus unworthy of adoption. Yet, through social norms, they can come to realize its importance as valued by others, and in turn, begin to value it themselves. Additionally, should people sense a conflict between the change and their own personal and societal identity, the development of a norm reflecting those who have previously displayed similar behaviors but have since changed can help align the new behaviors and those practicing them with one's own sense of congruity (Sparkman & Walton, 2019).

1.3 Nudging

In order to guide the individual to make a better choice for themselves or for their surroundings, it is important to understand how people make decision and the research field of judgment and decision making has precisely this aims.is made to the psychology of economic decision. Part of this field is represented by the nudge. Nudging is a “*gentle push*” that guide people to take one choice over another. Thaler and Sunstein defined nudge as “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid” (Thaler and Sunstein, 2009 p.6). In order for these principles to be respected, nudge must be distinguished from persuasion which can be defined as “a symbolic process in which communicators try to convince other people to change their attitudes or behaviors regarding an issue through the transmission of a message in an atmosphere of free choice” (Perloff, 2010, p. 12). In this regard, Thaler and Sustain (2008) have proposed three fundamental criteria to be applied when designing an intervention that uses nudging techniques:

- Nudges must be transparent and not deceptive: the person's choice must not be forced and the options must not be distorted
- Changing a decision should be as easy as possible: no big gestures should be required but simple actions

- Good reasons must exist to think that the behavior favored by a nudge can increase people's well-being

A well-known example of the application of nudge techniques can be found in the research of Johnson and Goldstein (2004) on the effect of the default choice on people's willingness to become organ donors. Participants were assigned to one of three conditions: control condition; opt-in condition, in which individuals must explicitly take action to agree or opt-out condition, in which individuals are automatically enrolled unless they actively choose to decline. The online experiment revealed that opting-out as the default significantly increased donation rates compared to opting-in, with a neutral setting seeing an intermediate rate. Further analysis strengthened this finding. Comparing European countries with explicit consent (opt-in) and presumed consent (opt-out) laws showed significantly higher donation rates in opt-out countries. Additionally, analyzing real-world organ donation data across countries revealed a notable increase in donations when opting-out was the default, suggesting that defaults play a crucial role in influencing organ donation decisions. This example shows that people tend to conform to what they have been primarily assigned, and that they rarely make an effort to get something different. Therefore, if people are automatically assigned to a greener condition, they should adopt more ecological. From this line of thought, it has developed the "Green default" branch, which investigates the effectiveness of this technique in order to obtain more ecological results, as by making green electricity the default option for consumers (Pichert & Katsikopoulos, 2008).

An example of green default was put in place by Liebe, Gewinner and Diekmann (2021), who conducted an experiment about green default on greenhouse gas emission in Switzerland. The authors analyzed two different electricity suppliers which promoted the conventional energy source as their default package. Later on, both suppliers switched it to the green one on separate timelines, even though the green package was priced higher than the conventional. The researchers found that the introduction of the green default had a significant impact. Before the switch, around 97% of households served by Supplier A and Supplier B used conventional energy. However, after the switch, this percentage decreased drastically to 15% for Supplier A and 11% for Supplier B, even though the paid price was higher. These changes remained stable over a period of six years. The long-term effectiveness of this treatment

is important to highlight the importance of using these zero-cost techniques, as they could lead to significant economic savings as well as a reduction in environmental impact and pollution.

Nudging techniques have also been used to intervene to reduce meat consumption, by making different types of changes to menus. In the field experiment of Campbell-Arvai, Arvai and Kalof (2014), the researchers compared two cafeteria scenarios in a university campus in the United States. The control scenario presented all options equally while the experimental scenario which highlighted vegetarian options through menu design, by visually distinguishing them from the meat options. Before acting in the dining halls of the campus, researchers used a survey to investigate the relative appeal of the meat-free options appearing on the menu in the experimental condition. The results were compelling; individuals presented with the default menu, regardless of whether it included additional information, were significantly more likely to choose the meat-free option. Interestingly, the attractiveness of individual menu items, while influencing overall choices, did not interact with the effect of the default menu.

In another study, Parkin and Attwood (2022) proved that a good strategy to promote the consumption of vegetarian food is related with the percentage of vegetarian options offered. This experiment presented three different conditions depending on the percentage of vegetarian dishes on the menu: 25%, 50% or 75%. When 25% or 50% of the dishes were vegetarian the authors found no significant effect, but when the menu was saturated with vegetarian options (75%) the omnivorous were significantly more likely to choose a vegetarian option. This can be very useful in cases where it is possible to intervene in environments such as canteens or restaurants to restructure them or in cases where it is possible to create incentives that push these environments to increase the percentage of vegetarian options they offer.

There is an increasing interest in assessing the influence of environmental labeling on food choices. As an example, a field experiment in a university restaurant in Sweden implemented a carbon labeling system to see how it would influence customer choices. Contrary to expectations, the red labels didn't significantly deter people from buying those dishes; meat dishes were reduced only by 4.8%, while the green labels

even led to increased sales of meat by 11.5%, possibly due to a positive surprise effect. The labels did, however, influence the sales of other options: yellow labels on fish caused a decrease, suggesting a negative surprise for consumers. Overall, the labeling system led to a 3.6% reduction in greenhouse gas emissions, highlighting its potential as a tool for promoting more sustainable food choices, though its effectiveness may vary depending on factors like label design and consumer expectations (Brunner, Kruz, Bryngelsson & Hedenus, 2018). Moreover, Arrazat et al. (2023) conducted a controlled laboratory experiment in France. Participants representing diverse age groups and responsible for household grocery shopping, navigated a virtual supermarket using VR headsets. They were randomly assigned to one of two groups: one seeing no environmental labels on food products and another seeing traffic-light labels indicating the environmental impact. Utilizing virtual reality, individuals made meal selections in both "everyday" and "environmentally friendly" scenarios. The study revealed that traffic-light labels significantly decreased the environmental footprint of food choices without negatively impacting nutrition, cost, or enjoyment. A traffic light system has been used even by Osman and Thornton (2019) to indicate environmental impact and calorie food content, to encourage consumers towards more sustainable and healthier meal choices in an online simulated canteen setting. Two experiments were conducted. The first experiment found that participants, regardless of the information provided (single labels for nutrition or sustainability, or dual labels indicating both), chose meals with lower carbon footprints and fewer calories compared to a baseline with no labels. The second experiment, conducted, replicated these findings. Additionally, it showed that dual labels led to a slightly greater shift towards sustainable meals compared to healthier options, suggesting a potential influence of sustainability in this specific context. The results of these studies suggest that traffic light labels can act as a simple and effective tool to encourage consumers to consider the environmental impact of their food choices.

