Beliefs About Dietary Fat and Sugar and Their Association With Self-Reported Dietary Adjustments Leading up to Cognitively Demanding Situations

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Abstract

Diet has for a long time been known to play a crucial role in human health and well-being. While fat and sugar are both essential to healthy brain function, long-term overconsumption–particularly of refined sugars, saturated fats, and trans fats–has been linked to negative effects on cognition and mood. Attitudes and beliefs significantly influence health-related behaviours, including dietary choices, emphasizing the importance of understanding public perceptions to promote healthier eating habits. While the effects of dietary fat and sugar on health have been extensively studied, little is known about how the public perceives their impact on mood and cognition. Given the prevalence of negative attitudes and narratives surrounding fat and sugar, it is possible that people also hold negative beliefs about their effect on mood and cognition. The present study surveyed 205 participants on their beliefs regarding fat and sugar's impact on cognitive performance and mood across several domains using agree/disagree scales. Participants also reported how they would modify their diet leading up to hypothetical cognitively demanding scenarios, such as university exams or job interviews. The results of this study provide some evidence of a popular belief that fat and sugar negatively affect both mood and cognition. Additionally, reported changes in dietary consumption were found to be associated with beliefs about mood but not cognition. Possible explanations for these findings are discussed in relation to the health belief model, alongside study limitations and directions for future research.

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Introduction

Recent years have shown a growing interest in how different diets and nutrients affect cognition and mood. While there are still many gaps in the literature, dietary fat and sugar have received particular interest. Despite this interest, little is known about public beliefs regarding the effect of fat and sugar on mood and cognition, or how such beliefs may influence food-related behaviour. As a result, the present study will explore these attitudes and beliefs, and how they may relate to dietary change in the face of cognitively demanding situations or events. This study hopes to bring clarity to public beliefs and behaviours in this area and to direct future research toward areas that warrant further investigation. Providing background information and context for this study will begin by reviewing how diet and food choices are made. This is important to place this study's findings in context alongside other factors that may interact with beliefs to drive food choices. Secondly, literature examining the effects of fat and sugar, especially on cognition and mood, will be reviewed. This will help to contextualise public beliefs and how they align with the broader scientific literature. Next, what is known about public beliefs and attitudes toward fat and sugar will be discussed, including gaps in knowledge, myths, and misunderstandings. Finally, rationale for this study will be presented, followed by the hypotheses.

Understanding Food Choice

Most people, especially in urban areas, do not see or participate in most of the process of getting food onto their plate. Global food systems have developed out of necessities and desires to give us far greater convenience in our diets but have also posed great challenges. As of 2023, around 13% of adults worldwide were classified as obese, yet at the same time over 9% of the world were undernourished (FAO et al., 2023; World Obesity Federation, 2023). This burden of malnourishment lies disproportionately on vulnerable and poverty-stricken populations who lack the necessary access or financial means to maintain a healthy and well-balanced diet. The disconnection between individuals and their food has profound implications on the day-to-

day food choices individuals make regarding the types of food they eat, how much they eat, and when they eat. Individuals' habits and choices relating to food play a pivotal role in their health and well-being, financial status, mood, appearance, physical performance, and many other aspects of life. These factors are intricately connected, often influencing each other in multiple directions. For example, economic resources impact food availability and choices directly through food prices, and indirectly through geographic location and nutritional accessibility. Conversely, food choices also directly impact people's economic resources and financial well-being.

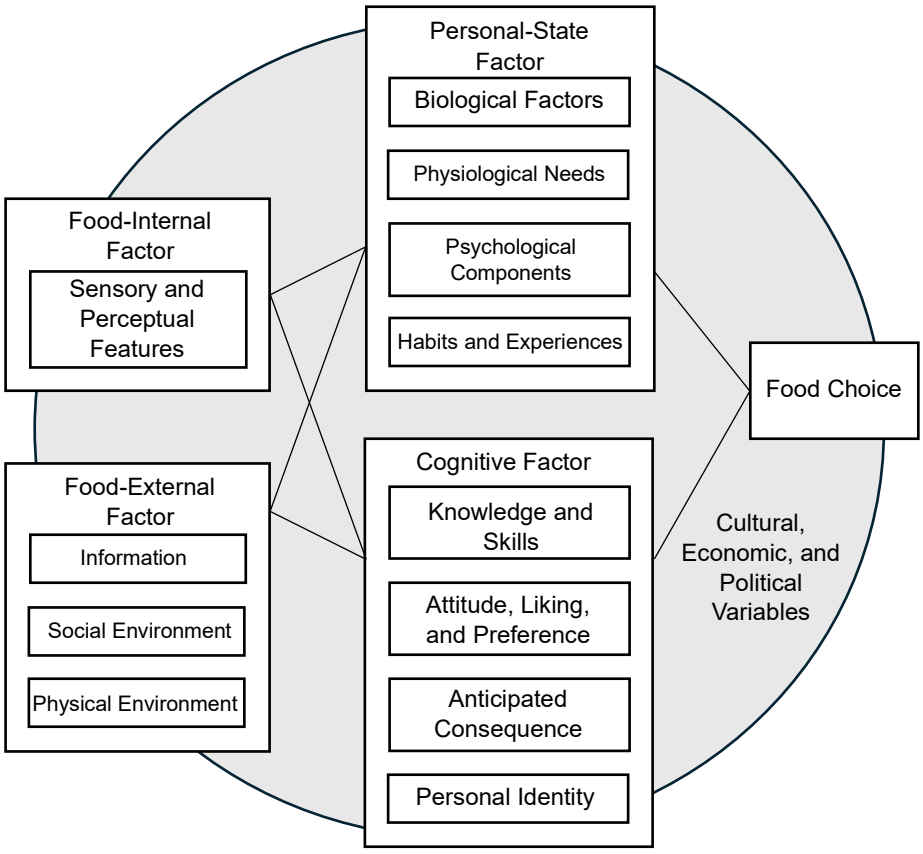
On a broader scale, individual food choices drive changes in food production and development, trade, and agricultural decisions, all of which are critical to public health, sustainability, and resource efficiency. Understanding food choice is a crucial step toward improving these areas and promoting individual and community well-being globally. While individual food choices have significant implications, they occur within broader regional, societal, or cultural contexts. Collective food choices, habits, and traditions develop and change over time, leading to great global diversity. However, recent globalisation and industrialisation have, in some ways, aligned the trajectory of food development across the world. This convergence means that different countries, cities, communities, and cultures are making increasingly similar food and food-related decisions (Fabiosa, 2011). The rapid spread of Americanised diets and food habits, often referred to as *coca-colonisation*, has shifted global dietary preferences toward convenience, taste, and affordability over nutritional value. Increasingly processed foods that are lower in essential vitamins and higher in caloric value, added sugars, fats, and salt are becoming more common globally, posing significant risk to public health (Monteiro et al., 2013). Despite this globalisation and alignment, there has also been an increasing disparity in food security, especially among racial and ethnic groups (Young, 2004). As areas with higher socio-economic status benefit from a more dynamic food marketplace, lower socio-economic status areas converge towards unhealthy diets that are associated with higher levels of obesity

(Hawkes, 2006). Given its complex nature, understanding food choice is difficult and has led to the development of intricate and multi-faceted models attempting to capture this complexity.

Among all the different models aiming to capture the complexity of food choice, there are some commonalities that can help understand which factors are driving the choices people make relating to food. Building on the work of Eertmans et al. (2001), Chen and Antonelli (2020) extracted five major factors of food choice from the broad range of conceptual models (see Figure 1). The key determinants of food choice were food-internal factors (sensory and perceptual factors), food external factors (information, social environment, physical environment), sociocultural factors (culture, economic variables, political elements), personal-state factors (biological features and physiological needs, psychological components, habits and experiences), and cognitive factors (knowledge and skills, attitude, liking and preference, anticipated consequences, and personal identity). While there is significant overlap between these topics, they provide a general guideline for the difficult task of overviewing such a complex topic.

Figure 1

Factors Influencing Food Choice



Note. Adapted from "Conceptual Models of Food Choice: Influential Factors Related to Foods, Individual Differences, and Society," by P.-J. Chen and M. Antonelli, 2020, Foods, 9(12), p. 6 (https://doi.org/10.3390/foods9121898). CC BY 4.0.

Food-Internal Factors

Food-internal factors are sensory (taste, texture, smell, etc.) and perceptual (portion size, nutritional value, quality, etc.) properties that food itself possesses. While foods are made up of distinct sensory and perceptual properties, these are not experienced in isolation. Instead, it is the combination of different properties together that cumulatively influence food choice (Reisch & Zhao, 2017). A large part of what is traditionally thought of regarding food-internal factors refers to palatability. Palatability is the subjective hedonic evaluation of the sensory

aspects of food, particularly at the time of eating (Yeomans, 1998). Foods that have more positive sensory cues (such as a pleasant taste and smell) are rated as more palatable and are generally consumed in larger quantities (Sørensen et al., 2003). While palatability is a major factor in food choice, other sensory and perceptual experiences also occur before and after the eating experience that influence food choice (Monteiro et al., 2018). For example, indigestion after a meal may alter someone's perspective of that food in the future (Yeomans, 1998).

Food-External Factors

Within a vast number of food choice models, information about food, as well as the surrounding social and physical environment (or food-external factors), was found to be a consistent factor affecting food choice (Chen & Antonelli, 2020). External information is distinct from individuals' beliefs about a food and refers to information presented, advertised, or available to consumers. Nutrition labelling on food packaging has become commonplace in most grocery stores around the world as a widespread method of improving consumer knowledge and aiding in dietary decision making. Frequent label users were found to have healthier dietary habits than infrequent label users, suggesting that nutrition labels at least play a mediating role in helping consumers eat healthier (Graham & Laska, 2012). In a systematic review of label use on pre-packaged foods, Campos et al. (2011) found a consistent link in the available literature between label use and healthier eating habits. To help encourage transparency and public knowledge, many countries require specific information to be present on food packaging such as a list of ingredients, allergen information, and quantity. In the United States, introducing mandatory nutrition facts labels had a modest but positive effect on consumer dietary intake (Variyam, 2008). Advertising regulations around the world protect against companies using false claims, untrue information, or embellishments about their products. Even with these regulations in place, there are many techniques used to improve consumers' perspectives on a product by manipulating the way they read or interpret information. The *health halo* effect, which describes people's tendency to place foods into binary

categories of healthy or unhealthy, causes people to make poorer nutritional decisions because they are fixated on one positive attribute (Chandon, 2013). For example, consumers tend to underestimate calorie content in food labelled as *organic* and assume they can consume more of it (Schuldt & Schwarz, 2010). Advertisers and food companies take advantage of advertising techniques like this to promote their product and boost sales. Advertising is a significant contributor towards food choice, especially when deciding between similar products (Nestle et al., 1998). This includes the look and design of food packaging, as well as retail environment, such as location and product placement on shelves (Castro et al., 2018; Wells et al., 2007). Consumers are also more susceptible to the effects of food advertising during periods of increased cognitive load, due to the more limited cognitive resources available (Zimmerman & Shimoga, 2014).

Sociocultural Factors

The broader context in which food choices are made is shaped by cultural, economic, and political influences at a societal level. As a result, many of the individual-level influences on food choice (i.e., food-internal and external factors, personal state factors, and cognitive factors) are not at all independent of sociocultural influences. Nutritional value is impacted by local laws and regulations, taste is impacted by cultural norms and food traditions, packaging and marketing is influenced by trends and fads of the day, and so on.

Governmental policies and economic trends drive development in the food industry, agricultural practices, and the affordability and accessibility of foods, all of which impact the individual day-to-day food choice of consumers (Shepherd, 1999). One major barrier to consuming healthier diets, especially for low-income families, is the monetary and time cost of finding, preparing, and consuming healthier foods (Larson & Story, 2009). Amidst other influences, agriculture and food policies hugely impact the price and availability of food. Diversity in food culture and tradition has long been celebrated across the world and contributes to what makes cultures unique. This diversity ranges from the types of foods that are consumed

and the meaning and symbolism behind foods, to times and patterns of eating, and eating utensils and techniques. Religious traditions and customs in relation to food are, in many cases, a central part of cultures' identities, such as Halal and Kosher laws.

Personal State Factors

Personal state factors revolve around how individual differences in biological, physiological, psychological, and experiential factors influence food choice (Chen & Antonelli, 2020a). While only explaining a small part of food preference, children are born with a small set of innate sensory preferences (including taste) that are distinct from any developed or learned preferences (Beauchamp et al., 1991). An increasingly common biological and physiological factor is the presence of allergies and intolerances (cow's milk being a common example), which often restricts individuals' diets and directs their food choices away from allergenic or intolerable foods (Chafen et al., 2010). Building on top of innate preferences and biological determinants, people continually develop their taste and food preferences throughout their lifespan, generally accepting more foods over time (Beauchamp & Mennella, 2009). Separate from natural growth and maturing, experience plays a pivotal role in developing food choice over time. Specific experiences with food impact future food choice, as do more general life course experiences such as memories, transitional stages, milestones, and impactful events (Sobal & Bisogni, 2009).

