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Review article

Breakfast: The most important meal of the day?

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ABSTRACT

Stating the obvious, we typically eat different foods at different times of day. But why should that be so? While much of this variation is likely down to cultural factors, the dietitians also have plenty to say on the matter of *what* we should be eating and drinking *when*, in order, for instance, to lose weight, or else to help enhance our cognitive performance during the course of the day. In recent years, many of the larger food companies have become increasingly interested in trying either to break into the profitable, not to mention growing, market for breakfast foods, or else to figure out how to convince more consumers to eat 'breakfast foods' at other times of day. In this review, I want to take a closer look at the psychological science behind the first meal of the day, highlighting why it may be even more important than most people think – both to the consumer but also the food industry more generally. Finally, I summarize a number of the current trends in the kinds of breakfast items that are becoming more/less popular, and consider what may be driving them.

Introduction

Breakfast is often described as the most important meal of the day, providing as it does sustenance and energy (i.e., calories) for whatever activities lay ahead. As nutritionist Adelle Davis famously put it back in the 1960s: *"Eat breakfast like a king, lunch like a prince and dinner like a pauper."* (Sifferlin, 2013).[1] According to the latest evidence, we should all be aiming to consume around 15–25% of our daily energy intake at breakfast (i.e., 300–500 calories for women and 375–625 for men; Spencer, 2017; though see also Betts et al., 2014). And yet the evidence from largescale surveys suggests that somewhere in the region of 18–25% of adults (Haines et al., 1996; Kant and Graubard, 2006; Spencer, 2017), and as many as 36% of adolescents in North America skip this putatively 'most important' meal (Seiga-Riz et al., 1998).[2]

There is, undoubtedly much cultural variation in the kinds of foods that different people like to eat at different times of day, as anyone who has stumbled across the sticky, slimy fermented soy bean dish known as *natto* at the breakfast buffet in Japan will know only too well. How could anyone contemplate eating *that* first thing in the morning? In fact, it would seem likely that there are more pronounced differences in how appropriate we find it to eat different foods at *this* time of day, as compared to at others, such as, for lunch or dinner, say. Despite these cultural differences, there is nevertheless a good deal of consistency within (and, on occasion, between) different cultures in terms of the kinds of items they choose to consume at the start of the day, not to mention growing interest in this meal (Cloake et al., 2017).

There have, of course, also been significant changes over the course of history. What we in the West eat for breakfast today is certainly very different from what previous generations would have thought it appropriate to eat. For instance, the notion that breakfast cereals constitute standard fayre is something that has only been common practice since the closing years of the 19th Century / early 20th Century (see Gitlin and Ellis, 2012; Severson, 2016a, for a history of breakfast cereals). As we will see later, though, the last few years have seen a dramatic drop in sales of both breakfast cereals and orange juice, both of which would have been stalwarts of the breakfast table only a few decades ago.

A large and growing body of scientific evidence now supports the claim that breakfast really is a very important meal. The first thing to take note of here is how the failure to eat something at the start of the

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[1] According to press reports, the astronauts on NASA's planned long distance Orion mission around the far side of the moon are going to be given a calorie-dense food bar for breakfast. Each bar containing somewhere in the region of 700–800 calories. The flavours that are currently on offer include banana nut, orange cranberry, ginger vanilla, and barbecue nut (see Mathewson, 2016). These breakfast bars have been especially designed to deliver the fuel that the astronauts will need at the start of their day, while at the same time minimizing the space/mass required to deliver all the nutrition that will needed in the small spacecraft for the duration of the astronauts' journey.

[2] Though, the situation may have changed over the last 15 years if the results of surveys conducted by the NPD group are to be believed (see Chamlee, 2016). According to these surveys, the average number of breakfast meals eaten by North Americans in 2015 was 361 – that is almost every day!

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day can have surprisingly serious health consequences for those concerned. For instance, Cahill et al. (2013) documented a 27% increase in coronary heart disease amongst those North American men who regularly failed to eat a meal at the start of the day.[3] Though, on the negative side, eating high-fat breakfasts too often has recently been demonstrated to increase the risk of atherosclerosis (see McFarlin et al., 2016).

Of course, what we consume first thing in the morning is as much about mental alertness as it is about providing fuel for the body. Many people drink coffee because they believe, erroneously as it turns out, that it improves their alertness.[4] Intriguingly, the evidence from an analysis of three large-cohort studies (N > 200,000 North American men and women) conducted by the Harvard School of Public Health demonstrated that consuming a couple of cups of caffeinated coffee a day literally halved the suicide rate (Lucas et al., 2014). The suggestion being that the moderate consumption of caffeine has a mild anti-depressant effect. So, taken together, the epidemiological research clearly suggests that what we eat and what we drink first thing in the morning can both exert a pretty dramatic effect on both our health and mental well-being.

The general advice from the health experts is to eat a substantial well-balanced breakfast, one that delivers its energy slowly over the course of the morning.[5] Indeed, the failure to eat (a well-balanced) breakfast has been documented to have a deleterious impact on cognitive performance, with the academic performance of school-aged children being the focus of much of the research in this area (e.g., Mahoney et al., 1998; Murphy et al., 1998; Wesnes et al., 2003). The argument is that improving cognitive performance may be especially important amongst those of school age (see Adolpus et al., 2013; and Pollitt and Mathews, 1988, for reviews). However, the latest epidemiological results from Finland suggest that eggs can also enhance cognitive performance in middle-aged men too (Ylilauri et al., 2017).

