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The Evolutionary Memetics of Obesity

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ABSTRACT This article proposes a memetic approach towards the history and current high prevalence of obesity in human societies. Due to the apparent absence of genetic evolution related to obesity, a traditional gene-culture coevolutionary perspective may no longer be valid. A memetic approach helps to identify decisive historical steps in the formation of obesogenic environment. Memetics may be even more useful for interpretating current obesity-related debates on the internet, and it may also partially explain the usually modest success of healthy lifestyle–oriented public health campaigns. Thus, the authors recommend the use of positive memetics as part of the social marketing of healthy diets and lifestyles.

Obesity has become the most significant preventable health problem in the world. Although the primary cause of obesity is obvious—namely, that energy intake in a given time period exceeds energy

consumption—efforts to reduce the intake of energy-rich foods in the diets of obese patients have largely failed (Sellayah et al. 2014; Velema et al. 2018). The main dietary shift that has occurred in Western human populations involves the introduction of industrially processed food that contains refined products such as carbohydrates and oil and additives such as sweeteners and gluten (Berticat et al. 2020).

Hippocrates is reported to have warned about the adverse health effects of obesity (Malomo and Ntlholang 2018). Although we have no statistical evidence of the prehistoric or historic prevalence of fatness, most scholars concur that obesity was not a widespread physical condition in the past. Still, there have probably always been obese individuals. In earlier times, obesity was most likely concentrated in the upper social strata of human communities, among those who were less susceptible to the undernourishment or hunger that afflicted less privileged members of communities. Access to abundant high-quality food has probably always been a status symbol, or as Albala (2002) phrased it: "An exquisite dish makes the eater exquisite" (184). However, since the onset of modern food industries in the late 19th and early 20th centuries, a great democratization of obesity has taken place. As Hill and Peters (1998) have pointed out, a selection of highly palatable and inexpensive foods is now available nearly everywhere in industrial countries. Furthermore, the prevalence of obesity is increasing in every region of the world (Swinburn et. al. 2019). In a great majority of countries, there are now more obese than underweight people (NCD Risk Factor Collaboration 2024).

The globally high prevalence of obesity requires a combination of biological and cultural explanations (Bellisari 2008; Tinning 2014; Wells 2006). In this article we present a memetic view of the history and current high prevalence of obesity. Although not a very well-defined field of research, *memetics* refers to the study of the replication, spread, and evolution of memes (Heylighen and Chielens 2009; Tinning 2014). The *meme,* a now popular concept for the basic unit of cultural transmission, was originally introduced by Richard Dawkins (1976), who observed that "Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation" (206). Based on this definition, a meme is a more-or-less indivisible cultural unit that can be

relatively easily imitated and spread across human populations, nowadays often via the internet (Akinsanya 2024; Leigh 2023; McNamara 2011).

From a memetic perspective, the current high prevalence of obesity is an outcome of changes in the memetic environment that in affluent countries has resulted in overabundance of energy-rich processed foods, combined with our biological propensity to accumulate fat (Wells 2006). Even the idea of obesity crisis itself has been considered a meme (Tinning 2014). In parallel with polygenic inheritance in biological evolution, a high number of interrelated memes is probably involved in all significant memetic processes. Dawkins (1976) called them coadapted mutually assisting memes, or *meme complexes*. The latter term has been shortened to the form *memeplex*. Memeplexes are collections of mutually supporting memes, which tend to be linked to each other and coevolve (Heylighen and Chielens 2009; Leigh 2023). In practice, defining individual memes—and especially identifying boundaries between memes belonging to the same memeplex—will always be challenging (McNamara 2011; Tinning 2012, 2014).

Obesity and Evolution

It has been argued for a long time that our biological tendency to become obese evolved in our prehistoric environment. We have a biological tendency to prefer high energy foods that in the past were essential for our survival and reproduction (Wells 2006). According to the so-called “drifty gene” hypothesis, our ancestors gradually gained the ability to defend themselves against large predators with the help of social hunting, fire, and stone tools and weapons. Speakman (2008) claims that the resulting decrease in predation risk allowed humans to become overweight or obese, as there was no longer an urgent need to stay agile enough to escape rapidly from natural enemies. Genes related to obesity started to spread partially due to lack of predation-related selection, and partially due to random genetic drift in small populations.