2. Individual differences in sustainable behavior

In the last few years there is more concern in understanding how and why people engage differently in sustainable behavior. According to the model presented by Garça, Godinho and Truninger (2019), to facilitate long-term shifts in practices and behaviors, a set of variables within these three components must be aligned in a way that supports the desired change: (1) “*capability*”, which includes both psychological (e.g., knowledge) and physical (e.g., dexterity) features in being able to perform a given behavior, (2) “*opportunity*”, which includes social (e.g., social norms) and physical (e.g., availability) features that foster/support or hinder/compromise the behavior and (3) “*motivation*”, which entails reflective (e.g., deliberate thinking) and automatic (e.g., habits) psychological processes that energize the behavior.

However, different studies in recent years highlighted the importance that various individual differences can have, despite having an appropriate knowledge or motivation. Duong and Pensisni (2023), for example, explored how individual’s connections to different social groups influence their environmental behavior. The findings revealed that feeling connected to nature, community, and humanity strengthens the link between a person's general prosocial tendency and their engagement in pro-environmental actions. Interestingly, the opposite is true for national connection, where a stronger national identity was associated with lower levels of pro-environmental behavior. These results suggest that fostering a sense of connection to the natural world and various social groups, could be an effective strategy for promoting environmentally friendly behavior. Another research (Hopwood, Lenhausen, Stahlmann & Bleidorn, 2022) explores the relationship between personality aspects, which are more specific facets of personality traits (like compassion and politeness within agreeableness), and diverse pro-environmental attitudes (like connection to nature and intrinsic motivation to protect the environment). The authors found that focusing on aspects like openness and agreeableness, rather than broad traits, reveals richer connections. Individuals high in openness, characterized by curiosity and appreciation for beauty, were more likely to hold positive environmental views. Similarly, agreeableness, reflecting care for others, often linked to environmental concern. Core values like social justice and environmental protection, and intrinsic motivations like

caring for the environment itself, were associated with a combination of openness, agreeableness, and even extraversion. However, extrinsic motivations driven by rewards or punishments, and social motives influenced by social pressure, showed different patterns, suggesting distinct personality profiles behind these environmental stances. This study emphasizes the importance of considering both individual personality nuances and the specific types of environmental concerns when fostering sustainable behavior and designing effective interventions (Hopwood, Lenhausen, Stahlmann & Bleidorn, 2022).

In conclusion, recognizing this intricate interplay between individual differences and specific behaviors underscores the need of interventions which can be tailored to resonate more effectively with different audience, leading to a broader impact on behavior change.

2.1 Individual differences in eating behaviors

Individual differences interfere even in dietary choices and beliefs due to a complex mix of factors beyond just taste preferences. As an example, sociodemographic factors like gender, age, and education play a role in the tendency to choose a specific dietary behavior. Women (Allen, Wilson, Ng & Dunne, 2000, Pfeiler & Egloff, 2017), younger individuals and those with higher education more likely to be vegetarian (Aston, Smith & Powles, 2013, Pfeiler & Egloff, 2017). Even political orientation seems to be correlated with food behaviors, with right-wing individuals to be more to identify as omnivores and consume more meat (Allen, Wilson, Ng & Dunne, 2000).

Moreover, health concerns often play a major role in dietary choices, with many individuals adopting vegetarianism due to perceived health benefits associated with reduced meat consumption (Dibb & Fitzpatrick, 2014). Ultimately, personality traits like openness may also be linked to a plant-based diet. Interestingly, a paper explaining two studies (Pfeiler & Egloff, 2017), suggests that vegetarians tend to hold a less conservative view compared to meat eaters. Firstly, vegetarians consistently scored lower on measures of conservatism compared to meat-eaters in both studies. Secondly, the studies explored motivations for vegetarianism, revealing a common theme of ethical concern for animal welfare. This value aligns more closely with liberal principles of compassion and social justice. Furthermore, vegetarians reported a

heightened interest in political issues, which might include environmental protection and animal rights, topics often championed by liberal viewpoints.

Moreover, a recent review examined the link between diet and personality, values, and empathy. It compared individuals following omnivore, flexitarian, and vegetarian diets. The results suggest that omnivores, compared to vegetarians, may hold more traditional and hierarchical views, prioritize power, and display less openness and empathy. Vegetarians, on the other hand, may be more open to experience and score higher on ecological values (Holler et al., 2021).

Allen, Wilson, Ng and Dunne (2000), aimed to uncover the deeper motivations driving the choice between vegetarian and omnivore diets. Researchers found that core human values differ significantly between the two groups. Vegetarians and vegans tend to prioritize intellectualism, excitement, love, growth, peace, equality, and social justice, while omnivores place greater value on self-control, responsibility, logic, equity, and social power. Additionally, omnivores focused on the reputation and practicality of products, while vegetarians and vegans were more concerned with a product's ability to express their personality and evoke positive feelings.

