

PSYCHOLOGY MISCELLANY

No.157 - 10th December 2021
"Food Fights"

Kevin Brewer

ISSN: 1754-2200

orsettpsychologicalservices@phonecoop.coop

This document is produced under two principles:

1. All work is sourced to the original authors. The images are all available in the public domain (most from http://commons.wikimedia.org/wiki/Main_Page). You are free to use this document, but, please, quote the source (Kevin Brewer 2021) and do not claim it as you own work.

This work is licensed under the Creative Commons Attribution (by) 3.0 License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/3.0/> or send a letter to Creative Commons, 171 2nd Street, Suite 300, San Francisco, California, 94105, USA.

2. Details of the author are included so that the level of expertise of the writer can be assessed. This compares to documents which are not named and it is not possible to tell if the writer has any knowledge about their subject.

Kevin Brewer BSocSc, MSc

An independent academic psychologist, based in England, who has written extensively on different areas of psychology with an emphasis on the critical stance towards traditional ideas.

A complete listing of his writings at <http://psychologywritings.synthasite.com/>. See also material at <https://archive.org/details/orsett-psych>.

CONTENTS

| | Page Number |
|--|-------------|
| 1. "Food Fights" | 4 |
| 2. Personalised or Precision Nutrition | 5 |
| 2.1. Zeevi et al (2015) | |
| 2.2. Fibre | |
| 3. Future Diets | 8 |
| 4. Ultra-Processed Foods | 9 |
| 4.1. Reformulation targets | |
| 5. Intermittent Fasting | 13 |
| 5.1. "Negative-calorie foods" | |
| 6. Diet and Health | 16 |
| 7. Food Waste | 18 |
| 7.1. During covid-19 | |
| 8. Vegetarianism | 23 |
| 9. Food and Consumer Enjoyment | 26 |
| 10. Environmental Changes | 30 |
| 10.1, Portion size and availability | |
| 10.2. Food packaging | |
| 10.3. Store atmosphere | |
| 11. Appendices | 36 |
| A - Enterotypes | |
| B - Alternate day fasting | |
| 12. References | 40 |

1. "FOOD FIGHTS"

Comparing nutritional data for different foods is popular, particularly on social media where interested players are arguing their case. Wong (2020) quoted an example from his social media feed under the heading, "Do you really need meat to get protein?". It presented broccoli as having 11.1 grams of protein per 100 calories¹ and beef 6.4 grams. The message was obvious.

But it was not factually correct (Wong 2020):

- Nutrient levels are usually shown as per serving or per 100 grams, not per calorie. "This matters because broccoli is lower in calories than steak" (Wong 2020 p25). The figures quoted above are for three servings of broccoli (285 grams) versus one-third of a serving of steak (55 grams).
- Different cuts of beef have different protein values based on the amount of fat. So, it depends what is being compared.
- Food is not consumed individually nor do humans eat just one type of food. "Because of this simple fact, there is scientifically really no such thing as healthy or unhealthy foods, just healthy or unhealthy diets" (Wong 2020 p25).

Another issue is that calories are not all the same because of the differences in the body's digestion of different foods. For example, protein has a caloric availability of 70% (ie: 30% is diet-induced thermogenesis - ie: heat given off during metabolism), while for fat it is 98%, and 90-95% for carbohydrates (depending on whether they are complex or refined) (Yeo 2021).

¹ A food calorie is defined as "the amount of energy it takes to raise the temperature of 1 litre of water by 1°C at sea level". This is 1000 times larger than a heat calorie, thus the use of kilocalorie (kcal) (Yeo 2021).

2. PERSONALISED OR PRECISION NUTRITION

Despite the continuing battle over which type of diet is better (eg: low-fat vs low-carbohydrate), evidence is emerging that individuals respond differently to food, and "that a customised diet based on an individual's metabolism and microbiome is required" (The Leader 2020 p5) (appendix A).

The idea has become known as "precision nutrition" (or "personalised nutrition") (Lawton 2020).

Individual differences in responses to the same food was formally reported by Zeevi et al (2015) in a study of 800 volunteers.

The PREDICT-1 (Personalised Responses to Dietary Composition Trial) studied 1002 health volunteers (including 86 pairs of identical twins) eating the same meals for two weeks (Berry et al 2020). Individual differences in response to the meals were found, even among the identical twins (table 2.1).

- Measures were taken up to six hours after specific meals (which varied in fat, carbohydrate, protein and fibre). Blood glucose was recorded at 15-minute intervals. The study involved two weeks in controlled conditions and two weeks at home.
- The study confirmed individual differences in responses of blood triglyceride, glucose, and insulin to the same meals. Genetic influence was less than expected from traditional clinic-based studies, which was seen in the differences between identical twins, but meal context (eg: timing; time to exercise; sleep) was more important than expected. In fact, meal context was as important as meal composition. Note that analysis only compared high fat and high carbohydrate meals "for pragmatic reasons" (p970).

Table 2.1 - Details of Berry et al (2020).

But the move to individualised diets should not ignore the good generic advice - "We should still all be eating a diverse diet with fibre-rich foods, fruit, veg, nuts and pulses, an appropriate amount of fat and limited processed food" (Sarah Berry in Lawton 2020).

2.1. Zeevi et al (2015)

High post-prandial (post-meal) glycaemic response (PPGR) is a predictor of the development of type II diabetes. Certain foods produce this elevated blood

Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

glucose level. Measurement of foods for predicting PPGR includes via the meal carbohydrate content, and glycaemic index (Zeeva et al 2015).

But it has become clear that a standard PPGR for each food is not appropriate because of factors like time of day of meal, proximity to physical activity, and interpersonal differences. In the case of the latter, individual differences in genetics, insulin sensitivity, lifestyle, and, what appears to be most important, gut microbiota (Zeevi et al 2015).

Zeevi et al (2015) set out to measure individual PPGR by studying a cohort of 800 healthy adults in Israel for one week. The meals were standardised, and multiple sources of data were collected including stool samples (for gut microbiota), physiological measures (eg: blood pressure), and questionnaires on lifestyle and nutrition. For the study period, each participant was connected to a continuous glucose monitor while maintaining their normal daily routines.

This study was able to establish that the same meal produced individual differences in PPGR (eg: a 30% difference between the high and low individuals). But individuals also had variability in their PPGR to meals. The cohort average PPGR was similar to published glycaemic index data for foods.

A machine learning algorithm was applied to the data to find the predictors of individual differences in PPGR, and 100 more participants were used as validation. A total of 137 features were analysed (eg: micronutrients of the food; exercise; blood cholesterol; genome of microbiome). It was found that PPGRs were associated with multiple factors, including those unrelated to the meal content, like features of the gut microbiota.

Next the researchers used this information to produce personally tailored diets for 26 adults. After one week of measurement, half the participants received a "good" diet (known to produce low PPGRs) for one week, and a "bad" diet (that produced high PPGRs) for the last week. The other half received a "personalised good" diet for one week. PPGRs were significantly lower with the personalised diet.

Zeevi et al (2015) concluded that personally tailored diets are beneficial for improving PPGRs, at least in the short-term. An extensive amount of data were collected as the basis of personalised nutrition.

The ability to predict what foods are best for individuals does, however, require a lot of data, some involving intrusive methods like the continuous glucose monitor.

2.2. Fibre

Promoting the beneficial microbes in the gut with pro-biotics, say, has grown in popularity, but this is "challenging because the gut microbial community... is highly complex, and because dietary responses are modulated by multiple hereditary and non-hereditary factors" (Leshem and Elinav 2021 p32).

Dietary fibre may be a possibility as beneficial gut microbes metabolise it. Working with germ-free mice (ie: genetically engineered to have no gut microbes at birth), Delannoy-Bruno et al (2021) compared three types of fibre supplementation (pea-fibre, orange fibre, and barley bran) on gut microbes colonised from an obese human. Bacterial species harboring genes related to the degradation of fibre gained a competitive advantage. The researchers then studied twelve overweight or obese humans given pea-fibre dietary supplementation.

This fits with precision nutrition, and the possibility of specific foods that encourage the beneficial gut microbes.

3. FUTURE DIETS

Tzachor et al (2021) noted that during the time of covid-19, as "societies coped with the pandemic, additional stressors – such as swarms of desert locust (*Schistocerca gregaria*) in East Africa, outbreaks of African swine fever in Asia and Europe, tropical cyclones in the Indian sub-continent and wildfires, droughts and a derecho [mega-storm] in North America – exacerbated food insecurity in regions experiencing severe undernutrition and undermined just-in-time supply chains in relatively food-secure regions" (p326). These problems highlighted food provisioning for the world, and Tzachor et al (2021) argued that "future foods" are a more resilient alternative. These include micro-algae (fast growing unicellular organisms), mycoprotein (from filamentous fungi), insect larvae and mealworm beetle.

Tzachor et al (2021) presented three resilience advantages of future foods in the time of anthropogenic climate change:

i) Many future foods can be cultivated in controlled environments that are unaffected by weather, for instance.

ii) Flexibility in cultivation to respond to changing demand.

iii) Local production and distribution that overcomes dependence on centralised sources, which, if disrupted, leads to shortages.

Tzachor et al (2021) ended: "In light of the coronavirus pandemic – an exemplar systemic risk event – and our increasing knowledge of structural risks, uncertainties and cascading failures in the global agri-food system, we maintain that a risk-resilient diet is essential to ensure short- and long-term food security" (p328).