A related theory, the “thrifty gene” hypothesis originally proposed by Neel (1962), claims that although the Neolithic revolution and start of agriculture increased food security, most human populations

were still subject to periodic famines and food scarcity. People with thrifty genes could use food energy more efficiently and thus avoided death or low fecundity (Wu and Xu 2023). The capacity to store fat was thus an essential component of human survival strategy before the onset of industrial revolution (Wells 2006).

A third evolutionary perspective on the current high prevalence of obesity stems from the theory of gene-culture coevolution, which involves close interaction between genetic and cultural information transmission systems (Boyd and Richerson 1985; Lumsden and Wilson 1981). Genes, physiology, and external stimuli obviously make us hungry, while cultural evolution has produced the luxurious supermarkets that in affluent countries more than fulfil our dietary needs. According to Gintis (2011), the essence of gene-culture evolution is "that life-forms affect their own environment and the environments they produce change the pattern of genetic evolution they undergo" (885). A textbook example of such interaction between the two processes is the relatively recent evolution of lactose tolerance in several human populations. Lactose tolerance has increased in frequency since the onset of human utilization of dairy products, suggesting that easy access to milk products has promoted the genetic evolution of lactose tolerance alleles (Vuorisalo et al. 2012).

A problem with the gene-culture coevolutionary perspective is the apparent lack of genetic evolution related to obesity in modern societies with ample energy-rich food resources. According to Wells (2006), genes that evolved in environments of scarcity cannot be expected to accommodate rapid changes towards energy abundance. This has resulted in a mismatch between our environment and genetics. Probably due to this, it has been argued that from the evolutionary perspective, obesity should not be regarded as a disease, but instead "as a normal response to an abnormal environment, rather than vice versa" (Egger and Swinburn 1997, 477). Today's "obesogenic" or "toxic" environment in many countries with constant access to overabundance of energy-rich foods is something our ancestors rarely experienced (Bellisari 2008; Velema et al. 2018; Wells 2006). Some scholars have therefore suggested that instead of focusing on weight loss programs, we should try to influence the environments that facilitate the high incidence of obesity (Egger and Swinburn 1997; Velema et al. 2018; Wells 2006).

However, labelling particular environments as normal, abnormal, or toxic is questionable. What is normal or abnormal depends on animal species, and "abnormality" only means that a particular environment presents challenges to the prevailing genotypic composition of animal (or human) populations. In evolutionary history, populations and species have adapted by genetic change to nearly any kind of environments. An alternative perspective to the question of normality stems from Dawkins's second influential concept, the extended phenotype. According to Dawkins (1982), the impacts of individuals' genes are phenotypically expressed not only in the individual itself, but also in the external environment of the individual, as exemplified by spider webs or the dam structures of beavers. In humans, the cumulative extended phenotype of mankind would thus encompass our cultural environment in all of its manifestations, including megacities and today's overabundance of obesogenic food items. From Dawkins's extended phenotype perspective, today's obesogenic environment is no less normal than our hunter-gatherer ancestors' hunting grounds in the savanna or in mammoth steppe ecosystems.

Historical Memeplexes and the Obesogenic Environment

Table 1 presents in a simplified form three historical and obesity-promoting memeplexes either related to physical safety (drifty gene hypothesis), enhanced food security (with periodic famines; thrifty gene hypothesis), or improved availability of processed carbohydrate products. They represent sequential steps in the history of global food production, from the Paleolithic (physical safety) and Neolithic (food security) to the Industrial (availability of processed carbohydrates). The first two memeplexes are related to highly relevant evolutionary hypotheses concerning the early origin of obesity. In what follows, we focus on the third, historically most recent, memeplex.

<Table 1 about here>

The food technological memes in Table 1 are all related to the mass production of high-energy carbohydrate products. There is no doubt, for instance, that increased availability of added sugar has contributed to the obesity problem (Zobel et al. 2016). Global sugar production was revolutionized in the early 19th century with the introduction of the sugar beet. This required two important technological

memes. The first was introduced in 1747 by a German apothecary, Andreas Marggraf, who managed to obtain sugar crystals from beets (Arrington 1967). The second technological meme was introduced by Jean-Baptiste Quéruel, who in 1811 developed a process that made industrial-scale production of sugar from sugar beets possible. Emperor Napoleon reacted immediately to this interesting discovery, and in a decree of March 25, 1811, he established the world's beet sugar industry (Arrington 1967). This new source of sugar gradually eliminated European dependence on cane sugar imports from the politically unstable and remote Caribbean, and it guaranteed local access to a cheap sweetener of various food products.