Understanding the link between meal preparation habits and sustainable and healthy dietary behaviors holds crucial significance. In a Japanese study, researcher identified five distinct patterns, revealing that individuals don't uniformly embrace all aspects of sustainable and healthy dietary behaviors. Some demonstrate a broader commitment to sustainability and health, while others prioritize specific areas like healthy food choices or reducing plastic use. Specifically, they identified 1) individuals who generally practiced most sustainable and healthy behaviors; 2) individuals focused on healthy food choices but lacked sustainable cooking practices; 3) individuals that prioritized avoiding and properly disposing of food waste; 4) individuals who emphasized avoiding plastic products and 5) individuals focused on checking and using food before expiration. Each group seemed to be influenced by specific patterns. The first group was more likely to be male, perceive greater benefits of sustainable and healthy dietary behaviors, and have higher cooking frequency and skill. The second group often came from larger households with higher income, were older, and perceived both benefits and drawbacks of sustainable and healthy dietary behaviors. The third and

fourth groups were driven by a higher number of environmental concerns, while the fifth group was linked to younger age, smaller households, and being responsible for food purchases (Kawasaki, Nagao-Sato, Yoshii & Akamatsu, 2023).

Recognizing the diverse characteristics within different groups is crucial for promoting sustainable eating behaviors. By understanding these traits, such as age, household size, cooking habits, and environmental concerns, it is possible to tailor interventions to resonate with specific segments of the population. This targeted approach allows for more effective messages and strategies. For example, individuals engaging in most aspects of sustainable eating might need encouragement to adopt the few remaining practices, while others might benefit from training on sustainable cooking within larger households. This approach acknowledges the unique needs and motivations of different groups, ultimately leading to a more impactful and lasting adoption of sustainable eating habits across the population.

2.2 Dietarian Identity Questionnaire (DIQ)

The labels we use to define our eating behavior can be more or less shared by the rest of society. Different people can attribute different definitions to the same label, or they can live their eating behavior with more or less rigidity and look at others behavior with more or less judgment and criticality.

The Dietarian Identity Questionnaire (DIQ) (Rosenfeld & Burrow, 2018, Italian validation by Amato et al., 2022) is an instrument for assessing dietarian identity, pursuing how people think, feel and behave regarding the consumption of animal products. Individuals adhere to a spectrum of dietary patterns, from unrestricted consumption of any animal product to different degrees of restrictions, due to physical, cultural or moral reasons. Focusing on dietarian identity is important because it integrates both personal and social aspects, framing an individual's dietary choice as a personal decision with implications for social identification, since often people form connections with others who share similar dietary patterns.

Rosenfeld and Burrow (2018) developed and validated the Dietarian Identity Questionnaire (DIQ) to better understand how to categorize the spectrum of eating behavior and capture the constructs outlined in the Unified Model of Vegetarian Identity (UMVI) framework. This framework proposes that dietary identity is a

multidimensional construct that includes attitudes, behavior, social aspects, and personal values related to food choices. The DIQ is a 37-item questionnaire that assesses these four dimensions of dietary identity. The authors found that the DIQ has good psychometric properties, including good internal consistency and test-retest reliability. They also found that the DIQ is able to differentiate between different types of vegetarians and non-vegetarians. These findings suggest that the DIQ is a valuable tool for researchers who are interested in studying dietary identity. In addition to its psychometric properties, the DIQ is also a comprehensive measure of dietary identity. It assesses all four dimensions of the UMVI framework, which is a more comprehensive approach than many other measures of dietary identity. This comprehensiveness allows the DIQ to provide a more nuanced understanding of dietary identity. Overall, the DIQ is a well-validated and comprehensive measure of dietary identity. It is a valuable tool for researchers who are interested in studying the relationship between food choices and identity.

In the DIQ, participants are asked to indicate which type of food they usually do not eat (red meat, poultry, fish, dairy, egg or eat all of this), and their agreement level to each of the 33 items on a 7-point Likert scale (1 = totally disagree, 4 = neither in agreement nor disagreement, 7 = totally agree). This 33-items are broken down into 8 subscales:

1. Centrality, 5 items (e.g., my dietary pattern has a big impact on how I think of myself)
2. Private regard, 3 items (e.g., people who follow my dietary pattern tend to be good people)
3. Public regard, 3 items (e.g., following my dietary pattern is associated with negative stereotypes)
4. Out-group regard, 7 items (e.g., Seeing people eat foods that go against my dietary pattern makes me upset or angry)
5. Prosocial motivation, 6 items (e.g., I view my dietary pattern as a way of making the world a better place for others)
6. Personal motivation, 3 items (e.g., I follow my dietary pattern because I am concerned about the effects of my food choices on my own well-being)

7. Moral motivation, 3 items (e.g., I follow my dietary pattern because eating this way is the morally right thing to do)
8. Strictness, 3 items (e.g., from time to time, I eat foods that go against my dietary pattern)

This questionnaire has been used to compare and contrast different dietary groups. For example, Rosenfeld (2019), in two studies examined potential gender differences in how individuals identify with their vegetarianism. While both men and women who self-identified as vegetarian reported similar levels of importance of their diet to their identity, personal well-being concerns, and perspectives on meat-eaters, some key differences emerged. Interestingly, women reported higher levels of prosocial motivation, meaning they were more likely to see their vegetarianism as benefitting others, possibly related to animal welfare or environmental concerns. Additionally, women were found to be stricter in adhering to their vegetarian diets compared to men. These findings have potential implications for understanding and potentially influencing dietary choices. Another study (Rosenfeld, 2018) explored how individuals who identify as vegetarian or vegan perceive their dietary choices. While both groups reported similar levels of strictness in adhering to their diets, distinct differences emerged in their dietary identity. Vegans, compared to vegetarians, displayed stronger connections to their food choices, finding them more central to their self-worth and feeling both more positively about their dietary group and judged negatively by others. Additionally, vegans reported higher levels of motivation based on concern for others, personal well-being, and moral principles. These findings suggest that vegetarians and vegans, despite sharing a plant-based diet, have unique experiences and perspectives shaped by their dietary identity. This research could have implications for understanding and potentially influencing dietary choices.

3. Methods

3.1 Purpose and Research Hypotheses

The aim of this research is to note whether and how dietary behavior related to meat consumption can be influenced by modifying the menu structure. Our purpose is to observe through an online questionnaire whether and to what extent it is possible to create a menu capable of incentivize people more to choose to consume a reduced amount of meat, thanks to the use of specific characteristics as dynamic norms (norms about the changes in behavior other people engage in) and the use of a traffic lights to clear out the impact that the specific food has on the personal health or the impact that is has on the environment.