4. ULTRA-PROCESSED FOOD

Ultra-processed food (UPF) consumption is a problem in the modern Western world. UPFs are "industrial formulations of ingredients that undergo a series of physical, chemical, and biological processes. They typically lack intact healthy food components and include various additives. Ultra-processed foods tend to be more energy-dense and nutritionally poorer (ie: high in levels of free sugar, salt, and saturated fats but low in levels of protein, dietary fibre, and micro-nutrients) compared with less processed alternatives and are designed to be cheap, palatable, durable, convenient, and appealing. These products are aggressively marketed by the food industry to promote purchasing and shape dietary preferences, and children are leading consumers of UPFs" (Chang et al 2021 pE2) ².

Concentrating on children, it is estimated that UPFs make up two-thirds of daily calorie intake in the USA and the UK, and their consumption is associated with weight gain (Chang et al 2021). The problem is also rising in low- and middle-income countries.

Longitudinal data are required to establish the relationship between UPF and later obesity. Chang et al (2021) used the Avon Longitudinal Study of Parents and Children (ALSPAC), which began in south-west England in 1991-2. The study began with over 14 000 births, and the latest follow-up was in 2017 at 24 years old (n = 9025).

Three-day food diaries were completed at 7, 10, and 13 years old by the parents. The data were divided into four food groups - unprocessed/minimally processed (eg: fruit), processed culinary ingredients (eg: butter), processed foods, and UPFs. The proportion of intake of UPFs was calculated, and five quintiles were distinguished for analysis. Measures of weight and body fat were taken annually between seven and seventeen years, and at 24 years old.

The mean UPF consumption was 23% of daily calorie intake in the lowest quintile, but 68% in the top quintile. Comparing these two groups, the UPFs consumed by the latter were fruit-based beverages, carbonated beverages, ready-to-eat/heat foods, and industrial-processed breads and buns. The top quintile were more likely to have lower maternal socio-economic status (based on occupation).

All children had an increase in weight as they grew,

² The focus on UPF, where there is agreement over its negative consequences for health, overcomes the problem of nutrition research which is "notorious for its contradictory results" (Wilson 2021 p37). Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

but the top quintile (compared to the bottom) had an additional 0.20 kg per year, and 0.17 cm per year waist circumference. The "findings suggest that higher UPF consumption is associated with greater increases in adiposity from childhood to early adulthood" (Chang et al 2021 pE1).

This pattern meant that young adults who had high UPF consumption in childhood were already much larger than low UPF consuming children (eg: BMI (body mass index) 1.18 greater and 1.53% more body fat at 24 years old).

This study had a longer follow-up than previous work. The sample was large, and a lot of data were available, though not between 17 and 24 years old (Chang et al 2021).

Allocation into UPF quintiles was based on reports by parents, and classification of foods by the researchers, which are open to mistakes, but Chang et al (2021) argued was "likely minimal". Also, the researchers admitted, "although we accounted for a wide range of factors, the observational nature of the study means that residual confounding may have affected our results" (pE9).

UPF is behind obesity, some argue, because it "disrupts gut-brain signals that normally tell us that we have had enough, and this failed signalling leads to overeating" (Shell 2019 p32). For example, in a two-week controlled environment, individuals with a UPF diet ate an extra 500 calories a day and gained two pounds compared to an unprocessed food diet when there was no restriction of the amount eaten (ad libitum) (Hall et al 2019).

This study involved an artificial situation, and participants ate only UPF or unprocessed food. In the real world, individuals eat a mix of the different types of foods (Rick Mattes in Shell 2019).

Neuroimaging studies have found that the striatum (involved in decision-making) is influenced by sensory cues (eg: Small and DiFeliceantonio 2019), and these are perceived differently with UPFs. Put simply, sensory cues trigger the brain to anticipate certain calories, which are not perceived accurately with UPFs, and so the individual is motivated to eat more (Shell 2019).

4.1. Reformulation Targets

Public Health England (PHE) have published voluntary
Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

reformulation targets for calories, sugar, and salt to encourage UK food manufacturers to improve the nutritional quality of their products (eg: 2017 salt). The success of these targets depends on the response of large food companies.

Bandy et al (2021) investigated the nutritional quality of products from the top ten UK food and drink companies using "nutritional profiling". This is, according to the WHO in 2011, "the science of classifying and ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health" (quoted in Bandy et al 2021).

The Food Standards Agency (FSA)/Ofcom nutrient profile model awards points, for example, for "each product's energy, saturated fat, total sugar and sodium content ('A-points') and fibre, protein and fruit, nut and vegetable (FNV) content ('C-points') per 100g..." (Bandy et al 2021 p3). Data for 2015 to 2018 were analysed.

During the study period, there was little change in nutrient profiling scores. There was a "very small increase" in the number of products classified as "healthy" (46% in 2015 to 47% in 2018). "This was largely attributable to a reduction in the sugar content of some soft drink products and an increase in the volume sales of healthy beverages (bottled water, low/no calorie drinks and fruit juices), changes likely driven by the introduction of the Soft Drink Industry Levy in 2018. Once soft drinks were removed, the proportion of healthy sales fell to 6% in 2018, down from 7% in 2015. This suggests that despite PHE's reformulation targets for calories, sugar and salt, there has been no improvement in the nutritional quality of foods that people are buying" (Bandy et al 2021 p6).

Note that the FSA/Ofcom nutrient profile model's "original purpose was for the assessment of whether or not a product should be advertised to children, rather than to assess the nutritional quality of a company's product portfolio and classifying products as healthy and unhealthy..." (Bandy et al 2021 p8).

In terms of individual targets, the evidence from other studies is mixed. For instance:

a) Salt - eg: only 28 of 52 targets met in 2018, according to a 2017 PHE report (Bandy et al 2021).

b) Sugar - significant reduction in soft drinks (eg:

Bandy et al 2020), but less so of foods (eg: 3% reduction between 2015 and 2018; Tedstone et al 2017 quoted in Bandy et al 2021).

A similar study to Bandy et al (2021) was conducted in India (Jones et al 2017) of the top eleven packaged food manufacturers, and only 17% of products were considered healthy (Bandy et al 2021).

Campaigns against UPF include higher taxes on them, but processed foods are cheap and convenient, "all of which matters if you are working long hours to support a family on a low income" (Wilson 2021 p40). Processed foods account for a large part of many people's diets, and so asking them to change overnight is unrealistic. Also there are processed options, like lower-calorie ready meals, which are healthier in terms of limiting fat and sugar (Wilson 2021).

5. INTERMITTENT FASTING

"Intermittent fasting" (IF) is "the diet du jour" according to Wallis (2020). This involves varying the quantity of food eaten, including alternate-day fasting (ADF) (appendix B) (eg: 500 calories maximum on fast days and no restrictions on other days), or the "5:2 plan" (five days of normal eating and two days of small meals or fasting per week), or "time-restricted fasting" (TRF) (eating confined to a certain part of the day; eg: 16:8 - eat within eight hours and fast for remainder on the day/night) (Wallis 2020).

de Cabo and Mattson (2019) explained that IF "elicits evolutionarily conserved, adaptive cellular responses that are integrated between and within organs in a manner that improves glucose regulation, increases stress resistance, and suppresses inflammation. During fasting, cells activate pathways that enhance intrinsic defences against oxidative and metabolic stress and those that remove or repair damaged molecules. During the feeding period, cells engage in tissue-specific processes of growth and plasticity" (p2541).

Energy for the body is usually from liver-derived glucose, but with fasting the source becomes adipose cell-derived ketones. "The metabolic switch from the use of glucose as a fuel source to the use of fatty acids and ketone bodies results in a reduced respiratory-exchange ratio (the ratio of carbon dioxide produced to oxygen consumed), indicating the greater metabolic flexibility and efficiency of energy production from fatty acids and ketone bodies" (de Cabo and Mattson 2019 p2543).

The majority of the research comes from mice, who lose weight with IF, and have lower blood sugar levels and blood pressure. Also known as "calorie restriction", and Weindruch and Sohal (1997) originally reported its benefits for increased lifespan in rodents, for instance. The transferability of dieting successes to humans is questioned (Wallis 2020).

Studies report weight loss benefits from TRF (eg: Gabel et al 2018), for instance, but also side effects like increased frequency of constipation, irritability, and fatigue, and the potential for disordered eating.

Gabel et al (2019) investigated the safety of TRF in a twelve-week study with twenty-three obese US adults (Gabel et al 2018). The TRF involved eating (with no restrictions) between 10 am and 6 pm daily (8 hours), and fasting the rest of time (16 hours) (except for water or calorie-free beverages). Safety (ie: negative side

effects or adverse events) were self-reported by questionnaire.

Body weight significantly decreased after twelve weeks, while self-reported adverse effects did not change from baseline (eg: eating disorder symptoms; concerns about body image).

Note that the study was small (ie: a pilot study), had no control group, and measured a limited number of adverse effects (Gabel et al 2019).

A question remains: "How much of the benefit of intermittent fasting is due to metabolic switching and how much is due to weight loss?" (de Cabo and Mattson 2019 p2544). The former seems to be the answer from studies of IF with humans. For example, overweight women undertaking a 5:2 IF regimen or a 25% reduction in calories for six months (Harvie et al 2013) both lost the same amount of weight, but "those in the group assigned to 5:2 intermittent fasting had a greater increase in insulin sensitivity and a larger reduction in waist circumference" (de Cabo and Mattson 2019 p2545).