Another source of high-energy carbohydrates is wheat. The most widely grown and most extensively traded cereal internationally, wheat may have had the greatest impact on the history of the human race (Campbell 2007). The important technological meme related to wheat was the introduction of the roller mill in the late 19th century (Campbell 2007). In this new method, the wheat grain was crushed between porcelain rollers, which provided millers with a far greater degree of control over the grinding process. Roller-milling was both quicker and cheaper than the traditional stone-milling method, and it made possible the production of flour of any desired degree of fineness. Campbell (2007) has summarized the technology's importance : "From its invention in 1873, the roller mill triumphed rapidly over millstones, such that by the turn of the century the revolution was essentially complete. The factors of wheat hardness, international grain trade and bread quality that gave rise to its birth are still those that dominate the practice of flour milling today" (399).

An interesting by-product of the roller mill revolution was the great expansion of the biscuit (both cookies and crackers) industry. According to Burnett (1989), the improved availability of standard-quality flour was essential to biscuit makers, whose success depended on maintaining uniform or standardized products of high purity. England was the pioneer country for large-scale manufacture and export of both biscuits and biscuit technology (Edwards 2019). By 1898, the leading biscuit company Huntley and Palmers was already producing more than 400 varieties of biscuits. From the start, biscuit marketing was very much aimed at children, and by the First World War, sweet biscuits had already become a genuinely

global convenience food that was in some countries consumed daily (Edwards 2019).

Our third case of memes in food technology is chocolate, the most craved food in the world (Latif 2013). According to a survey, 52% of adult North Americans consider chocolate as their favorite flavor, and 71% of North American chocolate eaters prefer milk chocolate (World Atlas of Chocolate 2019). The main technological memes for the mass production of chocolate have been described by Coe and Coe (2019). In Great Britain, the Fry enterprise discovered a technique to mix cocoa powder and sugar with melted cacao butter. This technological meme resulted in the first real chocolate bars, exhibited in the Exhibition of Industrial Arts and Manufacturers in Birmingham in September 1849. True milk chocolate, in turn, was invented in Switzerland as an outcome of collaboration between Henri Nestlé and Daniel Peter (Coe and Coe 2019). The first milk chocolate bars were made in Switzerland in 1879. In the same year, a so-called "conching" method was developed to further improve the quality of chocolate confectionery. With these innovations, and ample access to cheap cane or beet sugar, chocolate production started to increase rapidly. Imports of cocoa for national consumption in England increased fivefold from 1865 to 1890 (Burnett 1989).

World War II greatly promoted the mass production of high-energy luxury food items, chocolate included. Even before the war, the Hershey Chocolate Corporation started to cooperate with the US Army in the production of the so-called Ration D Bar. During the war, confections or chocolate bars were included in the dinner and supper units of the K rations for US Army mobile troops (Rees 2022). In 1939, Hershey was producing 100,000 ration bar units per day; by the end of 1945, the production lines on three floors of their factory were producing approximately 24 million units per week. It has been estimated that from 1940 to 1945 over 3 billion D Ration and Tropical Bars were distributed to American soldiers in different parts of the world (Hershey Archives 2018). In total, about a dozen Hershey chocolate products were used by the military (Hershey Archives 2010). It is very likely that the continued mass production of chocolate products in the postwar decades partially stems from the experience of World War II (Jacobson 2016).

Obesity Memeplexes on the Internet

Internet memes are often culturally significant symbols that are humorous and widely circulated on digital platforms (Akinsanya 2024). Typical targets of internet memes are politicians or celebrities who have done something controversial. However, internet memes have also become popular means through which people can express their thoughts on pressing issues such as health matters. In current online discussions, it is easy to discern at least two obesity-related memeplexes that differ in their contents and objectives: the Body Negativity memeplex and the Body Positivity memeplex.