This study is characterized by a 2 (dynamic norm vs. no message displayed to participants) x 3 (health-impacts-oriented vs. environmental-impacts-oriented menu vs. standard menu with no impacts mentioned) between-subjects condition design. In particular, at the beginning of the survey participants will be randomly presented with either a dynamic norm message or a control condition message. Subsequently, each participant will be asked to complete a menu-choice task. Such a task has three different conditions and each participant will be presented with only one of these three conditions. The intersection of our independent variables places participants in six possible conditions:

1. Exposure to a dynamic norm and presentation of the control menu.
2. Exposure to a dynamic norm and presentation of the menu with information about the dish's healthiness.
3. Exposure to a dynamic norm and presentation of the menu with information about the dish's environmental impact.
4. Absence of the dynamic norm and presentation of the menu with information about the dish's environmental impact.
5. Absence of the dynamic norm and presentation of the menu with information about the dish's healthiness.
6. Absence of the dynamic norm and presentation of the control menu.

This study includes two main dependent variables, the first one is the willingness to reduce meat consumption, which is important because, even if it does not represent an actual data of the behavior participants will decide to implement, it allows us to observe their future intention and therefore the commitment they would be willing to employ. The second dependent variable is the actual choice made in the menu-choice task, which is indicative of participants desire at the moment of completing the questionnaire and attests to the short-term effectiveness of the strategies adopted. Our purpose is to analyze the role of the menu design manipulation in influencing these dependent variables, and observe the relation of this manipulation with the Dietarian Identity Questionnaire centrality subscale score. So, our three mains hypothesis are:

H1: That the message in the experimental manipulation will affect both dependent variables, i.e., the willingness to reduce meat consumption and the responses in the menu-choice task. In particular, those presented with the dynamic norm message will be more willing to reduce their meat consumption (H1a) and will choose more vegetarian dishes (H1b) in their menu compared to those in the control condition (no message will be presented).

H2: That the menu-choice task will be predicted by an interaction of the two manipulations. Specifically, we hypothesize that when choosing dishes from a framed menu (menu with either the health impacts or the environmental impacts reported) people will choose more vegetarian dishes compared to those that will have to choose from a standard menu, and such effect will be stronger for those presented with the dynamic norm message rather than for those in the control condition. In testing this hypothesis, we will also control for the effect of the willingness to reduce meat consumption, expecting that those who are more willing to reduce their meat consumption, will choose more vegetarian dishes from their menu.

H3: That there is an interaction between the message manipulation and the centrality subscale of the Dietarian Identity Questionnaire (DIQ). Specifically, we hypothesize that those in the experimental group (dynamic norm message) will be more willing to reduce their meat consumption (H3a) and will choose more vegetarian dishes (H3b), the lower their score in the centrality subscale of

the DIQ, while this effect will not be significant in the case of the control condition. In the case of the menu-choice task as the dependent variable (H3b), we will also control for the main effect of the willingness to reduce meat consumption.

3.2 Participants

Participants were recruited at the university center (University of Padova). Specifically, they received a link through which they could access the questionnaire and fill it out. We excluded participants who didn't gave their consent to participate in the survey, underaged participants (i.e., younger than 18) and participants who didn't complete the entire survey. Moreover, we asked participants about their dietarian behaviors and excluded those who reported to be vegan or vegetarian. In total 313 participants were excluded.

At the end we recruited a total of 698 individuals. Participants ranged in age from 18 to 73, 30.5% were male (213 participants), 68.3% female (477 participants), 0,9% nonbinary (6 participants) and 0,3% choose to not indicate their gender (2 participants). Participants reported a political orientation mean of 3.85 measured on a 7-point Likert scale from 1 = extreme left to 7 = extreme right. Further information about the sample is reported in Table 1.

Table 1.

Means, standard deviations and frequencies for each socio-demographic information.

| | Experimental condition (N=355) | Control condition (N=343) |
|-------------------|-----------------------------------|------------------------------|
| Age | 26.1 (10.2) | 26.4 (11.1) |
| Gender | | |
| Female | 237 (66.8%) | 240 (70.0%) |
| Male | 114 (32.1%) | 99 (28.9%) |
| Non-binary | 2 (0.6%) | 4 (1.2%) |
| Prefer not to say | 2 (0.6%) | 0 (0%) |
| Education | | |

| | Experimental condition (N=355) | Control condition (N=343) |
|---------------------------------------|---|--------------------------------------|
| Middle | 12 (3.4%) | 12 (3.5%) |
| High school | 241 (67.9%) | 244 (71.1%) |
| Bachelor | 63 (17.7%) | 64 (18.7%) |
| Master | 37 (10.4%) | 20 (5.8%) |
| Specialization | 2 (0.6%) | 3 (0.9%) |
| Political orientation | 3.86 (1.28) | 3.83 (1.27) |
| Percived socio-economic status | 6.32 (1.40) | 6.18 (1.45) |
| Activism | | |
| Never | 240 (67.6%) | 234 (68.2%) |
| Sometimes | 114 (32.1%) | 101 (29.4%) |
| Often | 1 (0.3%) | 8 (2.3%) |
| Environmental behavior | | |
| Yes | 7 (2.0%) | 4 (1.2%) |
| No | 348 (98.0%) | 339 (98.8%) |
| Cantine frequency | | |
| Never | 22 (6.2%) | 21 (6.1%) |
| Less than 1 in a month | 88 (24.8%) | 80 (23.3%) |
| Less than 1 in a week | 124 (34.9%) | 123 (35.9%) |
| 1-4 times per week | 98 (27.6%) | 91 (26.5%) |
| 5+ times per week/everyday | 23 (6.5%) | 28 (8.2%) |
| Diet | | |
| Omnivore | 320 (90.1%) | 295 (86.0%) |
| Flexitarian | 35 (9.9%) | 48 (14.0%) |
| Meat weekly frequency | | |
| Mean (SD) | 7.06 (3.25) | 6.81 (3.41) |

3.3 Procedures

Participants provided informed consent and indicate their diet, if they were not excluded by our exclusion system, they completed the online survey programmed in Qualtrics, in Italian language. Qualtrics assigned the participants to one of the six conditions. For condition 1,2 and 3 they were presented with a dynamic norm message,

for condition 4,5 and 6 they were presented with a control message. Both messages are reported in the Table 2.