Two large-scale studies of IF with humans are (de Cabo and Mattson 2019):

a) Calorie Restriction with Optimal Nutrition (CRON) diet (eg: Fontana et al 2004).

b) Comprehensive Assessment of Long-Term Effects of Reducing Intake of Energy (CALORIE) (Rochon et al 2011).

de Cabo and Mattson (2019) considered three practical issues in relation to adoption of IF:

i) The diet of three meals (and snacks) per day is "so ingrained" in Western culture that "a change in this eating pattern will rarely be contemplated by patients or doctors. The abundance of food and extensive marketing in developed nations are also major hurdles to be overcome" (de Cabo and Mattson 2019 p2548).

ii) When switching to IF, "many people will experience hunger, irritability, and a reduced ability to concentrate during periods of food restriction. However, these initial side effects usually disappear within 1 month, and patients should be advised of this fact" (de Cabo and Mattson 2019 p2548).

iii) IF should be adopted gradually over several months, with particular reference to maintaining

nutritional needs.

5.1. "Negative-Calorie Food"

Reflecting on the "constant information bombardment" on social media around food, Wong (2021) considered the "received wisdom" that eating celery uses more calories chewing than are gained from digesting the food. This is an example of a "negative-calorie food".

In terms of the evidence, a controlled study by Clegg and Cooper (2012) (table 5.1) found that eating celery used up 86% of the calories gained. So, not a "negative-calorie food", technically (Wong 2021).

- Participants - 15 healthy female volunteers in Oxford.
- Apparatus - Participants wore a ventilated-hood that measured CO₂ exhaled, which was an indirect measure of calories expended.
- Procedure - Participants ate 100 g of celery (in 10 mins) (16 kcals), and then wore the hood for three hours while resting.
- Findings - It was calculated that 13.76 kcals of energy was expended for the consumption of 16 kcals from celery (ie: 86%).

Table 5.1 - Details of Clegg and Cooper (2012).

Another way of looking at the claim is that eating celery can lead to a reduction in more calorie-dense foods. This has been found with consumption of salad. For example, Roe et al (2012) asked their participants to consume a salad twenty minutes before or with a pasta main course, and also as much salad as wanted or a fixed amount. The participants were forty-six healthy female volunteers. They were tested on five occasions on the same day of the week (table 5.2), but the order of the conditions was varied for the participants.

Overall, less pasta was consumed in the conditions where participants could eat as much salad as they wanted than when forced to eat all the salad offered. The timing of the salad had no significant effect on pasta consumed. Significantly more pasta was consumed in the control condition than the four other conditions.

- 1 - Salad before pasta/consume fixed amount
- 2 - Salad before pasta/consume as much as wanted
- 3 - Salad with pasta/consume fixed amount
- 4 - Salad with pasta/as much as wanted
- 5 - No salad (control)

Table 5.2 - Five conditions of the experiment.

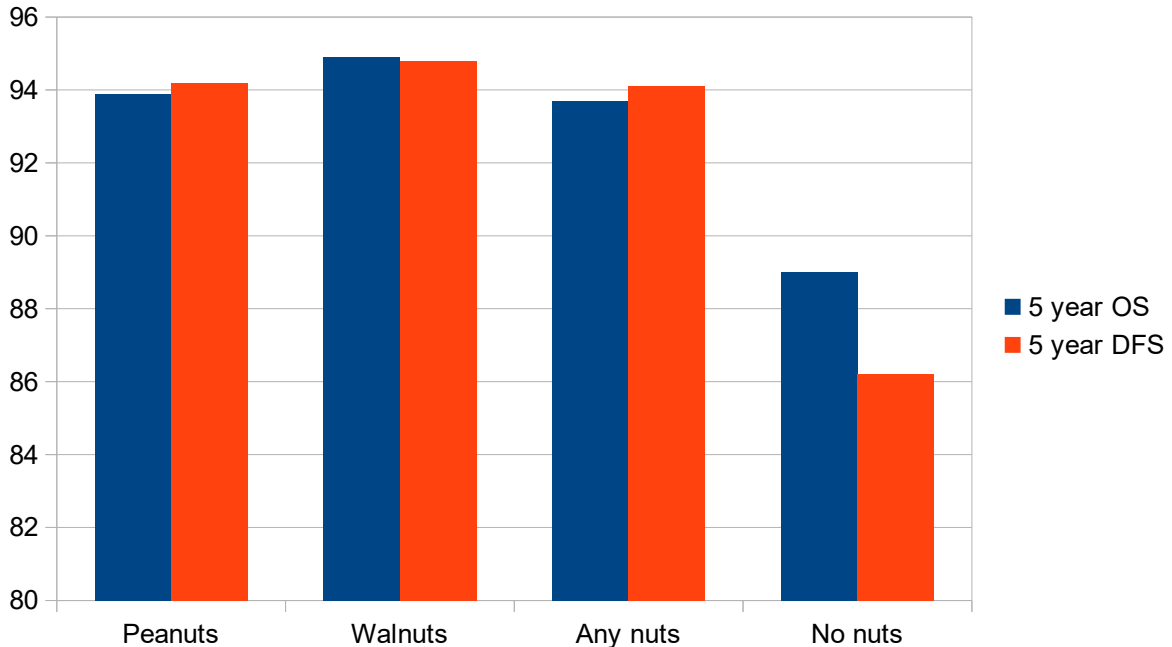
Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

6. DIET AND HEALTH

Diet has been linked to breast cancer risk and survival. This has been shown recently in the Shanghai Breast Cancer Survival Study (SBCSS) (Wang et al 2021).

This is a longitudinal study of 5042 women aged 20-75 years old in China who were diagnosed with breast cancer between March 2002 and April 2006. Of these, 3575 participants had survived five years or longer post-diagnosis. At 18 months, 3, 5 and 10 years after diagnosis the food frequency questionnaire (FFQ) was completed. Wang et al (2021) focused on nut consumption, which was categorised as zero, zero-median, and greater than median.

The main outcome variable was overall survival (OS), and nut consumers had a significantly higher rate than non-consumers (ie: 93.7% of zero-median and greater than median groups combined vs 89% of zero group). This was also the case for disease-free survival (DFS) (ie: no recurrence) (94.1% vs 86.2% respectively. After controlling for variables, like age, disease type, and body mass index, only BFS was still significant. There was an association between OS, DFS, and certain types of nuts (figure 6.1).



(Data from table 2 Wang et al 2021)

Figure - OS and DFS (%) for specific nut types (only significant findings).

Compared to previous studies (eg: Bonaccio et al Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

2015), the benefits were smaller in this study, but Wang et al (2021) explained that the "levels of nut consumption were relatively low in our study population (median = 17.32 gram/week) compared with the 42.5 g/wk recommended by the American Heart Association. Therefore, it is also possible that the levels of nut consumption among breast cancer survivors in our study did not reach a threshold of health benefits for OS" (p5).

In terms of the benefits of nuts, Wang et al (2021) outlined the physiological evidence: "Nuts are rich in several pro-health nutrients, including unsaturated fatty acids, protein, fibre, vitamins, minerals and other bioactive constituents such as phytosterols and phenolic compounds. Previous in vitro studies have identified several potential molecular mechanisms indicative of growth inhibitory effects of nut components (eg: ellagic acid, alpha-linolenic acid and β -sitosterol) on human breast cancer MCF-7 cells, which may prevent breast cancer recurrence. Other impacts of nut consumption on some intermediate markers, such as lowering cholesterol levels, inhibiting oxidation and regulating endothelial dysfunction, may also contribute to better DFS and OS among breast cancer survivors" (p6).

Table 6.1 summarises the key strengths and weaknesses of the study.

| STRENGTHS | WEAKNESSES |
|--|---|
| <ol style="list-style-type: none"> 1. Relatively large sample of breast cancer survivors. 2. Relatively long-term follow-up (median 8 years). 3. The multiple measures of the FFQ took account of dietary changes post-diagnosis and treatment. 4. The FFQ is a validated measure. | <ol style="list-style-type: none"> 1. The DFS was self-reported. 2. Despite the multiple use of the FFQ, nut consumption details were only collected at one point (five years post-diagnosis). "Information on change of nut consumption was not captured" (Wang et al 2021 p6). 3. "Bias due to reverse causality is possible because individuals with chronic diseases and poor health statuses may change their dietary habits" (Wang et al 2021 p6). Though the researchers rejected this possibility. 4. Potential confounders not measured or controlled for in the statistical analysis (eg: life stress; attitudes towards cancer). |

Table 6.1 - Main strengths and weaknesses of Wang et al (2021).

7. FOOD WASTE

It is estimated that up to one-third of food produced globally is "spoiled, lost or discarded uneaten. Wasted food has significant sustainability implications that cut across a number of human and planetary health issues. It contributes to global warming and land degradation, reduces food availability and affordability, represents unsustainable resource use, and threatens the long-term viability of global and local food systems" (Boulet et al 2021 p1).

In the Global South, food waste occurs at the production, harvest and transportation stages, while in the wealthy countries, it is at the consumer stage - ie: "buying more food than required; preparing too much at meal times; and not re-using leftovers" (Boulet et al 2021 p1).