One of the latest statistics that is giving many healthcare professionals real cause for concern is that British children under 10 years of age are currently consuming more than 50% of the recommended daily allowance of sugar at breakfast (c. 11 g) in the form of sugary cereals, drinks, and spreads (see Taylor, 2017).[6] Such patterns of consumption obviously fall a long way from the notion of a healthy, well-balanced breakfast that we often hear about. And perhaps most worrying of all, a recent survey conducted for Public Health England's Change4Life campaign found that many parents were unsure as to what makes up a healthy breakfast for their children. Specifically, 84% of parents whose children were found to be consuming more than 50% of their daily recommended dose of sugar before school started, actually considered that their child's breakfast was healthy (see Public Health England, 2017)!.

Matters are unlikely to be helped by a recent report from Japan suggesting that eating ice-cream on waking-up helps make people smarter (at least temporarily).[7] Note that although this story was widely covered by the global press (e.g., Pettit, 2016), it is hard to find a peer-reviewed academic research study to back-up this particular claim. Perhaps this is, in part, because Prof. Kago, the researcher behind the project, apparently only compared brain activity in those who ate ice-cream with those who ate nothing. If so, it would be impossible to say for sure whether it was ice-cream, in particular, or just eating 'anything' at all, that led to effects he reported.[8]

Meanwhile, Jakubowicz et al. (2012) garnered almost as much media attention a few years back with their suggestion that complementing one's regular breakfast with a slice of chocolate cake could help reduce sweet pangs later in the day (e.g., see Telegraph Reporter, 2012, for one such example). The idea in this case was that eating a slice of cake (or rather, a high carbohydrate and protein breakfast) might help those who wanted to lose some weight. The study was conducted on nearly 200 obese participants over a six week period. In this case, at least, there was a peer-reviewed academic publication underpinning the research.

Physiological changes

However, beyond any cultural factors and the latest dieting trends being peddled by the health consultants and nutritionists, one can ask whether there are any more fundamental factors at work, governing what we eat when, during the course of the day. There are certainly a number of important diurnal variations (circadian rhythms; e.g., Aschoff, 1965) that may underpin, at least in part, our food behaviours/preferences. The most important of which may well be the diurnal changes in our ability to detect sweetness. According to research conducted by Nakamura et al. (2008), we are significantly more sensitive to sweetness in the morning, while we find it significantly harder to detect this basic taste toward the end of the day. Intriguingly, however, no such diurnal variation was observed in this study for the other basic tastes (salt, sour, bitter, or umami). [9] The suggestion here is that the change in sweetness perception may help regulate our food intake. [10]

Another important diurnal rhythm is known as the cortisol awakening response (CAR; see Fries et al., 2009). Specifically, in humans, it has been shown that the secretion of cortisol from the adrenal glands follows a diurnal cycle, exhibiting a profound increase after awakening. The suggestion is that the anticipation of the day ahead is of major relevance for the magnitude of this response, which shows up as a 50% increase in cortisol levels on wakening. In fact, the CAR is the reason why consuming that caffeinated coffee straight after waking (or at breakfast) might not necessarily be the best idea (see Miller, 2013), since caffeine (e.g., in coffee) also stimulates the release of cortisol (e.g., see Lovallo et al., 2005).

Under normal circumstances, the peak production of cortisol occurs between 8 and 9 am; Meanwhile, survey results suggest that the majority of those who eat breakfast do so somewhere between 6 and 10 am, with the peak occurring at around 8 am.[11] As such, if one puts the various research together, the suggestion is that people would do

[3] Cahill et al. (2013) also documented a 55% higher incidence of coronary heart disease amongst those men who ate after going to bed as compared to those who did not. You have been warned!

[4] Contrary to the everyday intuition, though, the evidence suggests that while caffeine can help stave off caffeine-withdrawal in those who are regular consumers but who have been deprived, it doesn't actually increase alertness (see Rogers et al., 2010). One important point to note about the latter study is that the participants were given pills (either caffeinated or placebo). Hence, it remains unclear, on the basis of just this study, whether specifically coffee aroma might exert an alerting effect over people's performance (though see Smith et al., 1992, for evidence that it really is the caffeine, rather than the coffee aroma, that is doing the work). Though, the suggestion not to drink caffeinated coffee before going to sleep does appear to have a sound scientific footing (e.g., Drake et al., 2013).

[5] Hence, why oatmeal is often championed over ready to eat breakfast cereal (or, worse still, no breakfast). The former breakfast provides a slower and more sustained source of energy, and consequently results in more prolonged cognitive enhancement as compared to those who were given low-fiber high glycemic ready-to-eat cereal (Mahoney et al., 2005; see also Benton et al., 2007; Ohlsson et al., 2016).

[6] And, worse still, by the end of the day they will likely have consumed three times the recommended daily intake. Of course, it is hard not to consume too much sugar when the average serving of cereal actually contains a whopping 12g of sugar, all added (Lustig, 2017). Furthermore, according to a commentary by Lustig that appeared recently in The Guardian newspaper, in the US, the Environmental Working Group (2011): "*identified 17 breakfast cereals marketed to children in which added sugar constituted more than 50% of calories, and 177 with 40% or more.*" A subsequent report published in 2014 argued that nothing had changed in the intervening 3 years (see Environmental Working Group, 2014).

[7] It increases alertness and high-frequency Alpha brain wave activity, apparently.

[8] See Letzter (2016) for critical coverage of the reporting of this industry-funded 'study' in the press.

[9] Though note that others have reported diurnal variation in our sensitivity to the salt taste of sodium chloride (see Irvin and Goetzl, 1952).

[10] The recognition threshold for detecting sweetness is tied to circulating plasma levels of the hormone leptin.

[11] These figures coming from the results of a survey of eating habits over the 2 years 2013–2015 from the NPD group (see Chamlee, 2016).