Physiologically, the satiety cascade explains how the body uses appetite to regulate energy intake through a combination of physiological events, behavioural actions, and psychological processes (Blundell et al., 2010). Electrical signals from an empty stomach alongside hormonal (i.e., secretion of ghrelin) and metabolic signals (e.g., blood glucose) are the first indications of hunger, until feelings of fullness (i.e., satiety) lead to the cessation of eating through cognitive, sensory, and digestive cues (Amin & Mercer, 2016; Voigt & Fink, 2015). This physiology interacts with psychological influences especially in the anticipation of meals and reward/pleasure pathways.

Much of the research on the psychological aspects of food choice has focused on the influence of emotions in determining food choice as well as post-eating satisfaction and future anticipation. Food choice alters and is altered by individuals' emotional and mood states, which can reinforce food choices and behaviours (Gibson, 2006). The effect of food choice on mood can be altered by either an experience of short-term gratification or satisfaction after eating, as well as a reduction in negative mood (e.g., reducing feelings of hunger). Previous, often consistent, experiences like these reinforce eating habits, patterns, or diets. Interesting direct and indirect connections have also been documented between personality traits and food consumption. For example, Keller and Siegrist (2015) found higher levels of Big Five trait openness to be associated with higher fruit and vegetable consumption, and lower meat and soft-drink consumption.

Cognitive Factors

Nutritional knowledge, evaluation, and beliefs are all cognitive processes that help people to shape which foods they choose. Making food choices requires regular cognitive evaluation of attitudes toward foods, liking, and preference between choices (Steenkamp, 1997). The first part of these evaluations, as defined by Chen & Antonelli (2020), is attitude, which is the implicit evaluations that people make. Secondly, evaluations are based largely on sensory liking of foods (taste, smell, texture, etc.). Thirdly, individuals' evaluations are based on their personal preferences and comparison with other foods. With such a range of foods available, and broad selection of options within these, consumers must regularly decide between foods or similar products. This process relies heavily on, but also influences, a person's preference of one item over another. For example, children tend to prefer sweet foods over bitter or sour options (Ventura & Mennella, 2011).

While studies have yet to explore how individuals make dietary changes leading up to cognitively demanding events or periods of higher cognitive load, there is evidence to suggest that stress and cognitive load affect diet and food-choice (Lattimore & Maxwell, 2004). Under

stress, people generally tend to eat more unhealthy foods and eat less of healthy foods (Hill et al., 2022). One study found that high-stress work sessions compared to low-stress work sessions showed increased energy, saturated fat, and sugar intake (Wardle et al., 2000). Beyond the effect of stress, maintaining dietary restraint requires increased cognitive resources, making it more difficult to control diet while under higher cognitive load (Ward & Mann, 2000). High cognitive load is associated with making poorer eating choices such as decreased fruit and vegetable intake and increased emotional eating (Byrd-Bredbenner et al., 2016). Because of the increased mental effort and distraction, restrained eaters (those attempting to limit their intake in some way) are more likely to overeat, and unrestrained eaters are more likely to undereat, as well as both being more susceptible to the effects of food advertising (Zimmerman & Shimoga, 2014). These results are consistent with findings that students' diet quality tends to decrease during examination periods, generally associated with their increased stress levels as well as having less time available to prepare food (Michels et al., 2020). Given the effect of cognitive load on diet, the relationship between exam periods and diet may be mediated by students' increased cognitive load. This highlights an area for future research to explore how stress and cognitive load interact and how much each affect diet and dietary choices.

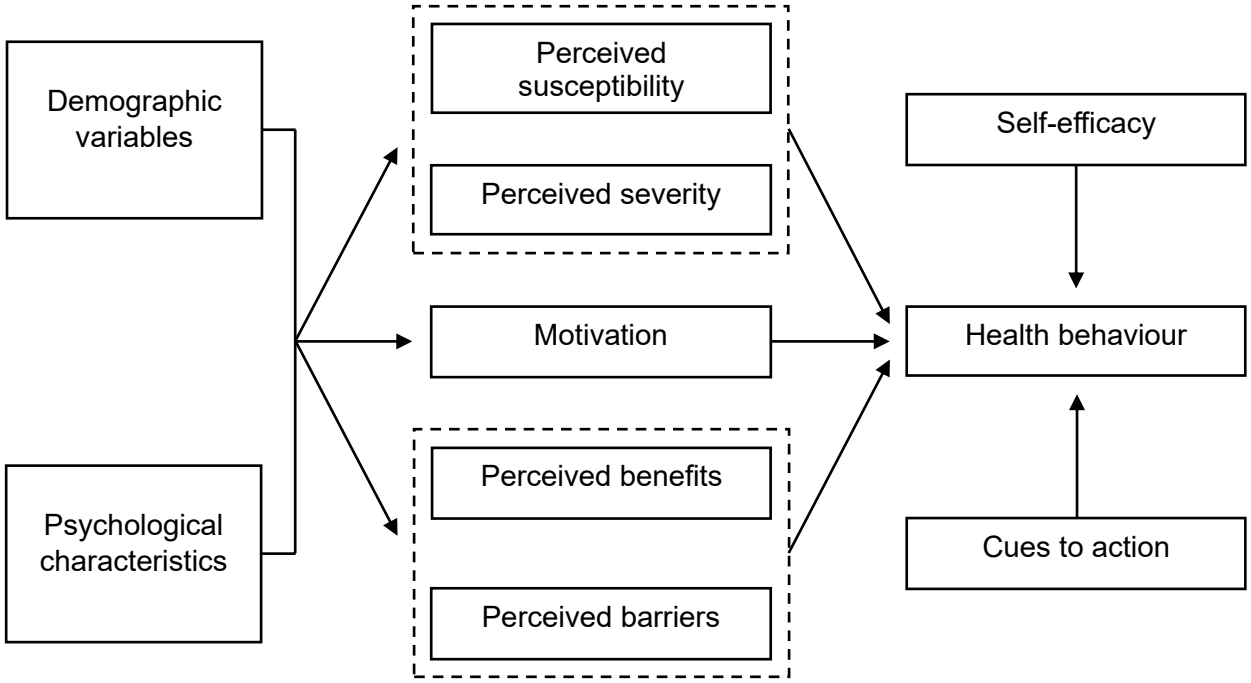
The Role of Beliefs in Food Choice

It is well known that beliefs have strong influence over behaviour (Ajzen, 1991). Lewin and colleagues (1944) suggested that behaviour is dependent upon (1) how much an individual values a certain goal and (2) how likely they believe a specific action is to achieve that goal. This laid the foundation for future literature and models that continued to explore the impact of beliefs on behaviour. As shown in Figure 2, the health belief model applied this to health-related decisions (e.g., surgeries, preventative measures, recovery, etc.), suggesting they depend on (1) how much individuals value a health-outcome and (2) their belief that a specific action will prevent or ameliorate illness (Janz & Becker, 1984). In Raghunathan et al. (2006), foods that were portrayed as less healthy were preferred when making hedonic food choices (choices

based on taste preference). Individuals with stronger beliefs that unhealthier foods taste better were less influenced by health claims and more likely to choose unhealthy foods they perceived as tastier (Mai & Hoffmann, 2015). This relationship between beliefs and behaviour is also consistent with food/health-related beliefs and food choice. Athletes, for example, often align their food choices with sports nutrition guidelines and their beliefs about how these choices will impact their performance (Eck & Byrd-Bredbenner, 2021). While manipulating and adopting dietary patterns or behaviours to improve performance or to slow aging is common practice, it is also becoming increasingly popular to make dietary changes or take dietary supplements to improve brain health or protect against dementia (Roe & Venkataraman, 2021). Applying the health belief model in these cases, the individual choice to take a supplement aimed at improving a cognitive function is a result of (1) how much the individual values the improved cognition, and (2) their belief that taking the supplement will give them these added benefits. Beliefs about fat and sugar's impacts on health regularly impact individuals' food choices in a similar way, however little is known about whether improving cognition or mood is ever a driver for decisions related to the consumption of these nutrients. This raises two questions: (1) how do sugar and fat impact mood and cognition? and (2) what do people believe about these effects? If individuals believe these nutrients influence cognition or mood, their consumption may vary based on the importance they place on these effects and the strength of their belief. The following sections will address these questions by summarising the relevant literature on how sugar and fat impact mood and cognition, as well as what is known about individuals' beliefs and attitudes toward fat and sugar, especially in relation to mood and cognition.

Figure 2.

The Health Belief Model



Note. Adapted from Appendix I: Understanding What Drives Behavior Change, by Centers for Disease Control and Prevention, 2025 (https://www.cdc.gov/suicide/playbook/behavior-change.html). In the public domain.

Effects of Dietary Sugar

Sugars, or saccharides, are a form of carbohydrate typically associated with a sweet taste, but also make up more complex carbohydrates such as starches and fibres (Coultate, 2023). Sugars can be made up of a single sugar molecule (monosaccharides; e.g., glucose, fructose, galactose) or two linked sugar molecules (disaccharides; e.g., sucrose, lactose, maltose). Glucose, fructose, and sucrose are forms of sugar found naturally in foods such as fruits and honey, while galactose and lactose are common in milk or milk-derived products (Hess et al., 2012). The public typically understands sugar to mean table sugar (or sucrose; Levy & Fügedi, 2005). Nutritional labels often display sugar content to help consumers make

informed food choices. Table 1 provides a list of sugar-related terms and definitions. Lollies (sweets, candy etc), pastries, and sugar-sweetened beverages (SSBs) such as soft drinks and fruit juices, are all examples of products with high sugar content (U.S. Department of Agriculture, n.d.). While sugar plays an essential role in the body's functioning, overconsumption has been linked to numerous negative health effects such as obesity, diabetes, dental caries, and cardiovascular disease (Bray & Popkin, 2014; Johnson et al., 2009; Touger-Decker & van Loveren, 2003).

Table 1

Sugar-Related Terms and Definitions

Term	Definition
Carbohydrates	Dietary macronutrient classified into three groups: sugars (DP 1–2), oligosaccharides (short-chain carbohydrates; DP 3–9) and polysaccharides (DP⩾10; Cummings & Stephen, 2007)
Sugars	Mono and disaccharides in food (Cummings & Stephen, 2007)
Total sugars	All mono and disaccharides present in food, regardless of the source they are derived from (Erickson & Slavin, 2015)
Added sugars	All mono and disaccharides added to foods during processing or cooking (Swan et al., 2018)
Free sugars	All added sugars, as well as those found in honey, syrups, and fruit juices. Free sugars exclude naturally occurring sugars in fruits and vegetables, milk and dairy, cereal grains, nuts, and seeds (Swan et al., 2018)
Sugar-sweetened beverages (SSBs)	Liquids with added caloric sweeteners, excluding alcoholic and dairy beverages (Philipsborn et al., 2019)

Note: DP is the degree of polymerization or the number of monomeric (singular sugar) units in a chain.

Dietary Sugar and Cognition

Glucose is the primary energy source for the mammalian brain, which, due to its high energy consumption, has the highest glucose demand of all organs in the body (Mergenthaler et al., 2013). Hypo and hyperglycaemia (prominent characteristics of diabetes) have been linked to decreases in cognitive function, demonstrating the importance of effective blood glucose regulation (Gonder-Frederick et al., 2009). Many studies have observed a glucose memory facilitation effect. These studies have shown that following the oral ingestion of glucose, there is a marked improvement in memory, especially episodic memory requiring significant mental effort and immediate verbal tasks (García et al., 2021; Smith et al., 2011). A recent meta-analysis showed glucose to have a significant improvement in immediate free recall, standardized mean difference (SMD) = 0.22 [95% CI, 0.08, 0.36], $p = .002$, but not a significant impact on delayed free recall, SMD = 0.24 [95% CI, −0.19, 0.72], $p = .233$ (Gillespie et al., 2023). Some evidence also points to benefits in related areas of functioning such as attention and verbal processing, especially for individuals with Alzheimer's or Down syndrome (Korol & Gold, 1998). According to Ginieis et al. (2018), some studies showed improved performance in prefrontal lobe tasks (simple response time, arithmetic processing, and the Stroop task) 20 minutes after glucose or sucrose administration. However, other research has failed to produce similar results, with some demonstrating the opposite effect (Benton et al., 1994). While there is a definite pattern of short-term cognitive benefits of sugar, some mixed results and variations in study design obfuscate the relationship, showing that more research is needed to get a clearer picture. Studies of non-glucose saccharides have shown long-term moderate intake of saccharides to be related to improved memory function (Best et al., 2008, 2015). What is also important is that, at higher intakes of saccharides, cognitive performance did not decline but plateaued. Improvements in cognitive function associated with sugar consumption seem to be most robust when participants are doing cognitively demanding tasks (Brandt et al., 2013).