So, changing consumers' behaviour in the these countries is important in tackling global food waste. Boulet et al (2021) outlined three themes from the research:

i) There are food-related behaviours that lead to greater waste (eg: shopping only in large supermarkets) and those that lead to less waste (eg: meal planning). "These behaviours are part of broader household food provisioning practices related to planning, purchasing, storage, preparation, consumption and disposal" (Boulet et al 2021 p2).

ii) Both internal factors (eg: attitudes) and external factors (eg: social norms) influence food-related behaviours (and consequently waste).

iii) The different factors interact in a complex web of "spaghetti soup" (Quested et al 2013). So, studies and recommendations should go beyond the narrow focus on single factors.

Boulet et al (2021) tried to achieve this with a multi-level perspective and review. Three levels are important (Boulet et al 2021):

- Micro (individual)
- Meso (household)
- Macro (community or society)

Also "lower, less complex, levels are nested within higher, more complex, ones. In these nested hierarchies,

Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

relationships exist within, and between, the levels... Entities or factors relevant to one level can influence those within other levels (and vice-versa), as well being part of interplays on the same level. For example, the density and location of food retail outlets (a macro level feature) may influence how much food is stock-piled in a household, while the food management skills of individuals (micro) influence how well that food is stored, and the dynamics between householders (meso) then determines what is actually eaten. Different behaviours, and household food waste, emerge from these interactions" (Boulet et al 2021 p3).

Boulet et al (2021) found 118 relevant studies published between 2000 and 2019 on household food waste and consumer behaviour. Most were European-based studies (n = 90), and published in the last five years.

Here are some of the key factors found at each level:

a) Micro - individual's attitudes, demographics, intentions, and perceived control and norms.

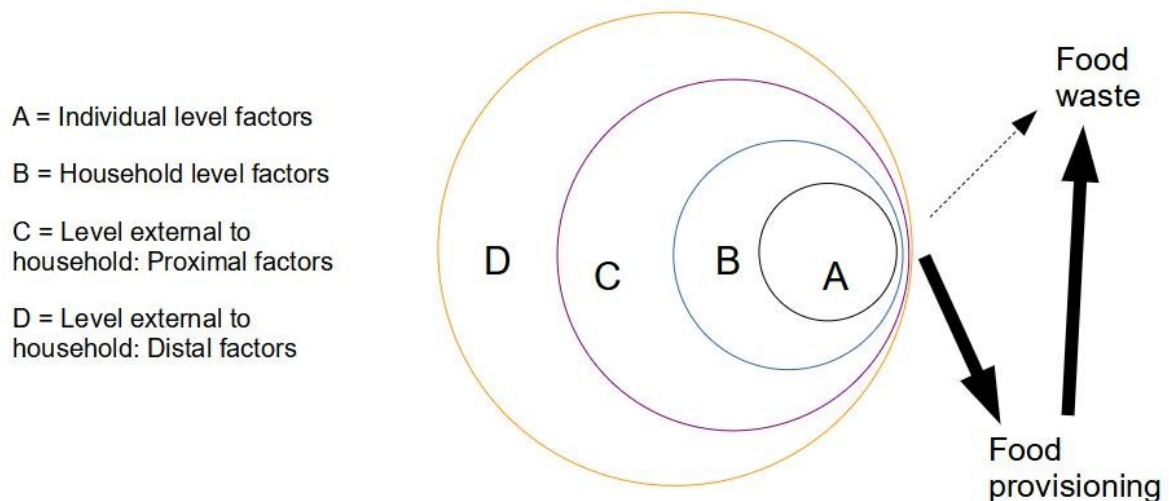
b) Meso - physical properties of the home (eg: pantry and refrigerator availability and size), and make-up of the household.

c) Macro - divided into proximal and distal factors. Proximal factors are those which consumers or households have "frequent engagement (namely external physical settings and extended social networks) and distal factors (such as economic, market and regulatory factors) that sit in the background and are more removed from consumers' daily lives" (Boulet et al 2021 p8).

Putting the factors together in a multi-level approach (figure 7.1), Boulet et al (2021) explained that the "enacted food provisioning practices of an individual, and their specific associated behaviours, are the emergent property of the interactions between the different factors depicted across the levels... Household food waste is then the final outcome of individuals responding (consciously and unconsciously) to these multi-level influences" (p8). The factors can be conflictual. "For example, while an individual may have particular attitudes, skills and knowledge which would predict minimal amounts of food waste, these might be subsumed by the tastes and needs of others in the household, or might be not be valued, and subsequently ignored, due to the particular dynamics between household

members" (Boulet et al 2021 p8). Graham-Rowe et al (2015) put it simply: "it is likely that people may not have complete control over the amount of [food] thrown away, due to the behaviour of other members of the household" (quoted in Boulet et al 2021).

Boulet et al (2021) wanted to get away from the focus on the individual and micro-level factors. They emphasised policies to combat food waste involving households, workplaces, and other institutions.



(Based on Boulet et al 2021 figure 4 p7)

Figure 7.1 - A multi-level approach to consumer food waste.

These researchers suggested key questions for future research, including:

- "Does online shopping reduce food waste compared to visiting the supermarket?"
- "Can the food package design reduce household food waste?"
- "Which household level factors block or enhance the impact of external food waste campaigns on individuals?"

7.1. During Covid-19

Rodgers et al (2021) used the situation of covid-19 and lockdowns in 2020 to examine food waste. It was predicted that "although panic buying might initially have increased food waste due to larger quantities of foods at home..., overall, in view of the perception of scarcity coupled with restrictions and likely anxiety related to leaving the home to purchase food, it was hypothesised that individuals would report having lowered their food waste compared to before the pandemic" (Rodgers et al 2021 p2). Three factors were examined - decreased access to supermarkets, changes in food choices due to health concerns, and increased home cooking.

The participants were an online snowball sample of 478 adults from the USA and 476 from Italy. They were recruited via social media in April 2020. The key questions were:

1. "Thinking about now compared to before the pandemic - Currently, are you more careful about not wasting food?".
2. "Thinking about now compared to before the pandemic - Currently, have you been cooking more than before?".
3. "Thinking about now compared to before the pandemic - Currently, are your eating choices conditioned by your worry about your health status?".
4. "I avoid spending time in public places such as the supermarket". The response options were "never" (0) to "always" (5).

In questions 1 to 3 above, the response options were (1) "much less than before" to (5) "much more than before".

Overall, 61.5% of the US sample compared to 38% in Italy reported response options 4 and 5 to question 1 above (ie: decreased food waste) (but overall 49%). Further analysis found that the reduction in food waste was predicted by more home cooking, changes in food choices linked to health concerns, and avoidance of supermarkets. Rodgers et al (2021) concluded that "the circumstances created by the pandemic resulted in changes in attitudes and behaviours related to food waste" (p4).

The researchers stated: "While the samples were convenience ones, and not representative of the general

population more broadly, these findings nevertheless convey important information regarding modifiable factors that may be useful targets for reducing food waste beyond the current context, in particular the role of perceived access to food and scarcity versus abundance, as well as cooking practices" (Rodgers et al 2021 p4).

The expansion of online grocery shopping options during the pandemic was not considered. All measures were self-reported, and related to early in the pandemic and lockdown. Note that only about two-thirds of the participants reported being in compulsory lockdown or stay-at-home orders or quarantine at the time of the survey.

Responses to question 1 above in particular "may have been related to broader pro-social norms during the pandemic or driven by social desirability. In the context of the pandemic, changes to food-related behaviours were confounded by compliance with overall health recommendations, and may therefore have reflected current social norms during the initial months of the pandemic. In addition, it has previously been suggested that individuals are aware of and responsive to social norms regarding food waste..., and this may also have impacted responses here" (Rodgers et al 2021 p6).

The sample was mostly younger adults (mean age 32 years old), female (over three-quarters), without children (around three-quarters), with low levels of financial and food insecurity. Rodgers et al (2021) explained: "It has been previously shown that households without children tend to generate less food waste than those with children..., and therefore extending these findings and exploring changes in food waste among households with young children in particular would be a useful direction. In contrast, however, it has also been suggested that overall young people are more wasteful of food, therefore the focus here on young adults is a useful one" (p6).

8. VEGETARIANISM

Reducing meat consumption can be seen as a "collective good" in terms of health, environment, and animal welfare. But Bolderdijk and Cornelissen (2022) described the problem that vegetarians and vegans ("veg*ans") are perceived as a small minority, and so a "tipping point" has not been reached to change behaviour. This can be challenged by veg*ans not "self-silencing". Bolderdijk and Cornelissen (2022) explored this issue.

Social change requires "frontrunners" to build momentum, and in time a "tipping point" is achieved where the new behaviour is perceived as normal or the majority activity. "Indeed, people who have more vegetarian friends tend to eat less meat..., and people are more likely to adopt a meat-free diet when they are under the impression that an increasing number of peers is doing so too... In other words, just like many other types of behaviours..., meat-free diets seems to be 'contagious': when people are exposed to peers in their social network who reduce their meat consumption, they are more likely to reduce their own meat consumption. However, for this social contagion to occur, existing and aspiring veg*ans need to express their meat-free preferences publicly. As long as majority members think that veg*anism is nothing more than a niche phenomenon, they may not reconsider their own dietary choices" (Bolderdijk and Cornelissen 2022 p2).