The Body Negativity memeplex echoes the concerns of national health administrations but in a negative way. As Kirkland (2008) notes, in the Body Negativity memeplex, being fat is highly stigmatized. Possibly due to prevailing mass media coverage, most people attribute fatness to unwise individual choices and behaviors. Further, the prevailing neoliberal political philosophy emphasizes individual responsibility for well-informed and health-affirming personal lifestyle decisions (Tinning 2014). In the neoliberal context, healthy citizens are regarded as being more productive members of society.

Akinsanya (2024), who studies internet memes related to obesity in the US, has found that negative body image framing related to fatness dominates in internet memes. Obesity is represented as unattractive, reinforcing stereotypes and the stigmatization of obesity in society. A category of the obesity memes "projects obese individuals as indolent people who prefer to stay idle rather than be involved in a minimal activity that could help them exercise their body and keep them fit," and such negative body image framing "reinforces the societal ideology that every overweight person is lazy, which is also stereotypical as it reflects a negative personality for the obese persons" (16). Some internet material related to the Body Negativity memeplex can be considered highly offensive and questionable (Bunzel et al. 2023).

Not surprisingly, such stereotypical images of obesity have induced reverse movements on the internet that are commonly known as either the fat acceptance movement or as the body positivity movement (Kirkland 2008; Sastre 2016). We call these memetic assemblages the Body Positivity

memeplex. The Body Positivity memeplex is critical of narrow Western beauty ideals, or the "cult of the body," that privilege white, slim, cis-gendered, and physically fit individuals (Petersen and Lupton 1996; Sastre 2016; Tinning 2014). There are several body positive web spaces that encourage the circulation of empowering body images and advocate for the visibility of bodies that do not fit mainstream beauty norms (Sastre 2016). However, although understandable from the human rights and psychological perspective, the Body Positivity memeplex can be considered problematic from the point of view of national health targets.

Discussion

Based on our analysis of the evolutionary memetics of obesity, we have reached three main conclusions. First, as the gene-culture coevolutionary approach has more or less lost its validity due to a lack of population-level genetic response to the changes in our food consumption patterns, we need to shift our focus—at least in modern affluent societies—towards the cultural evolution of obesity. Second, while it is possible to apply a memetic approach to obesity-facilitating historical steps in global food production, a memetic approach may prove even more useful for understanding the current obesity-related debates on the internet. Third, a comparative memetic approach might help us identify faults or weaknesses in our current public health approaches to obesity.

Our three historical cases show that it is relatively easy to identify individual memes and memeplexes in the past that have contributed to the current high prevalence of obesity. Industrial food production, together with revolutionary advances in agricultural productivity during the Green Revolution, have remarkably decreased global concerns about food security (Jain 2010). Contrary to Malthusian predictions, food production so far has grown more or less at the same pace as human population, while obesity has emerged as a serious and increasing global health concern. Due to generally improved food security, it has been possible to include zero hunger in the UN Sustainable Development Goals (SDGs) as target number two (UN 2024).

As noted earlier, our extravagant supermarkets can be considered as components of our extended

phenotype. In this sense, our obesogenic environments are no less “normal” than environments of any other species. However, from the nutritional point of view it makes sense to pay attention to our “toxic” environment. Instead of focusing on weight-loss programs—or perhaps in addition to such programs—we could attempt to influence the environments that promote overeating or obesity (Folkvord and Hermans 2020; Velema et al. 2018).

One increasingly popular means of promoting healthy diets is nudging. Thaler and Sunstein (2008) define nudging as any aspect of “choice architecture” that alters individuals’ behavior in a predictable way without excluding any other choice options. The target of nudging is to steer a “reluctant or ignorant” public towards goals, such as healthy diets, that are considered to be in the best interests of society (Chriss 2015, 000). Nudging may involve increasing the attractiveness of healthy food products, for example, by more aesthetic packaging or by reasonable pricing. Velema and colleagues (2018) observed in their empirical study of nudging that the attractive display placement of healthy products in worksite cafeterias had a positive influence on purchases. On the other hand, some consumers may resent too obvious attempts to socially control or even “manipulate” their purchase decisions (Chriss 2015). Overall, the success of nudging projects has been variable (Velema et al. 2018).