An increasing number of studies link long-term overconsumption of sugar, especially refined sugar, to impairments in memory, attention, mood, and overall cognitive function (Gillespie, Kemps, et al., 2023). Sugar overconsumption has been consistently linked with declines in global measures of cognitive function (Chong et al., 2019; Muth & Park, 2021; Naveed et al., 2020; Roberts et al., 2012). In Ye et al.'s (2011) Mini-Mental State Examination (MMSE) scores were negatively associated with intake of total sugars, added sugars, and sugar-sweetened beverages, adjusted odds ratio (AOR): 2.23 [95% CI: 1.24, 3.99], 2.28 [95% CI: 1.26, 4.14], and 1.57 [95% CI: 0.91, 2.73], respectively. Younger (perinatal, childhood, and adolescence) and older adult (typically over 60 years old) life stages seem to be more susceptible to these cognitive decreases (Gillespie, White, et al., 2023). For example, one study found that every additional 15 grams of sucrose consumed by mothers perinatally decreased Kaufman Brief Intelligence Test, Second Edition (KBIT-II) scores by 1.5 points (95% CI: −2.8, −0.2; Cohen et al., 2018). In Crane et al., (2013) study of older adults, higher glucose levels were associated with an increased risk of dementia in both non-diabetic participants and diabetic participants. Similar studies substantiate this relationship between sugar intake and dementia (E. Hill et al., 2019; L. Liu et al., 2022; Miao et al., 2020). Longitudinal studies also indicate memory impairments associated with excessive sugar consumption (Gillespie, White, et al., 2023). Many hypothesised effects of sugar are based on rodent studies, which have shown sugar consumption to have a negative relationship with hippocampal-based memory (Beilharz et al., 2015; Noble et al., 2019). In humans, the relationship is much less well understood or clear and research has often produced inconsistent results. Higher intakes of SSBs have been linked to lower MMSE scores, as well as poorer executive function in children (Chong et al., 2019; Gui et al., 2021). Somewhat contrarily, recent meta-analyses have shown the negative relationship between SSBs and cognitive impairments in middle-aged and older adults to not be statistically significant (Sun et al., 2021).

Dietary Sugar and Mood

Despite strong physiological rationale, studies continue to produce mixed results regarding sugar's impact on mood. Sugar consumption has been related to many self-reported mood constructs such as improved alertness (Owen et al., 2012), reduced depression (Fischer et al., 2001), clear-headedness (Smit et al., 2004), positive affect (Peacock et al., 2012), reduced fatigue (Reay et al., 2006), and calmness (Owen et al., 2012). Conversely, many studies have found there to be no significant effect of sugar on mood, or a negative effect (Giles et al., 2012; Sünram-Lea et al., 2011; Ullrich et al., 2015). Van de Rest et al. (2018) found that out of the 13 studies identified that compared the effects on mood of glucose consumption against placebo, 7 of these found no effect and 6 found small or partial beneficial effects (feeling less tense/ more energetic). This analysis also found all studies comparing sucrose with placebo to show no relationship with mood. Similarly, another recent meta-analysis did not provide support for a positive relationship between carbohydrate consumption and mood but found limited support for a detrimental effect of sugar on alertness and fatigue (Mantantzis et al., 2019). While some research has identified sugar to be a factor in hyperactivity and ADHD, studies have shown inconsistent findings and are largely inconclusive (Beecher et al., 2021). It has been hypothesised that the increased sugar consumption of children with ADHD could be a result of the disorder or confounding variables, instead of being a determinant (Del-Ponte et al., 2019; Farsad-Naeimi et al., 2020). Mantantzis et al. (2019) also characterised the idea of a *sugar rush* as a myth, with their meta-analysis suggesting sugar had no impact on any domains of mood. These mixed results could be an indication that the relationship between sugar and mood is being mediated or moderated by other factors. Jones et al. (2012), for example, found time after ingestion to significantly impact the effects of sugar. However, this study did not find sugar to have any effects on mood. Furthermore, Mantantzis et al. (2019) identified several potential moderating variables, including carbohydrate dose and type, fasting interval, and the type of activity before mood assessment. None of these were found to be significant

moderators, with activity before assessment being the only moderator approaching significance. The current evidence surrounding the relationship between mood and sugar intake seems to be too inconsistent to draw definitive conclusions.

A key limitation in the current literature is the use of non-caloric artificial sweeteners, such as saccharin, as controls. In studies with fasted participants, experimental groups have the cognitive benefit of energy from sugar, which control groups do not, inflating the effects of sugar compared to artificial sweeteners (Gillespie, Kemps, et al., 2023). In conclusion, the type of sugar and their source seems to be an important factor in determining whether sugar affects memory positively or negatively. The long-term deleterious effects of HSD, especially on global cognitive functioning and memory, are increasingly supported by evidence, likely due to added and refined sugars such as high-fructose corn syrup. There is some evidence for a relationship between sugar and mood, but research has been too inconsistent to sufficiently evidence this claim. Further research is needed to better understand these effects and the mechanisms at work, and to resolve inconsistent findings.

Effects of Dietary Fat

Dietary fats fall into four main classifications: saturated fatty acids (SFA), commonly found in dairy products, red meat, and coconut oil; monounsaturated fatty acids (MUFA), found in olive oil, avocado, and almonds; polyunsaturated fatty acids (PUFA), found in salmon, chia seeds, and sunflower oil; and trans unsaturated fats, found in margarine, baked goods, fast foods (Ross et al., 2020). High-fat diets (HFDs) have generally been linked to deleterious health effects such as increased risk of obesity, diabetes, cardiovascular disease, and cancer (A. G. Liu et al., 2017). However, not all fats are alike, and their effects depend on the type of fat, the quantity consumed, and other extrinsic factors such as exercise and lifestyle (Coelho et al., 2011; Schwab et al., 2014). While SFAs and trans fats are associated with negative health effects, MUFAs and PUFAs contribute positively toward health and well-being, acting as protective factors against various adverse health outcomes and diseases such as

cardiovascular diseases, cognitive decline, and metabolic syndrome (Assmann et al., 2018; Gillingham et al., 2011).

Dietary Fat and Cognition

HFDs in rodent studies have shown a rapid deterioration of episodic, spatial, and context memory, as well as mood behaviour (de Paula et al., 2021; Wang et al., 2020). The major hypothesised mechanisms involved in these effects on rodents are oxidative stress and neuroinflammation in the hippocampus, neuroplasticity, and impaired insulin sensitivity due to changes in the gut biome (Cordner & Tamashiro, 2015; de Paula et al., 2021; Leigh & Morris, 2020; Noble et al., 2017). Rodent studies play an essential role in understanding diet's impact on cognition, but relatively few studies have investigated HFDs' role in human cognition due to ethical and practical concerns (Taylor et al., 2021). HFDs have been shown to be associated with the rapid onset of hippocampal deficits in the human brain through hippocampal neuro-inflammation (Holloway et al., 2011).

While HFDs tend to show negative associations with cognitive function, some types of fats have enhancing and protective effects on cognitive function (PUFAs) and others deleterious and adverse effects (SFAs, and trans fats). PUFAs, particularly omega-3 and omega-6 fatty acids, have been shown to have cognitive benefits in the domains of memory and psychomotor processing (Dullemeijer et al., 2007; Eskelinen et al., 2008; Portillo-Reyes et al., 2014; van de Rest et al., 2016; Wang et al., 2020). In a meta-review, van der Wurff et al. (2020) found that while previous studies have arrived at mixed conclusions, the overall evidence suggests positive effects of omega-3 fatty acids on cognition, with greater omega-3 index percentages and supplementation dose sizes showing more pronounced differences. Research on MUFAs have shown less unanimous results. While some studies have reported improvements in memory to be associated with MUFAs (Naqvi et al., 2011; Okereke et al., 2012; Solfrizzi et al., 2006), other studies have found MUFAs to be associated with memory deficits (Cherbuin & Anstey, 2012; van der Wurff et al., 2020; Zhang et al., 2006). Higher intakes of SFAs and trans fats are

associated with cognitive deficiencies, including poorer recall, more visuo-spatial learning errors and exacerbated cognitive decline related to aging and dementia (Blake et al., 2022; Devore et al., 2009; Eskelinen et al., 2008; Gibson et al., 2013). However, there has been some contrary research finding SFAs to be associated with improved cognitive function, and inversely associated with cognitive impairment (Currenti et al., 2023; Karazurna et al., 2020).

Dietary Fat and Mood

The relationship between dietary fat and mood is even more difficult to understand because of the current lack of relevant research. Very few studies have investigated this topic, and those that have often seemingly contradict each other, and are generally cross-sectional. Therefore, the extent to which mood is impacted by dietary fat is largely unknown. Rodent studies have shown evidence of HFD having negative effects on mood, as well as HFDs being effectively used to manage stress, anxiety, and depression in the short-term (Edwards et al., 2011; Yu et al., 2021). In humans, there is similar ambiguity and contrasting results, especially regarding saturated fats, possibly due to differences in study design, methodology, or confounding factors. Some studies have found no significant associations between HFDs and mood, with others showing both significant positive and negative associations (Tzenios et al., 2023). While there is less research on MUFA and PUFA, Firth et al. (2019) found these to be associated with better mental health outcomes in young adults, with their anti-inflammatory characteristics being a possible mechanism. A few studies have also found MUFA intake to be inversely related to depression (Banikazemi et al., 2015; Sánchez-Villegas et al., 2011). Omega-3 PUFAs, commonly found in fatty fish such as salmon, have been strongly associated with significant mood enhancement and neuroprotective effects, especially in inflammatory-related symptoms or diseases such as depression, anxiety, and schizophrenia (Firth et al., 2018; McNamara, 2016). While there are currently few relevant studies available, those of which are often contradictory, dietary fat seems to play an important role in mood, with dietary inflammation being a likely mediating factor (Firth et al., 2019). Future research with a focus on

high-quality experimental studies would greatly enhance understanding in this area.

The current literature shows a trend of MUFA and PUFA being positively associated with cognition and mood, and SFAs and trans fats negatively (Muth & Park, 2021). However, the scarcity of available research means that studies with vastly different designs, purposes, samples, and targets are being compared to understand the relationship between cognition, mood, and dietary fats. While there have been some significant improvements in this area of literature in recent years, continued academic efforts are needed to clarify findings and specify relationships more accurately and clearly.

The Western-Style Diet

Much of the current research available has investigated the effect of the typical Western-style diet, which is typically high in both saturated fat and refined sugar. While different sugars and fats all have varying effects on cognitive function, collective HFS diets are also negatively associated with cognitive functions such as memory and executive function (vocabulary and verbal fluency; Akbaraly et al., 2009; Atak et al., 2023). Foods high in sugar and fat, especially those with added sugars and saturated/trans fats, tend to be relatively calorie-dense and nutrient poor. This ratio of energy to nutritional value means that foods typical of Western diets tend to contribute significantly to overconsumption and obesity (Kopp, 2019). However, the impact of high energy diets on memory can occur rapidly before any significant weight gain, indicating that diet may have a direct influence on cognitive function (Beilharz et al., 2015). HFD diets are specifically associated with hippocampal-dependent cognitive function (Francis & Stevenson, 2011). Attuquayefio et al. (2017) were the first to experientially demonstrate the effect on hippocampal-dependent learning and memory after brief exposure to a Western-style diet high in saturated fat and refined sugar. More recently, Yeomans et al. (2023) found habitual high fat and sugar intake to have a consistent negative relationship with objective and self-reported memory problems, showing that individuals had awareness of everyday memory problems they faced. This same study, along with others, also found HFS diets to be associated

with increased impulsivity (Chong et al., 2019). Oxidative stress, neuroinflammation, insulin resistance, and vascular alteration are all likely mechanism implicated in these relationships (Freeman et al., 2014).

Public Perceptions of Sugar and Fat

Between the 16th and 18th centuries, millions of sailors suffered from scurvy, eventually leading to the discovery that citrus fruits and their juices were an effective prevention and cure for scurvy. Despite this development, the use of citrus was for many centuries not widespread on voyages because many physicians and sailors either did not know about or believe in the efficacy of this treatment (Baron, 2009). In the same way, modern consumers' beliefs, attitudes, and perceptions of foods, often more so than actual nutritional properties of those foods, are vital to understanding food choice. Nutritional literacy in the public is increasing but still extremely limited, and beliefs are largely confounded with ambiguities, misunderstandings, and misinformation (Diekman et al., 2023). Alongside the increasing globalisation of information, consumers are becoming increasingly informed about their diets. While consumers tend to have some understanding of the difference between terms such as "natural" and "added" sugars, they generally report difficulty understanding sugar intake recommendations, reading sugar content on labels, and understanding other terms such as free sugars (Prada et al., 2021; Rampersaud et al., 2014; Tierney et al., 2017). Similarly, consumers have a confused understanding of dietary fat, its effects, and related health recommendations pointing to a broader lack of nutritional literacy amongst the public (A. G. Liu et al., 2017; Wiseman, 1994).