Choosing to cut out meat from one's diet when the norm is meat-eating can have a social cost called the "do-gooder's dilemma" (Hermann et al 2008). "Veg*ans elicit discomfort... and can be disliked... by those who do consume meat, because their choice to act on a virtuous principle triggers a fear in others, who do not live up to the same principle, of being judged as morally inadequate" (Bolderdijk and Cornelissen 2022 p2).

Cramwinckel et al (2013) showed this in an experiment described the participants as a "taste test", where a confederate refused to eat meat, either for moral reasons (eg: killing animals is wrong) or non-moral ones (eg: not liking the taste of meat). Ratings of liking for the confederate were lower (compared to the control who eats meat) for refusers, and especially in the moral reasons condition (Bolderdijk and Cornelissen 2022).

Bolderdijk and Cornelissen's (2022) experiment explored self-silencing by veg*ans (ie: avoiding expressing meat-free preference in front of meat-eaters). The participants were 93 veg*ans in a Dutch city. After

completing a survey about their attitudes, individual participants were introduced to three "non-vegetarians" (confederates) for a "group discussion on vegetarian and vegan products". Before the discussion started, the group moderator asked the members to sign a petition to get more non-meat alternatives in local supermarkets. The real participant was always last to have the opportunity to sign, and the confederates had either publicly signed (endorsement condition) or not signed it (no-endorsement condition). The set-up was similar to Asch's (eg: 1952) famous conformity experiment.

Would the veg*an participant publicly sign the petition when the three non-vegetarians had not or conform to the majority and not sign it?

The researchers also varied the petition to highlight the social benefits of less meat eating (other-regarding petition) or the personal benefits (self-regarding petition). However, it was found that this difference had no impact on the participants' signing of the petition or not.

Comparing the number of participants who signed the petition in the endorsement and no-endorsement conditions, there was significant less in the latter (52% vs 84%). This suggested that veg*ans "may indeed self-silence about their meat-free preferences" (Bolderdijk and Cornelissen 2022 p5) in a situation of majority meat-eaters.

Bolderdijk and Cornelissen (2022) explained: "Common wisdom maintains that 'vegans will tell you that they're vegan', and the more general notion of virtue signalling (Orlitzky 2017) implies that people tend to present themselves as more virtuous than they actually are. Our results suggest this may be a misperception..." (p6).

Yet half of the participants in the no-endorsement condition did sign the petition (ie: not conform to the majority). There is a tendency to ignore these and focus on the conformers. But Bolderdijk and Cornelissen (2022) asked: "What distinguishes these individuals from the ones that cover up their virtuousness in public settings? Are they oblivious to social costs, or do they simply care less about those social costs?" (p8).

This experiment was an artificial situation with a single outcome measure of signing the petition or not. There was no exploration of the motivations of the participants. However, Bolderdijk and Cornelissen (2022) reported some comments in the subsequent group discussion: "one participant commented that 'I am not a fanatic vegetarian'. A second participant noted that 'I tried to be vegan but it was too difficult for me. I am

not really like that, it was too much, and I also wear leather boots', and a third mentioned 'I'm not judging meat-eaters, but they put a lot of stuff in meat that people just don't know off [sic]'" (p5). The researchers explained that "these comments are consistent with the notion that vegan and vegetarian participants... were worried that expressing their meat-free preferences carries the stigma of being seen as judgmental, and they tried to pre-empt that. However, the 'group discussion' was not meant to prompt such voluntary comments, and we did not anticipate receiving them. Therefore, we did not systematically code and analyse participants' responses, and cannot conclude whether the comments by these three are representative of the entire sample" (Bolderdijk and Cornelissen 2022 p5).

9. FOOD AND CONSUMER ENJOYMENT

"Creating a unique and enjoyable customer experience is a central marketing management objective... Although there are many paths to enhancing customer experience, displaying and offering delicious food is a prevalent strategy for doing so" (Garbinsky and Klesse 2021 p705). This includes food with another experience, like "popcorn and movies", or encouraging food consumption with other foods (eg: images of tempting desserts while diners eat their main dish).

"Prior research has suggested that placing a pleasurable food in front of the consumer (vs keeping it hidden until the moment of consumption) increases the vividness of the future food consumption experience, which positively affects their enjoyment of that food when they ultimately consume it" (Garbinsky and Klesse 2021 p705). Key are mental imagery and expectation. As the individual eats their main dish, they can see the tempting dessert and imagine their future enjoyment of it. But this could result in reduced enjoyment of the current experience (the main dish). Garbinsky and Klesse (2021) undertook a number of studies to explore this.

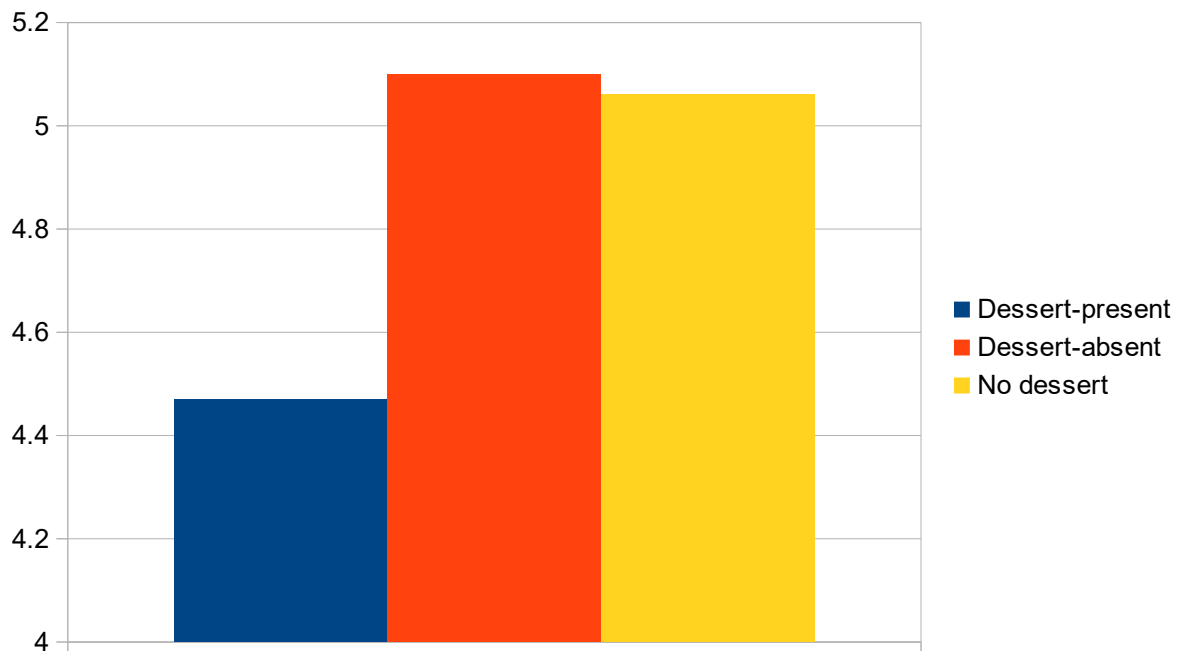
Study 1 - At a self-service US university dining hall, students could collect all their courses at once or in stages. The researchers took the opportunity to study those who took their dessert with their main course, so the dessert was present as they ate the main dish, and those who collected their dessert separately after eating the main dish (dessert-absent condition). There was also a group who had no dessert. After the meal, the participants rated their enjoyment of it.

Overall, the dessert-present students rated their enjoyment of their dinner significantly lower than the dessert-absent students (figure 9.1).

This was a quasi-experiment as the participants self-selected their condition by their behaviour.

A supplemental study randomly assigned students to consume vegetable soup (main dish) in the presence of a muffin (dessert) or not. The mean rating of the soup was 4.36 (out of 7) in the dessert-present condition compared to 5.18 in the dessert-absent condition.

Both studies provide evidence of the basic principle that "the presence (vs absence) of dessert while engaging in another target experience (in this case, consuming a main dish) decreases the enjoyment derived from that target experience" (Garbinsky and Klesse 2021 p709).



("I enjoyed eating my dinner": 1 ("not at all") to 7 ("very much"))

Figure 9.1 - Mean rating of enjoyment of dinner (out of 7) based on dessert present or absent in Study 1.

Study 2 - This was a field experiment at an outdoor music concert in the USA. Volunteers were given a cookie as reward for participation in the study. Half were given the cookie to eat when they completed a survey about their enjoyment of the concert (dessert-present condition), while the others were given the cookie after the survey (dessert-absent condition). The rating of the enjoyment of the music was significantly lower in the former condition. This confirmed the basic principle established in Study 1.

Study 3 - In this study the researchers added a new condition of mental imagery, where participants were asked to imagine the dessert (though it was physically absent). Similar to Study 1, but there were randomly assigned dessert-present, dessert-absent, and mental imagery conditions.

It was found that the rating of enjoyment of the dinner was similar in the dessert-present and mental imagery conditions, which was significantly lower than the dessert-absent condition (figure 9.2). This showed that mental imagery about the future food reduces the enjoyment of the current food.