Table 2

Dynamic norm message vs control message

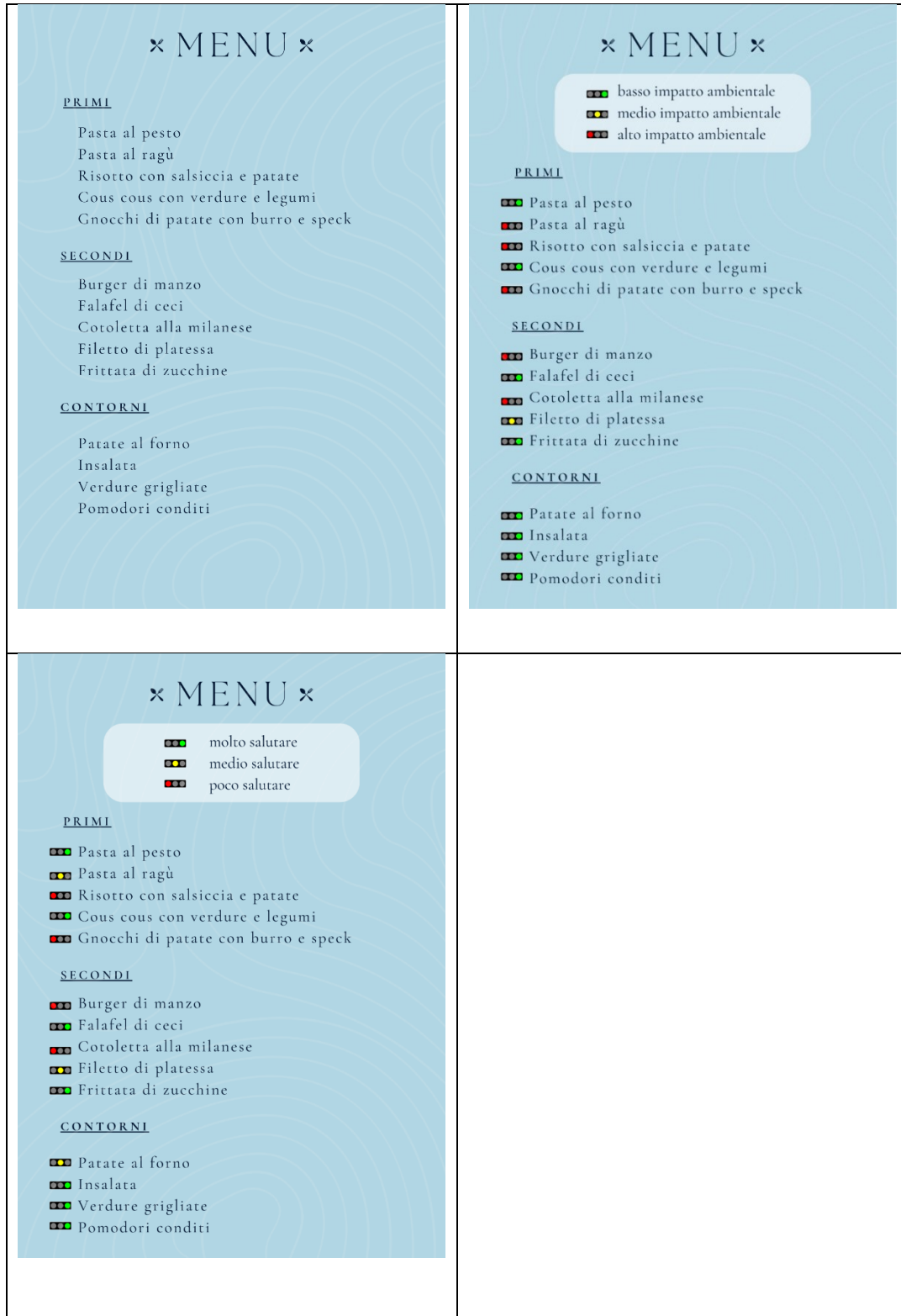
| | Original text | English version |
|--|---|---|
| Dynamic norm condition (conditions 1,2 and 3) | <p>La nostra società è in continuo cambiamento e ciò ci permette di mettere in atto nuovi comportamenti finché questi non diventano la norma, ovvero non sono messi in atto dalla maggioranza della popolazione. Negli ultimi anni, un cambiamento che sta avendo sempre maggior crescita è legato ai consumi alimentari: sempre più persone, giovani e adulti, donne e uomini, persone con diverse ideologie ad abitudini, si stanno impegnando per ridurre il loro consumo di carne.</p> | <p>Our society is constantly changing, allowing us to adopt new behaviors until they become the norm, that is until they are adopted by the majority of the population. In recent years, one change that is experiencing growing momentum is related to dietary consumption: more and more people, young and adults, women and men, individuals with diverse ideologies and habits, are making efforts to reduce their meat consumption.</p> |
| No dynamic norm condition (conditions 4,5 and 6) | <p>A causa degli orari di studenti e lavoratori, tante persone si trovano a consumare diversi pasti fuori casa. Ogni persona ha le sue preferenze alimentari e a volte anche delle restrizioni dovute ad esempio ad allergie. In questa ricerca vorremmo conoscere meglio le sue preferenze alimentari (tralasciando quelle che sono le sue possibili allergie). In particolare, ci interessano le sue preferenze alimentari sia quando si trova a casa sia quando ha l'occasione di mangiare fuori casa.</p> | <p>Due to the schedules of students and workers, many people find themselves eating multiple meals outside their homes. Each person has their dietary preferences, and sometimes, they have restrictions, for example, due to allergies. In this research, we would like to better understand your dietary preferences, excluding any potential allergies. Specifically, we are interested in your dietary preferences both when you are at home and when you have the opportunity to eat outside of your home.</p> |

Right after the experimental message, participants were asked to answer an attentional check where they were asked to report how carefully they read the text they were presented with on a 7-point Likert scale from 1 “Not at all attentively” to 7 “Very attentively”. Then, they had to answer 4 questions, adapted from Jansen (2016), about their willingness to reduce meat consumption according to a 7-point Likert scale (1 = completely disagree, 7 = completely agree). This measure assesses the participant’s willingness to reduce their meat consumption.