While historically viewed as an innocent and pure food, contemporary attitudes toward sugar have become far more negative, turning towards morally judgemental terms such as "excessive", "immoderate", and "improper". This change is owing to the drastic increase in sugar consumption during the 19th century, and the subsequent health consequences that followed (Fischler, 1987). Contemporary attitudes generally seem to be that sugar is pleasurable, yet harmful (Prada et al., 2021). Despite positive attitudes toward its taste, several studies have

found the public to have an awareness of the health risks associated with excessive sugar consumption, such as cardiovascular disease, obesity, and increased cancer risk, in adolescents (Lundeen et al., 2018; Miller et al., 2022; Prada et al., 2021) and adults (Miller et al., 2020; Žandaras et al., 2020). In each of these studies, however, significant gaps in knowledge were still commonplace. One study in the UK found that 94% of questionnaire participants, forum posts, and tweets reviewed believed that children in the UK consumed too much sugar, negative impacting their health (Swift et al., 2018). This attitude toward sugar makes sense considering the volume of research detailing the negative effects of sugar, as well as the prevalence of media campaigns, public awareness initiatives, and advertising aimed at reducing sugar consumption. Consumers similarly have an awareness of some of the risks associated with excessive fat consumption such as cardiovascular disease, obesity, and increased cancer risk (Assema et al., 1990; Landry et al., 2020) and tend to define foods containing less fat as healthier (Lusk, 2019). However, many consumers are also confused and are not sure what role dietary fat plays in their health, or whether it would be considered healthy or unhealthy (Diekman & Malcolm, 2009). More than just an awareness, the long spread campaigning against dietary fat has led to a collective *fear of fat* (Swift et al., 2018). Landry et al. (2020) found that many university students do not differentiate between types of fat and instead tended to avoid fat altogether. Consumers tend to believe low-fat diets are important for heart disease and weight-loss, with low-fat alternatives viewed more positively than high-fat foods (Davy et al., 2006; Steptoe et al., 2002).

Focusing specifically on how consumers believe fats and sugars effect their mood and cognition, less is known. The belief that sugar causes hyperactivity, especially in children, is commonplace. Despite little academic support, a great number of people have heard of or believed in a sugar rush, or that sugar is related to ADHD (Del-Ponte et al., 2019; Krummel et al., 1996). Furnham (2018) found that 20.5% of participants rated the statement *“Sugar intake causes children to be hyperactive”* as *definitely true*, and another 44.5% as *partly true*, showing

that this belief to still be widespread. There is limited research, online media, or discussions of beliefs relating to the effect dietary fat has on mood or cognition. Being such a niche topic, which has even received minimal academic interest, it is possible the public have simply given this area little thought. Consumers' generally negative attitude toward fat and sugar may be an indication that consumers believe these nutrients to also negatively impact mood and cognition, but this is yet to be explored. Research exploring what people believe about the cognitive and mood effects of fat and sugar may help to guide future educational efforts, dispel misinformation, and ultimately improve nutritional literacy rates.

Psychological Myths and Misinformation

Just as misconceptions about food and nutrition are widespread, the field of psychology is littered with myths and misinformation. Traditionally, myths are transmitted through word-of-mouth, but the rise of internet communication has accelerated their spread digitally (Fernback, 2003). Although online platforms are a useful tool for spreading information, they are also known to frequently spread misleading, unproven, or false information (Del Vicario et al., 2016). People regularly misjudge the accuracy of information on the internet, including determining the legitimacy of news stories (Pennycook et al., 2018; Pennycook & Rand, 2020). Myths and misconceptions among the public are especially common in the field of psychology, where findings are often counterintuitive, and even formal psychological education has limited success in alleviating these myths (Furnham & Hughes, 2014). Messages accompanied by brain images or neuroscientific explanations, even when irrelevant, are perceived as more believable (McCabe & Castel, 2008; Weisberg et al., 2008). Many different myths related to mood or cognition have been observed in the public, such as the belief that humans only use 10% of their brains (Dekker et al., 2012; Furnham & Horne, 2021; Furnham & Hughes, 2014; Herculano-Houzel, 2002). Since beliefs play a crucial role in shaping behaviour, inaccurate information presents a significant barrier to healthy dietary behaviours. The prevalence of myths and misinformation in psychology, particularly in relation to mood and cognition, highlights the

need to understand public beliefs to dispel myths and misconceptions and promote accurate information.

Rationale for Research

As discussed above, the research shows very complex and nuanced relationships between diet, cognition, and mood. The effects of different types of fats and sugars vary and are further influenced by multiple factors. In addition, much of the literature presents mixed or discrepant findings, often varying across studies. As a result, the information available to most people is often unclear and uncertain. This is exacerbated by the fact that most people are exposed to these findings through the lens of social and public media platforms, internet forums, and everyday communication. Consequently, misunderstandings, oversimplifications, or distortions of information are common. It is, therefore, important to understand what people believe about the connection between their diet and mood/cognition, and how these beliefs influence their behaviour.

Despite widespread negative attitudes toward dietary fat and sugar, it remains unclear how consumers perceive their effects on mood or cognition. Because this area remains largely unexplored, the present study aims to explore beliefs about dietary fat and sugar's impacts on cognition and mood, and how such beliefs influence behaviour. Negative perceptions of fat and sugar influenced the development of hypotheses 1 and 2, which predict that participants will associate these nutrients with negative effects on their cognitive performance and mood. In-line with the health belief model, individuals' desire to enhance cognition and mood, as well as their belief that modifying fat and sugar intake provides such benefits, is expected to impact how they adjust their consumption leading up to cognitively demanding situations. Therefore, it is hypothesised in this study that beliefs about fat and sugar will be positively associated with dietary behaviour leading up to cognitively demanding situations.

Hypotheses

H1a: Participants will believe that sugar negatively impacts cognitive performance.

H1b: Participants will believe that fat negatively impacts cognitive performance.

H2a: Participants will believe that sugar negatively impacts mood.

H2b: Participants will believe that fat negatively impacts mood.

H3a: Beliefs about the effect of sugar consumption on cognition are expected to be positively correlated with participants' self-reported change in sugar consumption leading up to cognitively demanding situations.

H3b: Beliefs about the effect of sugar consumption on mood are expected to be positively correlated with participants' self-reported change in sugar consumption leading up to cognitively demanding situations.

H4a: Beliefs about the effect of fat consumption on cognition are expected to be positively correlated with participants' self-reported change in fat consumption leading up to cognitively demanding situations.

H4b: Beliefs about the effect of fat consumption on mood are expected to be positively correlated with participants' self-reported change in fat consumption leading up to cognitively demanding situations.

Methods

Preregistration

The present study was preregistered on Open Science Framework before data collection commenced. This preregistration was made public (https://doi.org/10.17605/OSF.IO/QTW7A) on July 31, 2024. De-identified data, analytical code, and other supplementary materials needed to reproduce the analysis and results were also made public (https://osf.io/y62cn/).

Design

The present study employed a cross-sectional survey design to investigate public beliefs regarding the effects of dietary fat and sugar on cognitive performance and mood. The study also aimed to explore how these beliefs relate to self-reported dietary adjustment in cognitively demanding situations. This study is exploratory in the sense that there is little existing research to guide hypotheses. The aim of this study was to identify patterns in an under-researched area and guide future research.

Participants

Sample Size Determination

The sample size for this study was determined using an a-priori power analysis through G*Power 3.1.9.7 (Erdfelder et al., 1996). A two-tailed test was conducted to detect effects in either direction, reducing the probability of type I errors and remaining open to evidence contrary to the hypotheses. A conventionally small effect size of $r = .2$ was specified (Cohen 1988), allowing detection of effect sizes greater than .2. Hemphill (2003) argues that Cohen's correlation guidelines are too exigent, suggesting a more modest recommendation of $< .20 =$ small, $.20 – .30 =$ typical, and $> .30 =$ large. These suggestions were taken into consideration in interpreting the results of Pearson's *r* correlation coefficients. While the focus of this study is on the estimation of effect sizes and their precision, a traditional power analysis was conducted to ensure adequate sample size with sufficiently precise effect size estimates. The results of this power analysis indicated that it would take a sample size of 193 to achieve the desired power of 0.80 with an alpha (α) of 0.05 for an effect size of $r = .2$. A sample size of 250 participants was specified in Prolific to allow for up to 20% of data to be missing or removed while ensuring sufficient power.

Because each statistical test in this study is conducted independently, and not as a family of related tests (as with a union-intersection test), they do not require an alpha adjustment (Rubin, 2024). This is because inflated family-wise error risk only increases in a

family of tests. Rubin (2024) explains that when conducting multiple instances of independent testing, the probability of Type I error is not inflated above the individual error rate of .05. Instead, each individual test's probability of Type I error remains constant.

Demographic Characteristics

A breakdown of the demographic characteristics of the 205 participants in the final sample of this study is provided in Table 2. The final sample of 205 participants show a broadly balanced gender representation, though slightly skewed toward female. Participant ages ranged from 18 to 84, with a mean age of 37.5 ($SD = 13.3$). The largest age-group was 18–24 years (34.1%), with most participants located in Australia (74.6%), and the remainder (25.4%) in New Zealand.

Table 2

Demographic Characteristics of Participants

Demographic Item	Frequency	Sample %
Gender		
Male	90	43.9
Female	113	55.1
Non-binary / third gender	2	1
Prefer not to say	0	0
Age Range		
18-24	32	15.61
25-34	70	34.15
35-44	54	26.34
45-54	24	11.71
55-64	16	7.8
65-74	7	3.41
75 +	2	0.98
Location		
Australia	153	74.63
New Zealand	52	25.37

Note. The total sample size was 205.

Recruitment and Inclusion criteria

The participants from this study were recruited via a convenience sample through the Prolific crowdsourcing platform (www.prolific.com). A pre-screening criterion of 95% approval rating was specified on Prolific. Prolific calculates approval rating using the upper limit of the 95% confidence interval of prior task approval ratings. A second pre-screening criterion was applied to only make this study available to users in New Zealand or Australia. Only participants who met these inclusion criteria could view the advertisement and participate in the study.

Exclusion Criteria

On top of the inclusion criteria, a series of exclusionary criteria, specified in the preregistration, were also applied to filter participants:

1. Participants who responded “no” to the informed consent question at the beginning of the survey were directed out of the study using survey flow settings on Qualtrics.
2. Participants who did not respond to the gender or age questions were also directed out of the survey and excluded.
3. Participants who responded to the age question with a number below 18 were directed out of the survey.
4. Participants who do not select either Australia or New Zealand as the country they currently reside in were also be directed out of the survey using survey flow settings on Qualtrics.
5. Participants who responded to less than 75% of questions were also removed from the survey. In the preregistration, this was described as 28 out of 38 questions. However, this practically would have meant that participants only had to respond to one item in each matrix for the matrix to be treated as answered. Under this rule, participants could respond to none of the relevant fat and sugar items but still be included in the analysis. Instead, each matrix item was treated as a separate question to ensure that 75% of relevant questions were answered in the analysis.
6. Participants who did not respond *Increase Moderately* to the attention check item were excluded from the study.
7. Any responses Prolific identifies as a preview, test, or duplicate, were excluded during data processing. Responses from the same Prolific ID were all removed except the most recent

Ethics

The research plan for this study was peer-reviewed by Associate Professor Stephen Hill and Dr. Matt Williams, who has expertise in psychological methodology and ethics. After taking feedback into consideration and adapting the research plan accordingly, this study was deemed to be low risk. A Low-Risk Notification Form was submitted to the Massey University Human Ethics Committee on 3 November 2022 (Ethics Notification Number: 4000026674; see Appendix A).

Measures

The following describes each of the measures that were implemented in the survey which participants of this study filled out online. The first section measured participants' beliefs about the effects of sugar and fat on cognition and contains 14 items (1.1 – 1.14). Section two measures participants beliefs about the effects of sugar and fat on mood and contains 14 items (2.1 – 2.14). Section three measures participant's self-reported dietary adjustment using seven matrices (3.1 – 3.7). The copy of the full survey has been made available online (https://osf.io/y62cn/).

In the first two sections, which measure participants beliefs, half of the items were phrased positively (e.g., eating foods high in sugar improves my general level of alertness), and the other half were negated (e.g., eating foods high in sugar reduces my ability to solve difficult problems). Of the fourteen negated items, eight negations resulted in reversed items (questions 1.4 to 1.7 and 2.4 to 2.7). To reduce the potential confusion associated with reverse and negated items, the present survey underwent ongoing peer review and feedback during its development to ensure it is clear and cohesive to respondents.