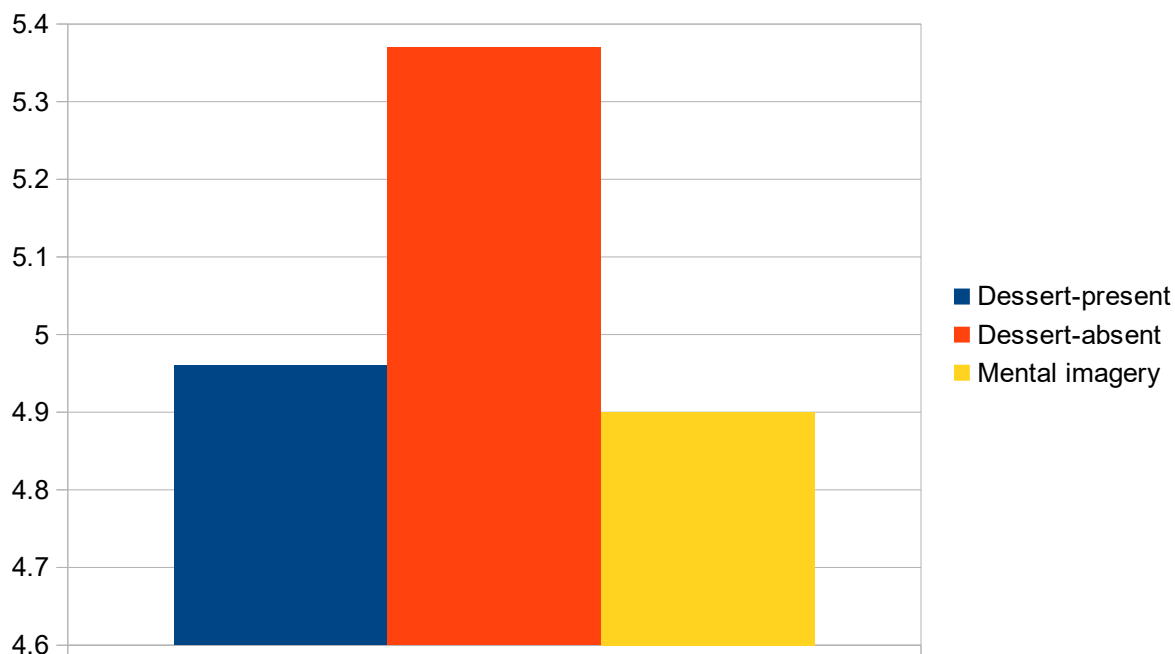


Figure 9.2 - Mean rating of enjoyment of dinner (out of 7) in Study 3.

Study 4 - In this case the researchers tested the basic principle by varying the dessert as tasty or functional. Student volunteers filled in a colouring book for five minutes either in the presence or absence of a snack bar. The snack bar was unknown to the students, and was presented as "extremely tasty and irresistibly gratifying" (tasty condition) or "extremely healthy and very energising" (functional condition) (table 9.1).

When the bar was described in functional terms, then rating of enjoyment of the colouring task did not vary in the present or absent conditions, but in the tasty conditions, enjoyment was significantly lower in the dessert-present than absent condition.

| | Dessert-present | Dessert-absent |
|------------|-----------------|----------------|
| Tasty | 5.28 | 5.87 |
| Functional | 5.88 | 5.78 |

Table 9.1 - Four conditions and mean ratings of enjoyment of colouring task (out of 7) in Study 4.

Study 5 - The basic principle of presence-absence was confirmed with a task to view pictures either with a

reward cookie present or not.

Study 6 - This developed the previous study and varied the pictures as positive or negative. When the pictures were positive (eg: beach scene), enjoyment of the task was lower in the cookie-present condition, as established previously. But when the pictures were negative (eg: litter-strewn beach scene), enjoyment was (non-significantly) higher in the cookie-present condition (table 9.2).

| | Cookie-present | Cookie-absent |
|-------------------|----------------|---------------|
| Positive pictures | 4.78 | 5.32 |
| Negative pictures | 2.94 | 2.48 |

Table 9.2 - Four conditions and mean ratings of enjoyment of viewing the pictures (out of 7) in Study 6.

This last finding was interesting, and the researchers reflected on future research, including which foods present would prompt the reduced enjoyment of the current experience, whether future negative experiences have an impact on the current experience, and non-food future experiences (eg: presence of a mobile phone during eating).

Garbinsky and Klesse (2021) offered some advice to companies, including:

- "For consumers who buy food that they do not have the opportunity to consume immediately, our work suggests they should place it outside of their view during the target experience" (p717).
- "For industries in which eating is a complementary experience (such as concerts...), companies might encourage customers to consume food immediately after its purchase. To do so, they might alter the types of food available, to feature more food that must be consumed shortly after its purchase (eg: ice cream that customers do not want to melt, hot chocolate that customers do not want to get cold). Alternatively, they could package food in a way that encourages customers to consume immediately, because customers want to avoid the hassle of carrying the food around" (p717).

10. ENVIRONMENTAL CHANGES

10.1. Portion Size and Availability

Unhealthy patterns of food consumption can be challenged by interventions in school, university or workplace cafeterias, including not only the food, but also the environment (eg: layout) (Reynolds et al 2021).

Reynolds et al (2021) concentrated on two aspects related to the food - the proportion of higher energy foods, and the portion sizes - with a field experiment involving nineteen worksite cafeterias at distribution centres of a major UK supermarket chain. After collecting baseline measures of food consumption via till receipts (for four weeks), the interventions were applied for twenty-one weeks in 2019. Firstly, the proportion of higher energy food and drink products available was reduced and lower energy food and drink products increased ("availability") (eg: 50% of cold drinks available below 50 kcals). Secondly, the portion size was reduced in volume for targeted products ("size") (eg: 5 to 4 meatballs; 5 oz to 4 oz scoop). The cafeterias were randomly chosen to apply the availability intervention for some weeks, and the combination of availability and size for other weeks.

The main outcome measure was energy (kcal) purchased.

The overall success of cafeterias achieving the intervention targets was calculated at 76%. In terms of availability, 58% of products available during baseline were classed as high energy, and this was reduced to 47-50%, while the average reduction in portion size was 14%.

Compared to baseline, energy purchased was reduced by 5-12% during the interventions (with combined availability and size periods being the most successful). "Decreasing the relative availability of higher energy foods and reducing their portion size both reduced energy purchased in worksite cafeterias" (Reynolds et al 2021 p12).

In a study involving six worksite cafeterias (Pechey et al 2019), reducing the availability of high energy products reduced the energy purchased by 7%, while a 10% reduction in portion size (Hollands et al 2018) produced a (non-significant) 9% reduction in energy purchased (Reynolds et al 2021).

Reynolds et al's (2021) study was larger than the previous studies, and for longer, as well as combining two interventions. But, Reynolds et al (2021) admitted,

"there was variation in outcomes between the different cafeterias. We observed statistically significant effects in only 3 of the 19 cafeterias for availability and 6 of the 19 cafeterias for availability plus size. This may have been due to the difference in success of implementation of interventions between each cafeteria" (p13).

The intervention saw a drop in revenue for the cafeterias, which may have been a temporary effect. "If implemented in practice, cafeterias could respond to lower sales by altering which products are sold and via additional strategies to make healthier food options more appealing. Such additional changes were not permitted in the current study to ensure the accuracy of the energy content across products and to minimise the reprogramming of till buttons mid-study" (Reynolds et al 2021 p13).

Though the till data were objective measures of purchases, information about individuals' purchasing was not available due to privacy rules. Also no information was available on compensation (ie: smaller portion sizes leading to consumption of food elsewhere and/or later).

Three issues needed further research for Reynolds et al (2021):

i) Long-term benefits or maintenance of effects.

ii) The optimal level of intervention (eg: reducing portion sizes further).

iii) The specific context for the intervention to be successful. The participants in the current study were predominantly manual workers.

Reynolds et al (2021) commented: "A review of energy overconsumption suggests that a reduction of only 28 kcals consumed per person, per day, would be sufficient to prevent further weight gain in 90% of the population. Therefore, if cafeterias in worksites, schools, and universities implemented these changes, this could help reduce overconsumption of energy and therefore aid in widespread efforts to reduce population-level obesity equitably" (p14).

10.2. Food Packaging

It has been found that "not only the colour of the product itself, but also the colours of the tableware, packaging, and environment can influence expectations and

perception of a food or a drink" (Baptista et al 2021 p1). "Predictive coding theory" explains these observations in terms of the brain using the information in front of them to search for cues to match with previous experiences of the food or drink, and this creates expectations which influence perceptions. Cues include colour of packaging, the cultural context, and the frequency of previous consumption (Baptista et al 2021).

Deliza and MacFie (2001), for instance, found that fruit juice in an orange box was expected to be sweeter, and preferred, to in a white box. While a dairy dessert in a yellow packaging was expected to be sweeter and creamier than in a black packaging (Ares and Deliza 2010).

Baptista et al (2021) studied packaging and chocolate. Seven different colours of packaging were compared for expected sweetness, bitterness, fruitiness, melting, and liking of milk and dark chocolates with Brazilian (n = 245) and French (n = 445) chocolate consumers.

The stimuli were pictures of "Lindt" milk and dark chocolate in black, blue, brown, green, red, pink, or yellow packaging. The study was performed online. A nine-point scale was used for the outcome measures. Each participant was presented randomly with two dark and two chocolate pictures.

There were few differences between the two countries, and the following generalisations about colour of packaging were found:

- Pink and yellow - expected to be sweeter and less bitter.
- Black - low sweetness and higher bitterness.
- Red, blue and green - no significant differences to other colours.
- Brown - highest expected sweetness rating and least bitterness.