Subsequently, participants were exposed to a menu with a list of dishes including both vegetarian and non-vegetarian options (created *ad hoc*) and they were asked to choose what they preferred to eat imagining to be in a restaurant reading that menu, the menus are reported in Figure 2. All the menus presented the same dishes, but they differ in their nudging symbols according to the menu between-subjects condition participants were assigned to. Specifically, those in the control menu saw the dishes of the menu with any indication as a standard menu, those in the environmental-impacts condition saw each dish with a traffic light indicating the impact on the environment, while those in the health-impacts condition saw the dishes with a traffic light indicating their impact on the health. The environmental impact was assessed in agreement to the guidance provided by the World Health Organization (WHO) (2023) and the United Nations (UN), (<https://www.un.org/en/climatechange/science/climate-issues/food>) according to the greenhouse emissions of the food. We have not found a precise evaluation scale for the healthiness of the dishes, therefore we referred to a series of studies (Sofi, et al., 2013; Guasch-Ferré & Willett, 2021) regarding the importance of the Mediterranean diet, evaluated as the healthiest one. Those studies highlight the importance Mediterranean diet can have in reducing chronic degenerative diseases, by having positive effects on cardiovascular health, intervening in cancer prevention and prevention of diabetes mellitus, making it a powerful tool in both primary and secondary prevention (Sofi et al., 2013). To establish the healthiness of the dish we therefore observed if the standards of the Mediterranean diet were respected e.g. preferring the use of olive oil instead of butter, or prefer a predominantly plant-based diet (Guasch-Ferré & Willett, 2021). At last, to assess how participants consider their dietary behavior important for their own identity, they were asked to fill in the Centrality subscale of the DIQ.

Figure 2

The top left menu is the control condition, the top right menu is the environmental condition and the down left menu is the healthiness condition



4. Results

4.1 Descriptive statistics

Correlations were analyzed separately for the experimental dynamic norms message condition and for the control message condition. In the dynamic norm message condition, the willingness to reduce meat consumption (WTRMC) and the percentage of vegetarian dishes chosen from the menus (Veg-percentage) correlated positively (to each other, meaning that the more people are willing to reduce their meat consumption and the more they select vegetarian dishes in the menu-choice task. Both the willingness to reduce meat consumption and the percentage of vegetarian dishes chosen negatively correlates with political orientation, meaning that people that are more liberal are more willing to reduce the meat intake and do select more vegetarian options. Furthermore, the centrality subscale of the DIQ positively correlates with the percentage of vegetarian dishes chosen from a menu, but does not correlate with the willingness to reduce meat consumption. Specifically, the more people perceive their diet as central for their identity and the more they select vegetarian options. Finally, the centrality subscale of DIQ is positively associated with political orientation, i.e., the more conservative people are and the more they perceive their diet as a key factor of their identity. Correlations for the dynamic norm message condition are reported in Table 3.

Table 3

Correlations dynamic norm message condition.

| Variable | 1 | 2 | 3 | 4 | 5 |
|--------------------------|-----|--------|------|-------|------|
| 1. Age | | | | | |
| 2. Political orientation | .08 | | | | |
| 3. MacArthur SES R | .04 | .07 | | | |
| 4. WTRMC | .09 | -.23** | -.06 | | |
| 5. Veg-percentage | .07 | -.13* | -.03 | .39** | |
| 6. DIQ centrality | .09 | .14* | .02 | .09 | .13* |

Note. * indicates $p < .05$. ** indicates $p < .01$.

In the control condition the willingness to reduce meat consumption and the percentage of vegetarian dishes chosen from the menus correlated positively to each other, as in the other condition, meaning that the more people are willing to reduce their meat consumption and the more they select vegetarian dishes in the menu-choice task. Again, both the willingness to reduce meat consumption and the percentage of vegetarian dishes chosen negatively correlates with political orientation, meaning that people that are more liberal are more willing to reduce the meat intake and do select more vegetarian options. The centrality subscale of the DIQ positively correlates with the percentage of vegetarian dishes chosen from a menu, indicating that, the more people perceive their diet as central for their identity and the more they select vegetarian options. Moreover, unlike the experimental condition, the centrality subscale of the DIQ positively correlates with the willingness to reduce meat consumption. Specifically, the more people perceive their diet as central for their identity, the more they are willing to reduce the meat intake and do select more vegetarian options. Correlations for the control message condition are reported in Table 4.

Table 4

Correlations control message condition.

| Variable | 1 | 2 | 3 | 4 | 5 |
|--------------------------|------|--------|-----|-------|-------|
| 1. Age | | | | | |
| 2. Political orientation | .09 | | | | |
| 3. MacArthur SES R | -.00 | .00 | | | |
| 4. WTRMC | .06 | -.26** | .01 | | |
| 5. Veg-percentage | -.01 | -.19** | .06 | .41** | |
| 6. DIQ centrality | -.02 | .09 | .10 | .19** | .16** |

Note. * indicates $p < .05$. ** indicates $p < .01$.

4.2 Effect of the message condition on the dependent variables

To test H1a, about the effect of the dynamic norm message on the willingness to reduce meat consumption, a linear regression model was run ($R_{adj}^2 = 0.06$). Results show that the willingness to reduce meat consumption is not affected by the condition, but it is affected by age and political orientation. Specifically, the older the people and the more liberal (vs. conservative) they are and the more they are willing to reduce their meat consumption. Results are reported in Table 5.