Beliefs About the Effects of Fat and Sugar on Cognition

Participant's beliefs about the effects of sugar and fat cognitive function were examined using a series of survey items (see Table 3). Participants rated how they believe sugar and fat influenced six distinct cognitive domains: attention, alertness, memory, decision making,

problem-solving/planning, and reasoning across six items for fat and six for sugar. Each item presented a statement about one of these domains, and participants responded indicating their level of agreement on a 7-point scale. The seven response options were: *strongly disagree*, *disagree*, *slightly disagree*, *neither agree nor disagree*, *slightly agree*, *agree*, and *strongly agree.*

The rationale for which six cognitive domains were measured was two-fold. First, while not exhaustive, these domains were chosen to capture a broad range of cognitive functions engaged in everyday life. Second, it was important that participants could understand and were familiar with the concepts and language being used. For instance, while common psychological language, terms such as *executive function* needed to be avoided to maintain accessibility for all participants. Furthermore, statements were anchored to everyday scenarios to help provide context. Rather than ask participants to generalize their beliefs, specific scenarios were stated for participants to agree or disagree with, making the items more intuitive and relatable. For instance, instead of asking "*do you believe sugar affects your memory*", participants responded to the statement "*Eating foods high in sugar improve my ability to remember things*". From these items, a sugar cognitive belief score was created from the mean of all sugar-related cognition items (i.e., 1.1 – 1.6) and a fat cognitive belief score) from the mean of all fat-related cognition items (i.e., 2.1 – 2.6), respectively. These scores were coded for analysis to have a midpoint of zero and a range of -3 to $+3$.

Beliefs About the Effects of Fat and Sugar on Mood

Questions 1.1 to 1.6 and 2.1 to 2.6 presented statements aimed to uncover how participants believe sugar and fat, respectively, to impact different cognitive domains. Questions 1.9 to 1.14 and 2.9 to 2.14 present statements about sugar and fat's respective perceived impacts on mood. Similarly to the cognitive belief questions discussed previously, there were six mood statements that were targeted toward different aspects of mood. The six domains of mood that were measured were based on the six subscales of the Profile of Mood States (POMS)

questionnaire (McNair, 1971). The original six subscales in the POMS were: fatigue-inertia, vigor-activity, tension-anxiety, depression-dejection, anger-hostility, and confusion-bewilderment.

Additionally, two non-cognitive and non-mood items were added in the fat and sugar sections to investigate how participants believe these foods impact quality of sleep and physical health. Table 3 shows each item and which cognitive or mood domains they relate to. Items 1.12 and 2.12 were adapted to measure motivation instead of fatigue/inertia. A sugar mood belief score was created from the mean of all sugar-related mood items (i.e., 1.9 – 1.14) and a fat mood belief score from the mean of all fat-related mood items (i.e., 2.9 – 2.14), respectively. These scores were coded for analysis to have a midpoint of zero and a range of −3 to +3.

Table 3

Cognitive and Mood Domains

Item	Item Number	Domain
“Eating foods high in sugar/fat improves my ability to focus on tasks that require concentration”	1.1/2.1	Attention
“Eating foods high in sugar/fat improves my general level of alertness.”	1.2/2.2	Alertness
“Eating foods high in sugar/fat improves my ability to remember things”	1.3/2.3	Memory
“Eating foods high in sugar/fat reduces my ability to make important decisions”	1.4/2.4	Decision Making
“Eating foods high in sugar/fat reduces my ability to solve difficult problems”	1.5/2.5	Problem Solving
“Eating foods high in sugar/fat reduces my ability to think clearly”	1.6/2.6	Reasoning
“Eating foods high in sugar/fat reduces the quality of my sleep”	1.7/2.7	Quality of Sleep
“Eating foods high in sugar/fat improves my physical health”	1.8/2.8	Physical Health
“Eating foods high in sugar/fat reduces my feelings of irritability or anger”	1.9/2.9	Anger-Hostility
“Eating foods high in sugar/fat reduces how disoriented or confused I feel”	1.10/2.10	Confusion-Bewilderment
“Eating foods high in sugar/fat reduces my feelings of depression or hopelessness”	1.11/2.11	Depression-Dejection
“Eating foods high in sugar/fat improves my motivation to start and complete tasks”	1.12/2.12	Motivation
“Eating foods high in sugar/fat improves how calm or relaxed I feel”	1.13/2.13	Tension-Anxiety
“Eating foods high in sugar/fat improves how lively, energetic, and active I feel”	1.14/2.14	Vigor-Activity

Self-Reported Dietary Adjustments

Participants were then presented with a variety of situations (some of which are cognitively demanding) and asked to reflect on how they would change their diet in response to each scenario. Table 4 shows each of the scenarios in this section of the survey that were presented to participants. Participants were given an 8-point scale (ranging from -4 = *remove completely* to $+3$ = *increase a lot*) for each of the dietary items to indicate how they would change their consumption of a variety of foods and drinks leading up to the scenario. Figure 3 shows an example of one of these matrix-style questions. The midpoint of this scale is zero and indicates that participants would not change their intake. The following foods were asked about in each scenario/matrix question: water, alcohol, caffeine, sugar/sugary products, fatty foods, and fruits and vegetables. Participants also had the option to add any other items they change in their diet (e.g., foods, drinks, supplements, vitamins etc.) into a category labelled *other*. This section relates to section 3 (items 3.1– 3.7). Items 3.6 (an upcoming social event) and 3.7 (a sports game or training), which are not typically considered cognitively demanding, were used as distractor items, as well as for exploratory analyses.

Two main indices were created to measure self-reported dietary adjustment: cognitive sugar adjustment and cognitive fat adjustment. Cognitive sugar adjustment was calculated using the mean of the self-reported change in sugar consumption for each of the cognitively demanding scenarios (items 3.1–3.5). Cognitive fat adjustment was calculated in the same way, except that self-reported change in fat consumption was used for each of the five relevant scenarios.

Table 4

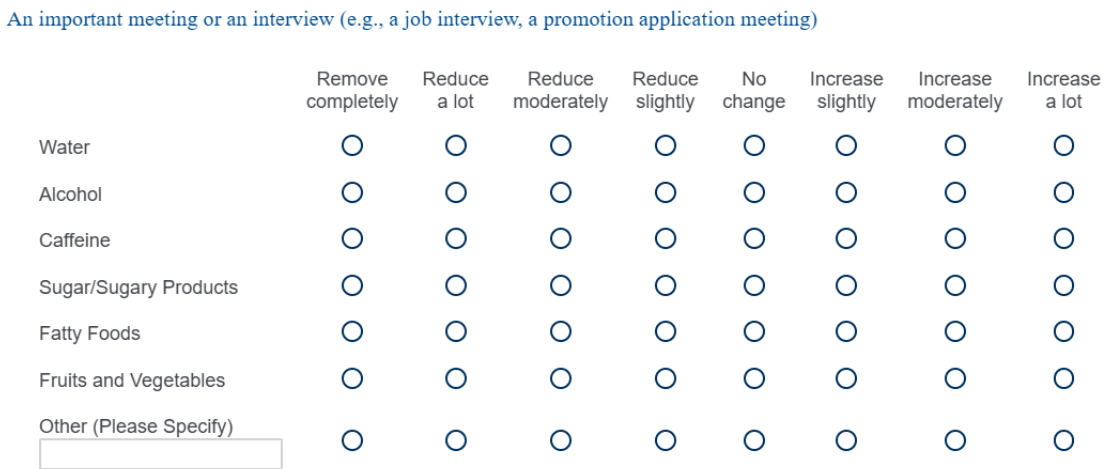
Dietary Adjustment Items

Item	Item Number
"An important test or an examination (e.g., an entrance test for a job, a crucial university examination, a promotion-related test)"	3.1[a]
"An important meeting or an interview (e.g., a job interview, a promotion application meeting)"	3.2
"An important presentation or a speech (e.g., a one-off opportunity to impress a potential client or employer, a speech in front of large audience)"	3.3
"An important report or an essay (e.g., a report to your employer or client, a crucial university assignment or thesis)"	3.4
"Learning a new skill (e.g., starting a new job, learning a language, learning to drive)"	3.5
"An upcoming social event (e.g., wedding, party, family holiday, work function)"	3.6
"A sports game or training (e.g., tennis match, football training, gym class)"	3.7

[a] An attention check was included in this matrix item.

Figure 3

Dietary Adjustment Item Example



Procedure

Participants were recruited via the Prolific crowdsourcing platform on 31 July 2024. The study was publicly available to users who met the pre-screening criteria under the title “Dietary Beliefs and Changes Study”. Participants from prolific were then directed to the survey which was hosted on Qualtrics. The advertisement on Prolific gave a brief description of the study. Participants were then given a summary of the type of questions that would be asked in the survey. The description also told participants that they needed to be at least 18 years of age and living in Australia or New Zealand to participate. Finally, participants were notified that the survey would take approximately 8-12 minutes to complete. Before signing up, participants could also see that they would be paid £1.25 (~2.77NZD).

Once in the survey on Qualtrics, participants were provided with a screener validation where they were asked to enter their Prolific ID, age, gender, and country of residence. Participants were also provided a more detailed information sheet about the present research (see Appendix B) before they were asked to provide informed consent. Participants could only continue with the rest of the survey if they provided informed consent.

Participants were then presented the sugar belief and fat belief items, followed by the dietary adjustment matrix questions. At the end of the study, participants were thanked for their participation and redirected to Prolific to register their submission. Participants completed the survey in an average duration of approximately 9 minutes and 6 seconds.

Analysis

A *new statistics* approach to analysing and reporting data was used in this study by reporting parameter estimates and their precision instead of relying on *p-values* as with traditional null hypothesis significance testing (NHST) (Cumming, 2013). In line with Kirk (2003), Cumming (2013) discusses the critiques and concerns of NHST and suggests that there should be a shift of focus from NHST to using effect sizes, estimation, and cumulative evidence. Furthermore, confidence intervals provide more meaningful insights into the magnitude and

precision of effects, beyond the limitations of binary significance. The use of confidence intervals are also more likely to be accurately interpreted by future researchers and readers (Fidler & Loftus, 2009).

All data analysis procedures, including data wrangling, were conducted using R version 4.4.1 (R Core Team, 2024) in the RStudio environment (Posit team, 2024). The following R packages were used: Amelia II (Honaker et al., 2011) was used for imputing missing data and metap (Dewey, 2024) for pooling across multiple imputations, openclsx (Schauberger & Walker, 2024) for data handling, psych (William Revelle, 2024) and effectsize (Ben-Shachar et al., 2020) for analysis and effect size estimation, emmeans (Lenth, 2025) for post-hoc group comparisons, and tidyverse (Wickham et al., 2019) for data manipulation, cleaning, and analysis. A complete copy of the R code used for this study has been made available on the Open Science Framework (https://osf.io/y62cn/).

Missing Data

After applying data exclusions, remaining missing data was imputed using the using expectation-maximisation through the Amelia II package in R (Honaker et al., 2011). The Ameilia II algorithm utilizes expectation-maximization on multiple bootstrapped samples of the incomplete dataset to generate parameter estimates for the complete dataset. This method was used because it limits wasted data by maximising the use of incomplete data, as well as providing the most accurate parameters estimates and measures of uncertainty (Donders et al., 2006). Multiple imputation as a method of dealing with missing values also introduces less bias than competing methods such as listwise deletion, pairwise deletion, and single imputation methods (Honaker et al., 2011; van Ginkel et al., 2020).

In the present study, five imputations ($m = 5$) were generated, creating multiple datasets subsequently pooled using Rubin's Rules. Rubin's Rules provide a framework for pooling estimates from multiple imputed datasets by accounting for both within- and between-imputation

variance (Rubin, 1987). This approach ensures that missing data variability is accurately reflected in the parameter estimates.

Data Handling Procedure

Data collection, handling, and analysis did not commence until after the preregistration was published online. Once data collection finished, the raw data was downloaded from Qualtrics and loaded into the R script. The raw data was then cleaned and formatted in preparation for analysis. This cleaning and formatting included deidentifying and saving the data set. This raw, deidentified data has also been made public on the Open Science Framework (https://osf.io/y62cn/).