Novel memetic approaches can also be found in the medical care of problems related to obesity. Recently developed medications based on incretins—a group of metabolic hormones that stimulate a decrease in blood glucose levels and slow the rate of absorption of nutrients into the bloodstream (Bailey et al. 2025; Chetty et al. 2024)—are now being used to treat type 2 diabetes mellitus and obesity, and their use is expanding worldwide. However, the first iterations of these drugs are injectable and expensive, and it is not known whether patients will need lifelong treatment. Due to their high cost, these medical solutions are so far available only to a wealthy minority of patients.

Because the two dominating memeplexes—Body Negativity and Body Positivity—aggressively support their own respective views, neither is likely to ameliorate the obesity problem. A more promising approach would be to emphasize positive memetics in the social marketing of healthy diets and lifestyles. Social marketing is the systematic application of standard marketing principles to achieve specific

behavioral goals for a social good (Kotler and Zaltman 1971), such as the promotion of family planning, safe driving, or healthy lifestyles (Chriss 2015).

Dawkins (1976) claimed that a successful meme or meme complex must have great psychological appeal. Leigh (2023) lists characteristics of such successful memes:

> Just as seeds may come wrapped in attractive packages, such as delectable fruits which are vehicles of their dispersion, so do memes wrap themselves in attractive packages, which may be themselves memes. Thus, memes packaged attractively, e.g., esthetically pleasing, spiced with sex and/or violence, will be memes that are more easily swallowed by the consumers. (129)

According to Heylighen and Chielens (2009), creating successful memes is "the Holy Grail of marketing research," as all competing brands attempt to become as widely known as possible.

Why not utilize memetics to more attractively package the recommendations included in numerous public health programs and campaigns? Although this has been attempted in some nudging programs (Velema et al. 2018), we are not aware of any studies that have evaluated the psychological appeal of public health projects from the memetic perspective. Chriss (2015) has claimed that "in order for such interventions [for healthy lifestyles] to be effective, they must meet with the approval of the public, and . . . more subtle ideas of nudging a reluctant public toward desired outcomes should be employed" (59). This suggests that in order to succeed, governmental or other top-down campaigns that aim to promote public health (at least on the internet) should be designed according to sound memetic principles (Heylighen and Chielens 2009). (Perhaps paradoxically, the tobacco industry offers models of successful meme marketing for healthy lifestyle campaigns; see Toll and Ling 2005.)

At present, the most promising cases of positive memetics in the health sector may be found in physical education. Tinning (2012, 2014) has studied physical education from a memetic perspective, and he has defined physical education as a memeplex that includes such component memes as systematic bodily exercise and sports as games play. As he notes, "Physical education is itself a product of the global flow of ideas. Physical education is an idea, and a set of cultural practices that embody the idea" (Tinning

2014, 116). He further suggests that the next dominating idea of physical education will center on the obesity/exercise memeplex (Tinning 2014). Memes that belong to this memeplex are all linked to the role of physical exercise in weight management and control, and the amelioration of obesity would serve as the primary purpose of physical education.

There is evidence for wide acceptance of obesity/exercise memes, not only within governmental health-care programs, but also in school and university curricula, especially within the field of kinesiology (Tinning 2014). If positive memetic social marketing is applied in other types of health-oriented campaigns, it may have more success than traditional top-down governmental campaigns. However, in the "global village" created by social media healthcare campaigns compete with other, possibly more attractive memes. To be psychologically appealing memetic campaigns for healthier life-styles should be specifically targeted to diverse cultural backgrounds, and take into account the needs and values of different groups of age and gender among recipients. It is unlikely that any single memetic campaign could prove successful for all recipient categories.

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Table 1

Historical facilitator memes and memeplexes that have promoted obesity

Memeplex		**Memes**
Paleolithic	Hunter-gatherer	Social hunting; stone tool technologies; use of fire (drifty gene hypothesis)
Neolithic	Agriculture	Plant and animal domestication; shifting cultivation; sedentary cultivation (thrifty gene hypothesis)
Industrial	Food technology	Sugar beet industry (1747, 1811); roller milling of wheat (1873); chocolate production (1849, 1879, WWII)