In terms of milk and dark chocolate, black, blue and green packaging had lowest ratings for liking the latter, but highest with milk chocolate. Pink and yellow packaging was the opposite - most liked for dark chocolate and least for milk chocolate.

So, in summary, the packaging colour affected the

expectations about the chocolate (particularly in terms of sweetness and bitterness), and liking ratings.

The study did not control for hue and brightness of packaging. "Participants of both groups were recruited from institutions that teach and research Food, Biology and Agriculture, therefore their background knowledge of scientific methods and/or food likely influenced the results" (Baptista et al 2021 p7).

10.3. Store Atmosphere

"Store atmosphere" influences consumer behaviour. Background music is one element of this, and Motoki et al (2022) looked at this in relation to food choices (healthy vs indulgent).

Inconsistent findings have been reported in relation to healthy food choices. Peng-Li et al (2021) found that a "healthy soundtrack" (eg: a jazz piece) increased choice of healthy foods, while an "unhealthy soundtrack" (eg: guitar melody) did the same for unhealthy foods. But Fiegel et al (2014), for instance, found no significant differences in food preferences between classical, jazz, hip-hop, and rock background music (Motoki et al 2022).

The findings are also inconsistent for unhealthy or indulgent food choices (eg: volume of music) (Motoki et al 2022).

Motoki et al (2022) performed two experiments that asked participants how much they would like to eat healthy savoury, indulgent savoury, healthy sweet, or indulgent sweet food (table 10.1) while listening to jazz, classical, rock/metal, or hip-hop music (table 10.2).

| | |
|-------------------|---|
| Healthy savoury | Soy hamburger, vegetable sandwich, vegetable chips, seafood pasta |
| Indulgent savoury | Beefburger, beef sandwich, potato chips, meat pasta |
| Healthy sweet | Yoghurt, low-fat milk, soymilk latte, soy serial bar |
| Indulgent sweet | Pudding, chocolate milk, strawberry milk latte, chocolate bar |

Table 10.1 - Food choices offered by Motoki et al (2022).

Experiment 1 involved 397 Japanese adults, and Experiment 2 399 more as a replication. The studies were

| | |
|------------|----------------------------------|
| Jazz | Dave Brubeck "Take five" |
| Classical | J.S. Bach "Air on the G string" |
| Hip-Hop | 2pac ft Dr Dre "California love" |
| Rock/Metal | Iron Maiden "The trooper" |

Table 10.2 - Examples of music used by Motoki et al (2022).

performed online.

The participants played one of the randomly allocated pieces of music (thirty-second segment) before and during the rating of each of the foods on a seven-point scale. They also completed a questionnaire about music preferences.

For savoury foods, jazz and classical music increased the preference for healthy choices compared to the other music genres, while a significantly higher preference for the indulgent choices came with all music genres compared to classical music.

For sweet foods, no pattern emerged for music genre between healthy and unhealthy choices. Classical music (compared to the others) increased the preference for sweet foods generally.

These relationships were mediated by the emotions evoked by the music. Music that was associated with positive emotions led to a preference for sweet foods, while feelings of arousal from the music led to preferences for indulgent savoury foods.

Methodological Evaluation:

i) The food classed as healthy and indulgent food by the researchers was different to other studies (eg: chicken as healthy, but fried chicken as unhealthy; or high vs low calorie/fat) (Motoki et al 2022).

ii) Aspects of the music, like volume, were not controlled (or studied) (Motoki et al 2022).

iii) There are other music genres not used (eg: country, electronica), and local/"ethnic" music (Motoki et al 2022).

iv) The studies were online "laboratory" experiments (ie: unlike real life) (eg: length of music; scoring of food preferences) as opposed to field research that could

measure actual purchases as the sign of preference (Motoki et al 2022).

v) Other mediators of the relationship between music and food choice could include semantic meaning of the music (including the words). The participants were Japanese, and the music with lyrics was in English. Around 3% of participants reporting understanding the lyrics (Motoki et al 2022).

11. APPENDICES

APPENDIX A - ENTEROTYPES

The human gut contains many micro-organisms (sometimes called "commensal bacteria"), and these have been grouped into four "enterotypes" (microbial profiles) (Arumugam et al 2011) depending on the abundance of particular species - Bacteroides 1 (Bact1), Bact2, Ruminococcaceae (Rum), and Prevotella (Prev) (Libby 2020).

Bact2 has been associated with health problems and inflammation (eg: inflammatory bowel disease; cardiovascular problems; obesity and metabolic syndrome) (Libby 2020). "However, the nature of the relationship between microbes and these conditions remains under debate" (Libby 2020 p263).

Vieira-Silva et al (2020) investigated the relationship between enterotypes and obesity using data from the MetaCardis Project, which covered over 2000 individuals in Europe and 1400 variables. Around 900 participants were classed as obese, and they were more likely to be categorised as Bact2. But there was a difference based on whether the individuals were taking cholesterol-lowering drugs called statins. "The obese participants taking statins had a significantly lower prevalence of the Bact2 enterotype (5.9% of the obese population) than did their obese counterparts not taking statins (17.7% of the obese population)" (Libby 2020 p264).

Libby (2020), however, advised caution "in particular with regard to the risk of confusing correlation with causation. As the authors of this large and carefully executed study rightfully acknowledge, we should consider whether statin takers have had better access to health care or been more engaged in other health-promoting behaviours than have the individuals who were not taking statins" (p264).

Gut Microbiota

The increasing knowledge about the importance of gut micro-organisms includes the impact of maternal gut bacteria on embryo development. Vuong et al (2020) found that specific maternal gut bacteria in pregnant mice influenced neural development of the foetus and subsequent behaviour changes in the offspring.

It was found that the brain structure of embryos of

pregnant mice who were germ-free (ie: lacking a microbiota) or had a microbiota altered by anti-biotics was different to normal microbiota mothers. The brain difference related to the connection between the thalamus and the cortex ("thinner-than-normal axons"; Meckel and Kiraly 2020). The offspring were later tested in different ways and showed deficits in behaviour (eg: mice born to deficient microbiota mothers were less startled by loud sounds).

One possible mechanism of the process described is "by metabolite molecules that are produced by gut microbes and absorbed into the bloodstream. During pregnancy, these metabolites, along with other nutrients from the maternal circulation, are transported by way of the placenta to the foetus" (Meckel and Kiraly 2020 p204).

In terms of other research, Buffington et al (2016), for instance, found brain and behavioural abnormalities in the offspring of pregnant mice fed high-fat diets during pregnancy.

Mice

Studies with mice have shown that the microbiota can influence social behaviour. Germ-free (GF) mice (ie: genetically engineered to have no gut bacteria) showed reduced social activity towards unfamiliar mice compared to healthy animals. This was also the case for normal mice given anti-biotics to kill the gut bacteria (Wu et al 2021).

These researchers investigated the mechanism for these observations. It appears that the gut bacteria modulate the physiological stress response (hypothalamus-pituitary-adrenal (HPA) axis), and it is this that influences social behaviour. For example, GF mice were found to have higher levels of the stress hormone corticosterone after social encounters. So, social encounters are stressful to the animals and this discourages them from interacting.

Wu et al (2021) then transplanted gut bacteria from healthy mice into the GF mice, and they showed lower corticosterone and normal social activity. So, "a complex microbiome suppresses an overacting stress response during the encounters with a novel mouse by dampening the HPA-axis-mediated production of corticosterone" (Wu et al 2021 p413).

The researchers further identified a bacterial species in gut most active in this process. They ended:

"It is tempting to speculate that symbiotic bacteria have evolved properties that promote social behaviours among animals under stress to disseminate micro-organisms within a population, create social groups among animals to preserve microbial communities, and/or influence animal mating to expand host-microbiome symbiosis across generations" (Wu et al 2021 p413).

APPENDIX B - ALTERNATE DAY FASTING

There is emerging evidence of weight loss of 3-7% of body weight over one year as well as improvements in blood pressure and insulin sensitivity with ADF (Kalam et al 2019).

"While these preliminary findings are promising, each of these previous trials implemented a traditional high-carbohydrate diet (50%-60% energy as carbohydrates on the fast and feast days). Mounting evidence indicates that individuals with obesity lose more weight when a low-carbohydrate diet (approximately 30% energy as carbohydrate) is implemented" (Kalam et al 2019 p532). So, these researchers investigated ADF combined with a low-carbohydrate diet. The six-month study involved fifty-two obese adults in the Chicago area of the USA.

On fast days, participants consumed three meal replacement shakes ("Optifast HP Shake Mix" from Nestle) that totalled 600 calories, and five shakes totalling 1000 calories and any food they wanted on feast days. The shake's composition meant 30% energy from carbohydrates (10 g), 35% energy from protein (26 g), and 35% energy from fat (6 g). This phase of the study lasted three months (weight loss period), and there were three months of three meal replacement shakes per fast day, and three shakes and any food on feast days (weight maintenance period). Participants kept a record of food eaten, and they were given information about low-carbohydrate foods. Thirty-one individuals completed the study.

The net weight loss was 6% of baseline body weight at the end of the weight loss period, and this was maintained in the subsequent three months. This is "clinically meaningful weight loss" (Kalam et al 2019 p536).