Cognitive and mood belief score items, as well as dietary adjustment items were rescored to make zero the midpoint of the scale and relevant variables were created for each of the indices needed for analysis. Data exclusions were applied and participants who met any of the criteria mentioned previously were excluded from the study. At this point, demographic information was calculated before beginning the imputation process. As mentioned previously, the Amelia II package (Honaker et al., 2011) was used to conduct expectation-maximisation imputations. The data was subset to only include columns with missing data, from which five imputed data sets were created. The imputed columns were then merged with the original data set to create five full imputed data sets with no missing values. Statistics for analysis were then calculated by looping through each of the imputed datasets and pooling results according to Rubin's Rules (Rubin, 1987). In alignment with Rubin's Rules, total variance was calculated accounting for within- and between-imputation variance (*W* and *B,* respectively). *m* is the number of imputed datasets generated. As seen in (1), standard errors (SE) were calculated by taking the square root of this total variance.

$$SE_{Pooled} = \sqrt{W + \left(1 + \frac{1}{m}\right) B} \quad (1)$$

Hypothesis 1

Hypothesis 1a and 1b were analysed by evaluating the pooled mean cognitive belief scores for fat and sugar, and their associated 95% confidence intervals. As explained above, a single sugar cognitive belief score was calculated as the mean of items 1.1 to 1.6 of all participants, and a fat cognitive belief score using the mean of items 2.1 to 2.6. A score was calculated for each of the five imputations and pooled sugar/fat cognitive belief scores were derived using the average of these five imputed dataset's means. Equation (2) shows the formula used to calculate the 95% confidence intervals using the pooled mean and pooled standard error (Enders, 2022; Rubin, 1987). The confidence limits on each side of the mean were calculated by multiplying the critical t-value ($t_{a/2}$, which corresponds to a quantile function at 0.975 with $m-1$ degrees of freedom) by the pooled standard error (SE_{Pooled}).

$$CI_{95\%} = M_{Pooled} \pm t_{\frac{a}{2},m-1} \times SE_{Pooled} \tag{2}$$

Cohen's *d* is calculated as the difference between the pooled mean (M_{Pooled}) and a reference value, divided by the pooled standard deviation (SPooled; Cohen, 2013). For this hypothesis, the pooled sugar cognitive belief score was compared to the neutral point of zero (3).

$$d = \frac{M_{Pooled} - 0}{S_{Pooled}} \tag{3}$$

Hypothesis 2

The data analysis for hypothesis 2a and 2b followed a very similar procedure as hypothesis 1a and 1b. However, for hypothesis 2, the pooled mean mood belief scores were

used for fat and sugar. The sugar mood belief score was created using the mean of items 1.9 to 1.14, and the single fat mood belief score using the mean of items 2.9 to 2.14. Again, a score was calculated for each of the five imputed datasets, which were subsequently pooled into two pooled mean belief scores (one for sugar and one for fat). The 95% confidence intervals were calculated in the same equation as hypothesis 1 (2). Cohens *d* was also then calculated to measure effect size using the same equation (3).

Hypothesis 3

Pearson's *r* correlation coefficients were created between sugar cognitive belief scores and cognitive sugar adjustment, as well as fat cognitive belief scores and cognitive fat adjustment. Each of these two indices were calculated using every imputed data set. To pool these correlation coefficients, Fisher's *z* transformation (Z_i) was used, where r_i is the correlation coefficient from each imputation (4; Enders, 2022).

$$Z_i = \frac{1}{2}\, In\left(\frac{r_i + 1}{r_i - 1}\right) \tag{4}$$

Once transformed, *z*-scores were then pooled using Rubin's rules and back-transformed to Pearson's R correlation coefficients (Buuren, 2018; Enders, 2022; Rubin, 1987). Associated confidence intervals were then also pooled using Fisher's *z* transformation in the same way.

Hypothesis 4

The procedure for analyses relating to hypotheses 3a and 3b were repeated for hypotheses 4a and 4b. For this section of analysis, Pearson's R were instead calculated for fat cognitive belief scores and cognitive fat adjustment.

Subgroup Analyses

Linear regression models were fitted to examine gender and age differences in dietary beliefs and adjustments. Specifically, the four belief scores (sugar cognitive belief, fat cognitive

belief, sugar mood belief, fat mood belief) and two dietary adjustment scores (cognitive sugar adjustment and cognitive fat adjustment) were compared across male and female participants. Because only two participants in the final sample responded *non-binary/third gender*, there was not enough data to accurately compare to male and female. No participants responded *prefer not to say* so this was also excluded from these analyses. Participants were categorized into three age groups: young adults (18–34 years), middle-aged adults (35–54 years), and older adults (55+ years). These were only compared if the initial regression models indicated evidence of an association between age and the outcome variable. Pairwise comparisons were conducted using the emmeans (Lenth, 2025) package in R, with confidence intervals extracted using the confint function.

Exploratory Analyses

The following post-hoc exploratory analyses were conducted. While this study's focus was fat and sugar, other dietary items were included in the questionnaire to disguise the exact purpose of the study and minimize response bias. The other foods included in this study as distractor items were water, alcohol, caffeine, and fruits and vegetables. Means, associated 95% confidence intervals, Cohen's *d* effect sizes and standard deviations were calculated from responses to each food in cognitively demanding scenario questions (3.1-3.5) for each of the five imputed datasets and pooled. Since the neutral point of the scale is zero (*no change*) and not the middle of the scale, Cohen's *d* quantified how far the observed mean is from zero, rather than the middle of the scale. Means, confidence intervals and Cohen's *d* effect sizes were also calculated for beliefs about effects of sugar and fat on quality of sleep (items 1.7 and 2.7) and physical health (1.8 and 2.8).

Results

Diet Adjustment Scores

The results in this study showed that participants, on average, reported small decreases of fat and sugar intake for both cognitively and non-cognitively demanding scenarios. Descriptive statistics for the cognitive and non-cognitive dietary adjustment indices are presented in Table 5. Dietary adjustment scores measured how much participants report they would increase or decrease their intake of each dietary item across the cognitive or non-cognitive scenarios presented to them. These scores ranged from −4 (*remove completely*) to +3 (*increase a lot*), with zero indicating no change. Non-cognitive fat/sugar adjustment represent mean sugar and fat adjustment scores for scenarios that are not typically cognitively demanding (questions 3.6 and 3.7). In both cases, the average decrease in dietary consumption was slightly larger for fat than for sugar. The standard deviations of these statistics show considerable spread in participants' responses. In cognitively demanding contexts, 68% of participants reported changes in sugar and fat consumption ranging from -1.33 to 0.79 and -1.38 to 0.58, respectively. This indicates most participants reported between moderate decreases to slight increases of fat and sugar consumption.

Table 5

Descriptive Statistics of Dietary Adjustment Scores

Measure	*M*	Median	*SD*
Cognitive sugar adjustment	−0.27	0	1.06
Cognitive fat adjustment	−0.40	0	0.98
Non-cognitive sugar adjustment	−0.31	0	1.09
Non-cognitive fat adjustment	−0.46	−0.5	1.07

Note. Dietary adjustment scores ranged from −4 (*remove completely*) to +3 (*increase a lot*), with zero indicating no change.

Beliefs About the Impact of Sugar and Fat on Cognitive Performance (Hypothesis 1)

The goal of hypotheses 1 and 2 was to investigate what individuals believe about the effect that sugar and fat consumption have on cognitive performance and mood. In the results below, Cohen's *d* was calculated as the difference between the pooled mean and neutral reference point (0), divided by the pooled *SD*. The pooled *SD* was calculated as the square root of the total variance, which was derived using Rubin's rules to account for between- and within-imputation variance across all five imputed datasets (Rubin, 1987). This approach provides a standardized effect size of the observed effect.

Hypothesis 1a hypothesised that participants would believe that sugar negatively impacts cognitive performance. Due to contemporary attitudes toward sugar being generally negative (Fischler, 1987), especially around sugar being harmful (Prada et al., 2021), it was expected that beliefs about the effects of sugar on cognition would also be negative. In keeping with this expectation, this study found that participants generally endorsed the belief that sugar has a negative effect on cognitive function. In our sample, participants tended to believe sugar to have a negative impact on cognitive performance. The pooled mean belief score for sugar's effect on cognition was -0.546 (95% CI [-0.713, -0.379]) on a scale ranging from -3 (*strongly negative*) to $+3$ (*strongly positive*), with the midpoint of zero representing neutral or no belief. The mean of -0.546 and associated confidence interval indicates evidence toward a belief that sugar negatively impacts cognitive performance. While the mean of -0.546 represents a small proportion of the scale's range, the corresponding effect size ($d = 0.64$) indicates that this belief is moderately different to the neutral point of no belief. This finding is consistent with the hypothesis.

Hypothesis 1b hypothesised that participants would believe that fat negatively impacts cognitive performance. This expectation was due to contemporary attitudes, which generally portray fat in a negative light in other areas, as well as the lack of other relevant evidence or research. The pooled mean belief score for fat's effect on cognition indicates a mild weak belief

that fat negatively impacts cognitive performance, $M = -0.734$, 95% CI [−0.897, −0.570]. The narrow confidence, relatively far from zero, indicates support for this conclusion. This is also reinforced with a moderate to large effect size of $d = -0.875$.

Beliefs About the Impact of Sugar and Fat on Mood (Hypothesis 2)

Hypothesis 2a proposed that participants would believe that sugar negatively impacts mood. Due to a similar lack of research as described above, this expectation was based largely on negative attitudes toward sugar in a health context. Therefore, it was expected that this belief may impact the way that participants view the relationship between sugar and mood. The results found that participants in this sample generally believed that sugar has a negative impact on mood, indicating evidence for a belief that sugar has a negative impact on mood, $M = -0.343$, 95% CI [−0.566, −0.121]. The corresponding effect size is $d = -0.298$. While these results are indicative of a genuine effect, the confidence interval is relatively close to zero and the effect size is small.

Hypothesis 2b proposed that participants would believe fat to negatively impact mood. As with the previous hypotheses, this is a scarce area of research, and little is currently known about public beliefs regarding fat, including its perceived effects on mood. The pervasive fear of fat and broader negative attitudes toward fat and its impact on health and well-being underpin the expectation that participants would similarly believe fat to have a negative impact on mood. Confirming the hypothesis, there is evidence of a small belief that fat has a negative impact on mood in this sample, $M = -0.557$, 95% CI [−0.765, −0.349]). These results correspond to a moderate effect size of $d = -0.522$.

In summary, the results for hypotheses 1 and 2 suggest that the public hold limited, but relatively weak, beliefs that both fat and sugar negatively impact cognitive performance and mood. While both hypotheses were supported, participants' beliefs that fat and sugar impact cognitive performance negatively were stronger than that of mood.

Sugar Beliefs and Reported Dietary Adjustment (Hypothesis 3)

The Health Belief Model suggests that health-related decisions, such as food-choice, are influenced by the value placed on a desired outcome and the belief that a certain action will achieve that outcome (Janz & Becker, 1984). Applying this model to the consumption of sugar and fat, dietary intake is expected to be shaped by the extent to which individuals value cognitive performance and their beliefs about how sugar and fat consumption impact cognition. Hypotheses 3 and 4 were developed to examine these relationships.

Consequently, it was hypothesised (H3a) that beliefs about the effect of sugar consumption on cognition are expected to be positively correlated with participants' self-reported change in sugar consumption leading up to cognitively demanding situations. Contrary to expectations, these results did not indicate support for a relationship between sugar/cognition-related beliefs and changes in sugar consumption in cognitively demanding contexts, $r(203) = -0.005$, 95% CI [−0.142, 0.132]. As the 95% CI encompassed zero, this finding provided no evidence for a meaningful association in this sample.

It was also hypothesised that beliefs about the effect of sugar consumption on mood are expected to be positively correlated with participants' self-reported change in sugar consumption leading up to cognitively demanding situations (H3b). In alignment with expectations, these results indicate evidence toward a moderate relationship between sugar/mood-related beliefs and changes in sugar consumption in cognitively demanding contexts in this sample, $r(203) = 0.341$, 95% CI [0.214, 0.456].

Fat Beliefs and Reported Dietary Adjustments (Hypothesis 4)

Hypotheses 4a and 4b were also developed using the framework of the health-belief model as a basis for investigation and prediction. These hypotheses differed from hypotheses 3a and 3b only in that they focused on fat instead of sugar. Therefore, hypothesis 4a predicted beliefs about the effect of fat consumption on cognition to be positively correlated with participants' self-reported change in fat consumption leading up to cognitively demanding

situations. These findings diverged from the hypothesis, indicating a lack of evidence for a meaningful association between fat/cognition-related beliefs and reported changes in fat consumption leading up to cognitively demanding contexts, $r(203) = -0.076$, 95% CI [−0.211, 0.062]. The 95% CI, which includes zero, provided no evidence for a meaningful association in this sample.

Hypothesis 4b expected beliefs about the effect of fat consumption on mood to be positively correlated with participants' self-reported change in fat consumption leading up to cognitively demanding situations. The findings from this analysis indicate that there is a small, but meaningful, relationship between fat/mood-related beliefs and reported changes in fat consumption, $r(203) = 0.201$, 95% CI [0.066, 0.329]. As stated in the inference criteria, the 95% CI not including zero confirms this result. Despite this, the small effect size, and confidence interval being very close to zero, provide important insight into size and strength of this relationship, which is weak.

Sub-Group Analyses

Gender

A series of one-way analyses of variance (ANOVA) were performed to determine whether belief scores differed significantly across gender groups (male, female, non-binary/third gender). No significant differences were found among gender groups in any of the four belief groups ($p > 0.05$ in all cases). Therefore, the results found no evidence that gender is a key determinant of participants' beliefs about sugar and fat's impacts on cognition and mood in this sample.