Table 5

Linear regression model with the willingness to reduce meat consumption as dependent variable, predicted by the message condition, controlling for covariates.

| | <i>B</i> | S.E. | <i>t</i> | <i>p</i> |
|------------------------|----------|-------|----------|----------|
| Condition ¹ | 0.009 | 0.12 | 0.07 | 0.94 |
| Age | 0.015 | 0.006 | 2.57 | 0.01 |
| Political orientation | -0.33 | 0.05 | -6.86 | < 0.001 |

*Note*¹. Condition: experimental condition = 0, control condition = 1.

To test H1b, about the effect of the dynamic norm message on the percentage of vegetarian dishes chosen from the menus, a linear regression model was run ($R_{adj}^2 = 0.02$). Results show that the percentage of vegetarian dishes chosen from the menus is not affected by the condition, but it is affected by political orientation. Specifically, the more liberal (vs. conservative) they are and the more they are willing to select more vegetarian options. Results are reported in Table 6.

Table 6

Linear regression model with the percentage of vegetarian dishes chosen from the menus as dependent variable, predicted by the message condition, controlling for covariates.

| | <i>B</i> | S.E. | <i>t</i> | <i>p</i> |
|------------------------|----------|-------|----------|----------|
| Condition ¹ | 0.013 | 0.018 | 0.721 | 0.471 |
| Age | 0.001 | 0.001 | 1.087 | 0.277 |
| Political orientation | -0.032 | 0.007 | -4.396 | < 0.001 |

*Note*¹. Condition: experimental condition = 0, control condition = 1.

4.3 Effect of the interaction between the message condition and the menu condition

To test H2, about the effect of the interaction of the two manipulations on the percentage of vegetarian dishes chosen from the menu, a linear regression model was run ($R_{adj}^2 = 0.16$). Results show that the percentage of vegetarian dishes is not affected by the menu manipulation, but is affected by political orientation and by the willingness to reduce meat consumption, meaning that people that are more liberal (vs conservative) and those who are more willing to reduce their meat intake, do select more vegetarian options from the menu. The use of framed menus and the interaction between the dynamic norm message and a framed menu, did not show any significant effect on the number of vegetarian dishes chosen. Results are reported in Table 7.

Table 7

Linear regression model with the percentage of vegetarian dishes chosen from the menus as dependent variable, predicted by the message condition, the menu condition and the interaction between menu condition and dynamic norm message condition, controlling for the willingness to reduce meat consumption and covariates.

| | <i>B</i> | <i>S.E.</i> | <i>t</i> | <i>p</i> |
|--------------------------------|----------|-------------|----------|----------|
| Condition ¹ | 0.020 | 0.020 | 0.676 | 0.499 |
| Age | 0.000 | 0.000 | 1.353 | 0.867 |
| Political orientation | -0.014 | 0.007 | -2.005 | < 0.05 |
| WTRMC | 0.057 | 0.005 | 10.601 | <0.001 |
| Menu environment ² | 0.040 | 0.029 | 1.353 | 0.176 |
| Menu health ³ | 0.041 | 0.030 | 1.349 | 0.177 |
| Condition 1 x Menu environment | -0.040 | 0.043 | -0.928 | 0.353 |
| Condition 1 x Menu health | 0.013 | 0.042 | 0.332 | 0.739 |

*Note*¹. Condition: experimental condition = 0, control condition = 1. ² Control menu = 0, Environmental menu = 1. ³ Control menu = 0, Health Menu = 1.

To test H3a, about the effect of the score in the centrality subscale of DIQ in the experimental condition on the willingness to reduce meat consumption, a linear regression model was run ($R_{adj}^2 = 0.006$). Results show no significant effects, meaning that the score obtained in the centrality subscale of DIQ and the interaction between this score and the dynamic norm message condition had no effect on participants intention to reduce their meat intake. Results are reported in Table 8.

Table 8

Linear regression model with the willingness to reduce meat consumption as dependent variable, predicted by centrality subscale of DIQ and the interaction between such score and the control message condition, controlling for covariates.

| | <i>B</i> | S.E. | <i>t</i> | <i>p</i> |
|------------------------------|----------|-------|----------|----------|
| Condition ¹ | -0.492 | 0.393 | -1.251 | 0.212 |
| DIQ centrality | 0.050 | 0.066 | 0.749 | 0.454 |
| Condition 1 x DIQ centrality | 0.119 | 0.096 | 1.234 | 0.218 |

*Note*¹. Condition: experimental condition= 0, control condition= 1.

To test H3b, about the effect of the score in the centrality subscale of DIQ in the experimental condition on the percentage of vegetarian dishes chosen from the menu, a linear regression model was run ($R_{adj}^2 = 0.09$). Results show that the percentage of vegetarian dishes chosen is not affected by the score obtained in the centrality subscale of DIQ nor by the interaction between such score and the dynamic norm message condition, but it is affected by the willingness to reduce meat consumption. This indicate that participants that are more willing to reduce their meat intake are more willing to choose a vegetarian option from the menu. Results are reported in Table 9.

Table 9

Linear regression model with the percentage of vegetarian dishes chosen from the menus as dependent variable, predicted by the centrality subscale of DIQ and the interaction between such score and the control message condition, controlling for the willingness to reduce meat consumption and covariates.

| | <i>B</i> | S.E. | <i>t</i> | <i>p</i> |
|---|----------|-------|----------|----------|
| Condition ¹ | 0.010 | 0.056 | 0.186 | 0.852 |
| DIQ centrality | 0.012 | 0.009 | 1.285 | 0.199 |
| WTRMC | 0.046 | 0.005 | 8.064 | <0.001 |
| Condition ¹ x DIQ centrality | -0.001 | 0.013 | -0.086 | 0.932 |

*Note*¹. Condition: experimental condition= 0, control condition= 1.