Adherence to the meal replacement regimen was high overall (>80% of shakes consumed), but the study drop-out was 40% (due to "dislike of the ADF regimen and/or the taste of the meal replacements"; Kalam et al 2019 p537). There were minor side effects of the shakes (eg: constipation; bloating). The researchers accepted that

"we only provided one type of meal replacement during the 6-month study (ie: shakes). Providing other types of meal replacement products (eg: low-carbohydrate bars, and soups) may have improved compliance as this would have increased diet variety" (Kalam et al 2019 p537).

Adherence to fast days was not complete as an additional 6000 calories was self-reported as consumed. Kalam et al (2019) admitted that "since the subjects were consuming approximately 1200 kcal on fast days and approximately 1600 kcal on feast days, this diet more closely resembles daily calorie restriction than ADF. This should be taken into consideration when interpreting these findings" (p537). Also the food records were self-reports, and it is known that "individuals with obesity under-report food intake by 20% to 40%; thus, the estimates of energy intake are most likely inaccurate" (Kalam et al 2019 p537).

There was no control (or comparison) group.

The study was sponsored by Nestle.

12. REFERENCES

Ares, G & Deliza, R (2010) Studying the influence of package shape and colour on consumer expectations of milk desserts using word association and conjoint analysis Food Quality and Preference 21, 8, 930-937

Arumugam, M et al (2011) Enterotypes of the human gut microbiome Nature 473, 174-180

Asch, S.E (1952) Group forces in the modification and distortion of judgments. Asch, S.E (ed) Social Psychology Englewood Cliffs, NJ: Prentice-Hall

Bandy, L.K et al (2020) Reductions in sugar sales from soft drinks in the UK from 2015 to 2018 BMC Medicine 18, article 20

Bandy, L.K et al (2021) Assessing the healthiness of UK food companies' product portfolios using food sales and nutrient composition data PLoS ONE 16, 8, e0254833 (Freely available at <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0254833>)

Baptista, I et al (2021) Effects of packaging colour on expected flavour, texture, and liking of chocolate in Brazil and France International Journal of Gastronomy and Food Science 24, 100340

Berry, S.E et al (2020) Human post-prandial responses to food and potential for precision nutrition Nature Medicine 26, 964-973

Bolderdijk, J.W & Cornelissen, G (2022) "How do you know someone's vegan?" They won't always tell you. An empirical test of the do-gooder's dilemma Appetite 168, 105179

Bonaccio, M et al (2015) Nut consumption is inversely associated with both cancer and total mortality in a Mediterranean population: Prospective results from the Moli-sani study British Journal of Nutrition 114, 5, 804-811

Boulet, M et al (2021) Towards a multi-level framework of household food waste and consumer behaviour: Untangling spaghetti soup Appetite 155, 104856

Buffington, S.A et al (2016) Microbial reconstitution reverses maternal diet-induced social and synaptic deficits in offspring Cell 165, 7, 1762-1775

Chang, K et al (2021) Association between childhood consumption of ultra-processed food and adiposity trajectories in the Avon Longitudinal Study of Parents and Children birth cohort JAMA Pediatrics 175, 9, e211573

Clegg, M.E & Cooper, C (2012) Exploring the myth: Does eating celery result in a negative energy balance? Proceedings of the Nutrition Society 71, E217

Cramwinckel, F.M et al (2013) The threat of moral refusers for Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

one's self-concept and the protective function of physical cleansing Journal of Experimental Social Psychology 49, 6, 1049-1058

de Cabo, R & Mattson, M.P (2019) Effects of intermittent fasting on health, ageing, and disease New England Journal of Medicine 381, 2541-2551

Delannoy-Bruno, O et al (2021) Evaluating microbiome-directed fibre snacks in gnotobiotic mice and humans Nature 595, 91-95

Deliza, R & MacFie, H (2001) Product packaging and branding. In Frewer, L.J et al (eds) Food, People and Society Berlin: Springer

Fiegel, A et al (2014) Background music genre can modulate flavour pleasantness and overall impression of food stimuli Appetite 76, 144-152

Fontana, L et al (2004) Long-term calorie restriction is highly effective in reducing the risk for atherosclerosis in humans Proceedings of the National Academy of Sciences, USA 101, 6659-6663

Gabel, K et al (2018) Effects of eight-hour time restricted feeding on body weight and metabolic disease risk factors in obese adults: A pilot study Nutrition and Healthy Aging 4, 4, 345-353

Gabel, K et al (2019) Safety of eight-hour time restricted feeding in adults with obesity Applied Physiology, Nutrition and Metabolism 44, 1, 107-109

Garbinsky, E.N & Klesse, A-K (2021) How (and when) the presence of food decreases enjoyment of customer experiences Journal of Marketing Research 58, 4, 705-720

Graham-Rowe, E et al (2015) Predicting household food waste reduction using an extended theory of planned behaviour Resources, Conservation and Recycling 101, 194-202

Hall, K.D et al (2019) Ultra-processed diets cause excess calorie intake and weight gain: An in-patient randomised controlled trial of ad libitum food intake Cell Metabolism 30, 1, 67-77

Harvie, M et al (2013) The effect of intermittent energy and carbohydrate restriction vs daily energy restriction on weight loss and metabolic disease risk markers in overweight women British Journal of Nutrition 110, 1534-1547

Hermann, B et al (2008) Anti-social punishment across societies Science 319, 1362-1367

Hollands, G.J et al (2018) Impact of reducing portion sizes in worksite cafeterias: A stepped wedge randomised controlled pilot trial International Journal of Behavioural Nutrition and Physical Activity 15, 78-92

Jones, A et al (2017) An evaluation of the healthiness of the Indian packaged food beverage supply Nutrients 9, 10, 1103

Kalam, F et al (2019) Alternate day fasting combined with a low-carbohydrate diet for weight loss, weight maintenance, and

Psychology Miscellany No. 157; 10th December 2021; ISSN: 1754-2200; Kevin Brewer

metabolic disease risk reduction Obesity Science and Practice 5, 531-539

Lawton, G (2020) Food for thought New Scientist 12th September, 34-38

Leshem, A & Elinav, E (2021) Designer fibre meals sway human gut microbes Nature 595, 32-34

Libby, P (2020) Statin drugs might boost healthy gut microbes Nature 581, 263-264

Meckel, K.R & Kirlyay, D.D (2020) Maternal microbes support foetal brain wiring Nature 586, 203-205

Motoki, K et al (2022) Is classical music sweeter than jazz? Cross-modal influences of background music and taste/flavour on healthy and indulgent food preferences Food Quality and Preference 96, 104380

Orlitzky, M (2017) Virtue signalling: Oversocialised "integrity" in a politically correct world. In Monga, M & Orlitzky, M (eds) Integrity in Business and Management, Cases and Theory New York: Routledge

Pechey, R et al (2019) Impact of increasing the proportion of healthier foods available on energy purchased in worksite cafeterias: A stepped wedge randomised controlled pilot trial Appetite 133, 286-296

Peng-Li, D et al (2021) Sounds healthy: Modelling sound-evoked consumer food choice through visual attention Appetite 164, 105264

Quested, T et al (2013) Spaghetti soup: The complex world of food waste behaviours Resources, Conservation and Recycling 79, 43-51

Reynolds, J.P et al (2021) Impact of decreasing the proportion of higher energy foods and reducing portion sizes on food purchased in worksite cafeterias: A stepped-wedge randomised controlled trial PloS Medicine 18, 9, e1003743 (Freely available at <https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1003743>)

Rochon, J et al (2011) Design and conduct of the CALORIE study: Comprehensive assessment of the long-term effects of reducing intake of energy Journal of Gerontology A: Biological Science and Medical Science 66, 97-108

Rodgers, R.F et al (2021) "Waste not and stay at home": Evidence of decreased food waste during the covid-19 pandemic from the U.S and Italy Appetite 160, 105110

Roe, L.S et al (2012) Salad and satiety: The effect of timing of salad consumption on meal energy intake Appetite 58, 1, 242-248

Shell, E.R (2019) Obesity on the brain Scientific American October, 30-37

Small, D.M & DiFeliceantonio, A (2019) Processed foods and food reward Science 363, 346-347

The Leader (2020) Food for thought New Scientist 12th September, p5

Tzachor, A et al (2021) Future foods for risk-resilient diets Nature Food 2, 326-329

Vieira-Silva, S et al (2020) Statin therapy is associated with lower prevalence of gut microbiota dysbiosis Nature 581, 31--315

Vuong, H.E et al (2020) The maternal microbiome modulates foetal neurodevelopment in mice Nature 586, 281-286

Wallis, C (2020) Feast and famine Scientific American September, p21

Wang, C et al (2021) Nut consumption in association with overall mortality and recurrence/disease-specific mortality among long-term breast cancer survivors International Journal of Cancer (<https://onlinelibrary.wiley.com/doi/10.1002/ijc.33824>)

Weindruch, R & Sohal, R.S (1997) Calorie intake and ageing New England Journal of Medicine 337, 986-994

Wilson, C (2021) Dangerously delicious New Scientist 12th June, 36-40

Wong, J (2020) Number crunching New Scientist 8th August, p25

Wong, J (2021) Do negative-calorie foods exist? New Scientist 22nd May, p24

Wu, W-L et al (2021) Microbiota regulate social behaviour via stress response neurons in the brain Nature 595, 409-414

Yeo, G (2021) The trouble with calories New Scientist 29th June, p20

Zeevi, D et al (2015) Personalised nutrition by prediction of glycaemic responses Cell 161, 1079-1094