Two additional one-way ANOVAs were performed to determine whether cognitive fat and sugar adjustment scores varied by gender in this sample. Participants' self-reported sugar adjustment in cognitively demanding situations did not differ significantly by gender ($F(2, 202) = 1.137$, $p = .323$, $\eta^2 = .001$). Similarly, neither did participants' self-reported fat adjustment in cognitively demanding situations ($F(2, 202) = 2.036$, $p = .133$, $\eta^2 = .003$).

Age

A series of one-way ANOVAs were conducted to determine whether any of the relevant variables in this study vary significantly between age-groups. Ages were split into three groups: young adults (18-34), middle-aged adults (35-54), and older adults (55+). No significant differences were found between age groups in participants' beliefs about the effects of fat on mood ($F(2, 202) = 0.344$, $p = .709$, $\eta^2 = .003$), fat on cognitive performance ($F(2, 202) = 0.142$, $p = .868$, $\eta^2 = .001$), or sugar on cognitive performance ($F(2, 202) = 1.207$, $p = .301$, $\eta^2 = .01$). However, there was a significant difference in participants' beliefs about the effects of sugar on mood among age groups at the $p < 0.05$ significance level ($F(2, 202) = 3.121$, $p = .046$, $\eta^2 = .03$). Though this result was statistically significant, the effect size is small, suggesting a minor but meaningful influence on sugar mood beliefs. Tukey's HSD post hoc test revealed that the young adults' group ($M = 4.12$, $SD = 1.03$) had significantly higher sugar mood belief scores compared to the older adult's group ($M = 3.49$, $SD = 0.97$), $p = .037$. There was no significant difference in sugar mood beliefs between middle-aged adults ($M = 3.55$, $SD = 1.01$) and either young adults ($p = .905$) or older adults ($p = .087$). Participants' self-reported adjustment in sugar consumption in cognitively demanding situations did not differ significantly by age ($F(2,202) = 1.647$, $p = .195$, $\eta^2 = .02$). Nor did participants' self-reported adjustment in fat consumption in cognitively demanding situations ($F(2,202) = 0.163$, $p = .850$, $\eta^2 = .001$).

Exploratory Analyses

Additional non-preregistered post-hoc analyses were performed to explore relationships beyond the main hypotheses and aims of this study. These analyses were not determined a-priori (i.e., before data collection) and should be treated as exploratory and hypothesis-generating instead of confirmatory. While unplanned post-hoc analyses can provide valuable insights by leveraging the breadth of information collected during data collection, they are also susceptible to Type 1 errors and potential overinterpretation (Curran-Everett & Milgrom, 2013).

Therefore, the results from the following analyses should be interpreted with caution and not regarded as definitive until confirmed by more appropriately designed studies.

After the initial analyses, it was explored whether the other foods in the questionnaire would also be adapted leading up to cognitively demanding situations. While this study's focus was fat and sugar, additional dietary items were included in the questionnaire to disguise the exact purpose of the study and minimize response bias. Water, caffeine, alcohol, and fruit/vegetable intake were also asked about in the survey. Means and 95% CIs were calculated from responses to each food item in the cognitively demanding scenario questions (3.1-3.5), as displayed in Table 6. Since the neutral point of the scale is zero (*no change*) and not the middle of the scale, Cohen's *d* quantifies, in this case, how far the observed mean is from zero, rather than the middle of the scale. Participants reported a modest increase in water, and a slight increase in caffeine, and fruits and vegetables when presented with cognitively demanding scenarios. Alcohol showed a substantial decrease with a large negative effect size. The standard deviations for all four variables indicate considerable variability in participant responses, reflecting diversity in dietary adjustments.

Table *6*

Adjustment Scores for Additional Dietary Items

Variable	*M*	95% CI [lower, upper]	*SD*	Cohen's *d*
Water	0.826	[0.674, 0.978]	1.105	0.748
Alcohol	−2.373	[−2.620, −2.126]	1.795	−1.322
Caffeine	0.221	[0.006, 0.437]	1.565	0.141
Fruit and Vegetables	0.371	[0.256, 0.485]	0.833	0.445

Discussion

Summary of Findings

Despite increasing research on the cognitive effects of various dietary foods and choices, beliefs about the impact of dietary fat and sugar on cognition and mood remain largely unexplored. Responding to the lack of research in this area, the current study aimed to exploratorily investigate two main areas: (1) whether people believe that consuming fat and sugar impact their cognitive function and mood, and (2) how such beliefs relate to the consumption of dietary fat and sugar leading up to situations that are cognitively demanding. In line with the hypotheses, this study found that participants generally believed both fat and sugar to each individually negatively impact both mood and cognition. However, mixed results were found regarding the relationships between beliefs and self-reported dietary adjustment leading up to cognitively demanding situations. Specifically, beliefs about the effects of fat and sugar on mood were correlated with reported changes in these respective nutrients. Surprisingly, however, no association was found between beliefs about the cognitive effects of these nutrients and reported dietary adjustment. A more in-depth discussion of these findings and exploratory analyses follows.

Beliefs About the Effects of Diet on Cognition and Mood

The present study found that participants generally believed dietary fat and sugar negatively impact both mood and cognition. This finding broadly aligns with existing literature, which suggests public attitudes toward these nutrients are often skewed negatively, especially regarding their perceived impact on health (Hervik et al., 2022; Prada et al., 2021; Swift et al., 2018; Throsby, 2018). This research was unique, however, in that it focused particularly on participants' beliefs related to cognition and mood—an area that, to our knowledge, has not previously been explored. Participants showed the strongest negative beliefs about the impact of sugar on physical health, with more than one standard deviation higher than participants' beliefs about the effects of fat or sugar on mood or cognition. Participants generally disagreed

when presented with statements suggesting fat or sugar improve their physical health. In contrast, when presented with statements suggesting fat or sugar affect mood or cognition negatively, participants' responses were weaker, averaging between *somewhat disagree* and *neither agree nor disagree*. Weaker beliefs regarding cognitive and mood effects, compared to physical health, may reflect differences in exposure to health messaging and advertising. Over the past two decades, extensive campaigns and media attention have focused on the negative effects of fat and sugar on physical health, such as obesity, diabetes, and heart disease (Borra & Bouchoux, 2009; Saguy & Almeling, 2008). Conversely, public health messaging around their effects on mood and cognition have been less common, likely contributing to the relatively weak strength of beliefs. Though the extent of its effect on mood- and cognition-related beliefs is unknown, contradictory and confusing information in the media influences public beliefs about fat and sugar (Clark et al., 2019). Combined with an already limited understanding of diet and health, it is unsurprising that beliefs regarding the impact of fat and sugar on mood and cognition are relatively weak or uncertain.

Additionally, the complexity and nuance of relationships between fat, sugar, mood, and cognition may further explain these mildly negative beliefs. Research indicates that fat and sugar can positively and negatively impact these domains, depending on several contextual factors such as type, dosage, timing, and individual differences (Blake et al., 2022; García et al., 2021; Gillespie, White, et al., 2023; Ginieis et al., 2018). For instance, while HFDs are typically associated with impaired cognitive performance (Edwards et al., 2011), omega-3 fatty acids positively impact memory (Dullemeijer et al., 2007). Interestingly, participants' beliefs that fat negatively affects cognition and mood were slightly stronger than those concerning sugar, possibly due to exposure to media and public discourse.

While this study suggests that the public hold slightly negative opinions regarding the impact of fat and sugar on cognition and mood, some areas warrant further exploration. Future

research should examine the specific factors influencing these beliefs, including the role of public discourse, media, and messaging.

Changes in Sugar and Fat Consumption and Cognitively Demanding Situations

When presented with hypothetical cognitively demanding scenarios, participants tended to report that they would slightly decrease their intake of both fat and sugar leading up to the event. However, responses varied significantly, with many indicating no change, or even a slight increase in intake of these nutrients. This finding shows uncertainty as to whether the public generally do adapt their fat and sugar in anticipation of cognitively demanding situations. The main analyses regarding dietary adjustment in this study aimed to uncover whether people's beliefs correlated with their change in diet leading up to cognitively demanding scenarios. These results were mixed. No meaningful associations were found between participants' beliefs about fat or sugar's impact on cognitive function and reported changes in their intake. However, beliefs about the impact of fat and sugar on mood were both associated with changes in participants' consumption. Participants who believed fat or sugar affected their mood reported adjusting their dietary intake accordingly.

Deciphering the most probable explanations for these findings is challenging because of the limited relevant literature. Notably, despite participants holding stronger beliefs about the cognitive effects of fat and sugar, only beliefs about mood were associated with dietary adjustments. This apparent contradiction can be better understood through the health belief model, which suggests that while beliefs influence health-related decisions, behaviour is also shaped by a combination of other factors as well (Janz & Becker, 1984). These findings align with the model, highlighting the complexity of dietary choices and the need to consider additional influences when interpreting public attitudes toward nutrition.

Diet Change and the Health Belief Model

Relating these findings to the health belief model can help make sense of the finding that participants who believe fat and sugar to negatively impact mood also report decreasing their fat

and sugar consumption. The health belief model suggests that, among other factors, health related decisions are dependent on how much individuals value a health-outcome and their belief that a specific action will achieve their desired outcome (Janz & Becker, 1984). If individuals value and prioritize mood regulation, they may be more inclined to modify their diet to support this goal. This could explain why beliefs about mood effects correlate with dietary adjustment. Individuals' motivation to maintain a positive mood, combined with their belief in the negative effects of fat and sugar on mood and their perceived susceptibility to these effects, may be contributing to their decision to reduce intake.

The health belief model also suggests that individuals' weighing of perceived benefits and barriers impact health-related actions. The findings in this study that participants believe fat and sugar to negatively impact mood could suggest that they see improved mood as a benefit to reducing intake. On the other end, taste, convenience, and cost are often major barriers to reducing fat and sugar intake (Pinho et al., 2018). These perceived costs may deter people from reducing sugar or fat intake, despite awareness of the cognitive benefits (Sallis et al., 2008). The results in this study suggest that despite these barriers, individuals report adapting their fat and sugar intake according to their beliefs around the effects of these nutrients on mood but not cognition. The health belief model also suggests that participants' perceptions of the severity of mood and cognition effects, along with their perceived susceptibility to these effects, influence the likelihood of dietary adaptation. It is well established that individuals often underestimate personal health risk (Rothman et al., 1996), and inaccurately estimate dietary consumption (Carels et al., 2007; Thomson et al., 2023), especially sugar intake (Dallacker et al., 2018; Prada et al., 2021). Therefore, participants in this study may not perceive themselves as vulnerable to the risks associated with excessive sugar consumption. Despite believing that sugar negatively impacts cognition, underestimating perceived susceptibility creates little urgency to reduce intake.

The factors discussed above, while not sufficient individually, likely interact to partly explain the findings in this study regarding participants' reported fat and sugar intake and their dietary adjustments leading up to cognitively demanding situations.

Metacognition and Mood Self-Awareness

While the health belief model provides insights into the findings in this study, it does not fully explain why beliefs about mood, but not beliefs about cognition, were associated with dietary adjustment. One explanation for this is that people may be more aware of their mood states than their cognitive processes. Self-awareness of mood states relates to individuals' ability to recognise and understand their emotions and feeling, while metacognition is the awareness of cognitive processes and performance (Norman et al., 2019). While people are relatively aware of their own mood, changes in cognitive function are much more subtle, and so may be more difficult to understand. Marino et al. (2009), for example, found that subjective perceptions of cognition were more accurate measures of their mood than their objective cognitive performance. People generally have some understanding of their own mood and emotions. However, these are not always completely accurate (Robinson & Clore, 2002), and some people have more difficulty than others in identifying and describing their emotions and feelings (Gu et al., 2013). Cognition and mood do not exist independently, but are significantly affected by one another (Forgas, 2017). This suggests that while individuals may be consciously adapting their diet to improve mood, they may also be indirectly affecting their cognitive processes. In this way, self-awareness of mood states and beliefs about diet may be unconsciously used to alter cognitive function. While this hypothesis is speculative, it may help to explain that although participants may not consciously adapt their diet to alter cognitive processes, they may still do so indirectly. The relationships between beliefs, behaviour, and self-awareness/metacognition are extremely complex, and future research may benefit from exploring these areas. More specifically, it would be interesting to continue to investigate the

extent to which individuals are better at being self-aware of their mood than their cognition, and how this relates to individuals' dietary choices.

As discussed above, there are several possible explanations for the findings in this study. Due to the present study exploring a relatively new avenue of research, drawing firm conclusions is difficult. Consequently, it is recommended that future research not only confirm some of the patterns found here but also investigate possible psychological and social mechanisms driving this behaviour.