5. Discussion and conclusions

Climate change is a serious threat, and meat consumption is a major contributor due to the high greenhouse gas emissions associated with its production (Gomez-Zavaglia, Mejuto, & Simal-Gandara, 2020; Allen & Hof, 2019). While vegetarian diets offer a more environmentally friendly option, along with potential health benefits, the number of people who choose this lifestyle remains low (Kemper, 2020). Since individual differences have an influence on the personal eating behavior, focusing on strategies to reach people is important to develop a more impactful and lasting shift towards sustainable food choices.

This study aimed to investigate the effectiveness of menu design and social norm messaging on reducing meat consumption. Acknowledging how social nudges and menu design can be combined could be important to promote sustainable behavior related to food consumption. Since meat production is an important part of the greenhouse gas emissions (González, Marquès, Nadal & Domingo, 2020; Gomez-Zavaglia, Mejuto, & Simal-Gandara, 2020; Allen & Hof, 2019), study how to promote a more sustainable diets between a larger part of the population is an important goal for our future.

Specifically, in this research we wanted to investigate whether a message describing the increasing number of people who are reducing their meat consumption (dynamic norm message) would directly increase the personal willingness to cut down on meat consumption and to choose more vegetarian menu vegetarian options in menu (H1). Our results did not report any effect of the dynamic norm message on the willingness to reduce the meat intake of participants, nor on the amount of vegetarian dishes they choose. However, we found that the age and the political orientation have an impact on the willingness to reduce meat consumption, since the older the people and the more liberal they are and the more they are willing to reduce their meat consumption. Political orientation has an effect even on the percentage of vegetarian dishes chosen from the menu, since the more liberal participants were, the more they choose a vegetarian option.

We then investigated if this message interacted with the framed menu condition (i.e., standard, health-labeled, or environmentally-labeled); expecting framed menus

(health or environmental labels) to have a stronger effect on vegetarian choices, especially for those who saw the dynamic norm message (H2). Results did not confirm our hypothesis, but highlighted the influence that political orientation and the willingness to reduce the meat intake have on the percentage of vegetarian dishes chosen from the menu. The more participants were liberal and the more they wanted to reduce their meat consumption, the more they choose vegetarian dishes.

Finally, we explored how the importance our diet has in our personal identity, measured through the Dietarian Identity Questionnaire, interacts with the message. We hypothesized that the message would be more persuasive for those who don't see diet as central to their identity, leading to a greater willingness to reduce meat consumption and more vegetarian menu choices (H3). Results show that the score obtained in the centrality subscale of the DIQ did not influence the dietarian behavior. However, the more participants were willing to reduce their meat intake, the more they choose a vegetarian option.

According to the data collected, the message encouraging reduced meat consumption (dynamic norm message) did not directly affect participants' willingness to reduce their meat consumption or their vegetarian menu choices. This contrasts the results obtained by Sparkman and Walton (2017) in a series of studies about the use of dynamic norm messages. Those studies showed that participants exposed to the dynamic norm expressed greater interest in lowering their meat intake, regardless of political orientation and gender. Moreover, those studies confirmed even the effectiveness of dynamic norms in a real-world setting. Future research can explore the effectiveness of tailoring dynamic norm messages to specific groups. This could significantly enhance the persuasive power of the message. By aligning the norm with the values and interests of a specific group, the message could resonate more deeply and lead to a stronger positive behavior change. In the case of the present research, the message manipulation could have not affected the dependent variables for different reasons. This could have happened due to the message itself, that may not have been strong enough to nudge behavior, or the wording might not have resonated with the participants.

Additionally, the menu labels may not have been clear or salient enough to effectively influence choices. However, some demographic factors influenced choices. People with more liberal political views were more likely to report a willingness to reduce meat consumption and choose vegetarian options. This finding is in line with previous research studies that highlighted a correlation between the political orientation and meat consumption and in exploring plant-based meat alternatives (Allen, Wilson, Ng & Dunne, 2000; Yule & Cummings, 2023). However, Wansink (2010) proved how menu's modification can have an impact without the influence of other variables. In his study, the author manipulated the number of dishes on a menu and found out that providing too many options (173 tips) overwhelmed participants, leading to lower engagement. In contrast, presenting just 3 pre-selected tips, along with the option to choose their own, resulted in higher adherence and satisfaction. According to those results, by offering a limited, curated set of options, interventions could increase adherence and potentially improve the success rate. Future studies could refine the approach by tailoring messages to specific groups based on demographics or partnering with relevant communities, which could enhance resonance. Moreover, addressing political bias by focusing on broader health benefits or ethical concerns in meat consumption can broaden the appeal.

Finally, how strongly someone identifies with their diet (centrality score) did not significantly interact with the message to influence either willingness to reduce meat consumption or vegetarian menu choices. This could be because the message did not effectively target the identity-based aspects of meat consumption for some participants. Future studies could tailor messages more related to what is important for different dietarian identity groups. For example, messages emphasizing the importance that our behavior can have in the future we are building, can be more effective on flexitarian since they are already trying to moderate their meat consumption.

This study presents some limitations. For instance, the study was conducted online with a self-reported questionnaire, which may introduce limitations due to social desirability bias. Future research could explore these questions in real-world dining settings to assess how menu design and social norms influence actual food choices. This happened in the field study by Campbell-Arvai, Arvai and Kalof (2012) in which college students responded to two variations of vegetarian menu: with appealing or

unappealing descriptions. Students were significantly more likely to choose a vegetarian option when the description was appealing, with a strong effect when the appealing options appeared in the default location on the menu.

Another major problem could be related to the realness of the situation: participants are not actually ordering a meal, and this might make the strategies used less effective. For example, it can be interesting to actually offer this type of menus in a canteen. Finally, a limit of this study can be found in the lack of representativeness in the sample, participants are young (average age: 26.2 years) and predominantly female (68.3%).

In conclusion, given the importance that meat consumption has on our planet and the consequences it will have for our future, it is important that this area of research receives more attention. Although our study has not yielded significant results, it allows us to understand the importance of focusing on more specific population targets for which to develop a specific approach, so that we can reach more and more people.

6. References

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