Exploratory Analyses of Changes to Other Dietary Components

Exploratory analyses found that participants in this study reported decreasing alcohol intake significantly leading up to cognitively demanding situations. Furthermore, modest increases in water, caffeine, and fruit and vegetables were reported. These results largely coincide with previous research, although they highlight some areas which could be investigated further. Most of the current research available has investigated diet changes during examination periods in school or university, often highlighting the role of stress. Coinciding with the exploratory findings in this study, a few previous studies have found that alcohol intake decreases during exam periods, despite impaired self-control during this time (Noel & Cohen, 1997; Oaten & Cheng, 2005; Tremblay et al., 2010). Furthermore, caffeine intake has been associated with an increase in consumption during exam periods (Oaten & Cheng, 2005; Zunhammer et al., 2014). However, exams and stressful times have generally been associated with a decrease in diet quality, including a decrease in fruit and vegetable consumption (Barker et al., 2015; Michels et al., 2020). Therefore, the finding that participants in this study report increasing fruit and vegetable and water consumption is unexpected. This may be because the present study included a variety of cognitively demanding situations not just exams which are typically very stressful (Spangler et al., 2002). A social desirability bias may also be influencing participants' responses (Fisher, 1993). No relevant studies investigating water consumption were found in the current literature. These exploratory findings highlight the need for research to

more explicitly investigate how individuals' diets change during cognitively demanding and stressful periods such as examinations, as well as the mechanisms underlying this change.

Limitations and Implications for Future Research

The first significant limitation in this study is found in its methodological design. The present study is cross-sectional and relies on self-reported data as opposed more objective assessments and longitudinal measures. This limits this study's ability to establish causal relationships between participants' beliefs and their dietary behaviour. Participants in this study were asked at a single point in time to reflect on what they would do in certain hypothetical situations. While this has many benefits, and is appropriate for a variety of research contexts, self-report measures also introduce many opportunities for bias (Chan, 2010). While correlations were observed between participants' beliefs and reported dietary adjustment, it is unknown whether these beliefs directly influence such changes or are merely associated with them. Future research should verify and expand upon these findings using more robust research designs, such as experimental and longitudinal studies.

A second limitation of this study was that the measures of beliefs and reported change in dietary consumption were not validated. Despite belief items being based on robust concepts of mood and cognition, the questions in this study have not been validated. Questions related to participants beliefs about the effects of fat and sugar on mood, for example, were based on the POMs questionnaire, which has demonstrated significant psychometric integrity (Terry, 2003). However, since the questions in this survey have not been validated in the same way, it is uncertain whether they are accurately capturing the concepts they set out to capture, despite face validity. Future research should focus on using measures with higher reliability and validity such as food diaries or food frequency questionnaires (Cade, 2017).

A third limitation to consider in this study is the omission of control variables. Previous research identifies several factors that influence dietary behaviour and could be confounding variables in this study. In particular, stress and anxiety, which is extremely common in

cognitively demanding situations, has been shown to significantly impact diet (Wardle & Gibson, 2002), cognitive performance (Martin et al., 2019; Sandi, 2013) and mood (Bolger et al., 1989; van Eck et al., 1998). Furthermore, controlling for participants' baseline dietary intake would have helped to identify participants who already have low quantities of fat or sugar in their diet. Individuals who hold strong beliefs about the effects of fat and sugar may already have limited their intake and would therefore be less likely to further decrease their intake in the face of cognitively demanding situations. These omissions further limit the present study's ability to identify whether the beliefs are responsible for shaping dietary behaviour. It is recommended that potential future experimental studies account for factors that could be mediating the relationship between beliefs and dietary behaviour.

Practical Implications and Applications

In discussing the results in this study, it is important not only to consider whether the effects found here are present in the population, but also their practical significance and implications. In the case of these results, it is important to ask whether the strength of beliefs found in this sample are significant enough to prompt changes in behaviour. Confidence intervals and effect sizes indicate that there likely is a preference present in the public toward the belief that fat and sugar impact cognitive performance and mood, however, the relative strength of this belief seems modest. More specifically, participants tended to indicate they *neither agree nor disagree* or *somewhat agree* with statements suggesting fat and sugar negatively affect mood and cognition. Given that stronger, more confidently held beliefs are more likely to lead to changes in behaviour, the moderate strength of beliefs identified here suggests that additional targeted interventions and strategies to reduce barriers to dietary change (e.g., clearer public health messaging, increasing access to healthy foods, and improving health and food policies) may be required to achieve more meaningful behavioural shifts (Carpenter, 2010). This is significant because public health initiatives and advertising can be targeted to increase nutritional literacy and reduce myths and misconceptions, ultimately

improving public health outcomes. For example, schools and universities could tailor some of their advertising toward encouraging healthier eating habits, especially during exam periods. Given that some participants in this study already report adapting their diet in ways beneficial to mood and cognition, strategies aimed at reinforcing these behaviours could also be advantageous.

While influencing beliefs remains an essential strategy for encouraging healthier diets, the benefits to mood and cognitive performance from making healthier dietary choices can also be achieved via alternative avenues. Although cognitive factors such as knowledge, attitudes, and preferences are important, the current literature has also indicated food-internal factors (sensory and perceptual factors), food external factors (information, social environment, physical environment), sociocultural factors (economic, political, and cultural factors), and personal-state factors (biological and physiological factors, habits and experiences) that contribute to individual and collective food choices (Chen & Antonelli, 2020). Practically, this highlights the continued need for well-established strategies such as decreasing cost, increasing availability, and improving the sensory appeal of healthy foods. In a meta-analysis of the effectiveness of the health belief model to predict behaviour, Carpenter (2010) found barriers and benefits to consistently be the strongest predictors of behaviour. Furthermore, supporting healthier laws and policies, fostering cultural change, and enhancing accessibility of healthy food options may all contribute toward the goal of improving diet quality (Burris et al., 2010; Nestle et al., 2009). As public nutritional intake becomes healthier, cognitive and mood benefits would likely follow. Future research could consider measuring the extent to which population-level improvements in dietary habits correlate with cognitive and mood benefits.

Conclusion

The aim of this study was to begin exploring public beliefs about fat and sugar in relation to cognitive performance and mood, as well as their association with self-reported dietary adjustments leading up to cognitively demanding situations. The findings support the

hypotheses that participants believe fat and sugar negatively impact mood and cognition. While beliefs about their effects on mood were associated with reported dietary adjustments leading up to cognitively demanding situations, no evidence was found linking beliefs about their cognitive effects to dietary adjustments. While beliefs contribute to dietary choice, several other factors are also involved. Increased nutritional literacy and awareness, as well as reducing barriers are recommended to encourage healthier diets. To encourage healthier dietary behaviour, efforts should be made to increase nutritional literacy and knowledge, reduce misconceptions, and reduce barriers to healthier food choices. This study contributes to the wealth of knowledge already guiding policies and regulations, health initiatives, and dietary recommendations to the public. Prior to this study, little, if any, research has explored dietary beliefs related to mood and cognition. Thus, this study offers a unique contribution to a relatively new area of research, providing insights for future studies and practical implications and recommendations for promoting healthier diets.

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Appendix A

Human Ethics Application Risk Assessment Form

Project Type

Postgraduate Student Research

Aim of the Project

This study aims to explore how people's beliefs about the relationship between diet/food and cognition are related to people's (self-reports of their) decisions about what they eat when faced with cognitively demanding situations. More specifically, this study is interested in how individuals' beliefs about sugar and fat are related to their diet-related decisions when faced with cognitively demanding situations such as an exam or job interview.

Project Summary

This study aims to explore how people's beliefs about the relationship between diet/food and cognition are related to people's (self-reports of their) decisions about what they eat when faced with cognitively demanding situations. More specifically, this study is interested in how individuals' beliefs about sugar and fat are related to their diet-related decisions when faced with cognitively demanding situations such as an exam or job interview. A sample of 250 New Zealand and Australian participants aged 18+ will be recruited using the Prolific crowdsourcing platform. A survey, hosted on Qualtrics, will be given to participants. This survey will take approximately 8 minutes. Participants will be reimbursed 12USD per hour for the completion of this survey via prolific . Participants will be asked about how they believe fat and sugar impact their mood and cognition. This will be measured using 14 7-point Likert scale questions. The mood-related questions are derived from the Profile of Mood States (POMS) scale (McNair et al., 1981). Self-reported dietary adjustments will be measured using a matrix where participants rate how much they increase or decrease their consumption of the following foods: water, alcohol, caffeine, sugar/sugary products, fatty foods, fruits and vegetables, as well as a category for participants to list other foods. This matrix will be presented alongside each of the 8 events

or scenarios, and participants will be asked to indicate how they would adapt their diet to each of the scenarios. This research aims to take an exploratory approach to shed light on the relationships between individual's beliefs about fat/sugar and cognition and how they adapt their diet in the face of cognitively demanding situations. The findings in this research will be useful to highlight important gaps in the current literature and to make recommendations for future research to investigate.

Describe the peer review process that has been used to discuss and analyse the ethical issues present in this project

This research plan has been developed over several months in consultation with my supervisor (A/P Stephen Hill) following the guidelines developed by the school of psychology. Dr Matt Williams, who has expertise in psychological methodology and ethics, has read over a draft of the ethics information and discussed the project with me. His feedback has been taken into account in the final version.

Summarise the ethical issues considered and explain how each has been addressed

Participants will be respected as autonomous individuals who can make responsible decisions. This survey will show no criticism or disrespect, nor will any demeaning comments or descriptions be made. All questions pertaining to diet aim to understand how participants believe they alter their diet in different situations and will not be measuring consumption. Informed consent from participants will be established before their participation. This will include the research intent and purposes; potential risks and hazards; time and participation requirements; data collection, storage, and anonymity procedures; and information about compensation for participation. Participants will be asked if they understand and consent to the information provided. Their response will be timestamped and stored beside their Prolific ID. If participants do not consent, they will be directed out of the study. Personal information/data will be stored and transferred using only secure software. Participants will not be asked for any unnecessary identifying information (e.g., name or address) and all stored data will be de-

identified by removing any personal information such as Prolific ID and IP addresses. Raw data will only be accessed by Dr Stephen Hill and myself. De-identified data will be shared openly using the Open Science Framework where it is available to the public. It is not believed that this survey will cause any harm. It is recognized that the topic of diet may be considered sensitive by some. Harm to participants was minimised by using appropriate wording and avoiding questions that may cause distress Research has indicated surveys about sensitive topics are unlikely to cause significant distress and among participants who experience a small increase in negative mood, they are usually not reluctant to participate further, or regret their decision to participate (McMurtrie, 2022). Therefore, this study has been deemed unlikely to result in discomfort, embarrassment, or harm.

With whom did you peer review the ethical aspects of your research?

Dr. Matt Williams

Risk Level

Due to your responses to the risk assessment questions, your application has been categorized as Low Risk.

Approver Signoff

Happy for this to be submitted

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

17/03/2025

Dear

Re: Protocol No.

The above application was considered and granted approval to proceed by the Animal Ethics Committee at its meeting held on

Approval for ongoing research, testing or teaching procedures must be resubmitted for consideration at least every three (3) years.

Any proposed alteration to an approved application must be considered for approval or noting by the Committee or by the Chairperson acting with authority vested through sections 3.11.1-3.11.2 of the Code of Ethical Conduct. A description of such modifications must be submitted to the Secretary for review at the next meeting.

Yours sincerely

Rebecca Hickson (Associate Professor)

Chairperson

Massey University Animal Ethics Committee

Research Ethics Office, Research and Enterprise

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Appendix B

Participant Information Sheet

MASSEY UNIVERSITY
TE KUNENGA KI PUREHUROA
UNIVERSITY OF NEW ZEALAND

Researcher Introduction

My name is Delon de Bruin; I am a Master of Science (Psychology) student at Massey University. This research is being supervised by Dr Stephen Hill.

Project Description

This study aims to investigate how people change their diet in different circumstances, as well as how people believe they are affected by eating foods high in fat and sugar. To be eligible to participate in this survey you need to be 18 years of age or older.

Project procedures

If you choose to participate, you will first be asked to indicate the extent to which you agree to several statements. You will then be given a series of scenarios and asked how you would normally change you consumption of certain foods during these events. This survey is expected to take around 10-15 minutes to complete.

Data Management

After data analysis has been completed, the data from this study will be made public on the Open Science Framework and stored indefinitely. This means that other researchers and members of the public will be able to access the data. Before this data is shared, any identifying information that might indicate who you are will be removed (e.g., your Prolific ID).

Participant Rights

You are under no obligation to take part in this study. If you do decide to participate, you are free to refuse to answer any questions or stop answering questions at any time.

Project Contacts

If you have any questions about this research, you are welcome to contact me via the Prolific messaging system.

Ethics Statement

This project has been peer reviewed and judged to be low risk. Therefore, it has not been reviewed by one of Massey University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this project. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact…

Having read the information above, do you consent to participate in this study?

- ○ Yes
- ○ No