**NARRATIVE REVIEW**

**Have people always been fat? An historical enquiry.**

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**Objective.** Some investigators claim that obesity has always been a feature of human society, but others maintain that obesity was absent from traditional hunter-gatherer communities. Resolution of this issue is important to prevention and treatment. Can obesity be avoided by the rigorous daily activity and limited availability of food found in many hunter-gatherer groups, or is the accumulation of body fatan inevitable consequence of the human genome ? **Methods.** A narrative review has gathered available information on eating habits, habitual daily physical activity and body fat accumulation over various historical eras, ranging from the earliest Paleolithic and Neolithic communities to Victorian society.  **Results.** The success ofPaleolithic and Neolithic communities generally depended upon high levels of daily energy expenditure, and despite the discovery of some obese "Mother Goddess" figurines, studies of small communities that have maintained a Neolithic lifestyle still show very low levels of body fat.With the development of settled societies based upon an agricultural economy, an economic surplus and social stratification allowed the emergence of a growing upper echelon of society that could over-eat and engaged in too little physical activity. However, the widespread prevalence of obesity across developed societies is a late 20th century phenomenon, associated with ever-decreasing needs for energy expenditure in daily life, reduced opportunities for deliberate leisure activity in mega-cities, the promotion of over-eating and unhealthy diets by commercial interests, and possibly a greater public acceptance of obesity.  **Conclusions.** Obesity is typically an expression of over-eating and inadequate habitual physical activity. Although there are occasional pathological causes, an excess of body fat is a health problem that could be resolved quite readily for most people by a disciplined return to the dietary and physical activity patterns of earlier generations.

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**Introduction**

 Over the past 20 years, much attention has been focused upon an obesity epidemic affecting not only North America, but also many other developed and developing nations (GBD 2013 Obesity Collaboration, 2014; World Health Organisation, 2014). Perhaps as a consequence of this attention, we tend to regard an excessive accumulation of body fat as a modern problem, brought about by a combination of over-eating in response to the wiles of giant commercial food distributors, intent to increase our consumption of their products, by industrial automation with ever more sedentary work, and by a progressive reduction of daily energy expenditures in our leisure time.

 In exploring the lifestyle of successive cultures from the Paleolithic world through to Victorian times, this historical review in general supports the thesis that obesity was the exception rather than the rule during most of antiquity. Nevertheless, it also highlights some seemingly well-documented examples of gross obesity from the early history of humankind, a finding that some have interpreted as evidence that the ability to store fat was an early adaptive feature of human evolution (Bray, Bouchard, and James, 2003). We note further that the potential for people to become obese generally seems to have followed the transition from a hunter-gatherer society to settled agricultural communities, where an economic surplus allowed social stratification, and an elite of wealthier individuals could opt to over-eat and engage in little physical activity. As we explore the phenomenon of obesity, it will become apparent that many of the healers and physicians of antiquity recognized over-eating and a lack of physical activity as twin causes, and that they proposed as staples of treatment a regimen that embraced a moderation of food intake, accompanied by regular and vigorous physical activity.

**Fig. 1**. The Venus of Willendorf: a grossly obese historical artifact discovered in Austria. Source: https://en.wikipedia.org/wiki/Paleolithic#/media/File:Wien\_NHM\_Venus\_von\_Willendorf.jpg



**Paleolithic and Neolithic communities**

**Paleolithic era**.

 The Paleolithic era, also known as the Old Stone Age, was marked by the fashioning of tools formed from chipped stone and antlers. This phase of history extended from some 2.5 million years ago to about 10,000 BCE. Given the lack of written records, inferences about the likelihood of obesity in Paleolithic communities have been limited to a knowledge of the economy and a study of cave art and occasional artifacts.

 ***Paleolithic economy*.** The economy of the Paleolithic people was based upon the hunting of wild animals and birds, fishing, and the gathering of berries, nuts and roots. In most habitats, this would likely have implied a life of hard physical labour, with the sharing of what was a rather limited amount of food among members of the community. Inferences are supported by 20th century studies of communities that have maintained a Neolithic lifestyle (below). The available resources would hardly have predisposed to the development of obesity, an argument supported by measurements of body fat content in communities still following the Neolithic way of life (below).

 ***Paleolothic artifacts*.** Cave art and a small number of carved idols have been found across Europe, from south-western France to Russia. Many of these items date back to 25,000-30,000 BCE. The cave art has not contributed much to arguments about the prevalence of obesity during this era, but the unearthing of a number of pudgy miniature idols has stimulated much discussion. The most famous of these relics is the Venus of Willendorf, a small statuette found near Krems, in Lower Austria (Stéphen-Chauvet,1936). This particular artifact is characterized by pendulous breasts and marked abdominal obesity (**Fig. 1**).

 Bray et al. (2003) listed a number of similar Paleolithic and Neolithic artifacts that archeologists had discovered in digs over at least 8 sites in Europe. The idols were carved from ivory, limestone, serpentine or terracotta. All appeared to represent very obese women. Bray et al. (2003) cited the earlier verdict of the French physician Hautin (1939): *"The women immortalized in stone age sculpture were fat; there is no other word for it*." Bray et al. themselves concluded "*That obesity was known in this early period is evident from Stone Age artifacts."* More recently,Josza(2012) has reinforced this viewpoint; in a study of photos or copies of 100 Paleolithic statues, 97 of which were of women, he noted that 24 were skinny, 15 of normal weight, and 51 were overweight or obese.

 Nevertheless, there is no good evidence that either these chubby idols or some of the slim athletic statues of male deities were in any way representative of the Paleolithic population. Episodes of starvation make obesity an unlikely occurrence (Colman, 1998). The figurines with their exaggerated female sexuality are more likely to have been idealized primordial female deities, fertility goddesses or more general symbols of the bounty of the earth; some authors have even suggested that they werea form of Stone Age pornography (Beller, 1977; Gimbutas, 1991; Guthrie, 2006; Stone, 2012).

**Neolithic era.**

The Neolithic era or New Stone Age began around 10,000 BCE, and in various parts of the world it continued to 4500-2000 BCE, ending with the introduction of copper, bronze and iron tools. The Neolithic economy was generally similar to that of the Paleolithic people. A few obese artifacts have again been discovered from this period, but studies of continuing Neolithic communities provide more direct evidence on levels of habitual physical activity and the resulting accumulation of body fat.

**Fig. 2**. Woman of Catalhöyük, Turkey, from about 6000 BCE. Source: https://en.wikipedia.org/wiki/Seated\_Woman\_of\_%C3%87atalh%C3%B6y%C3%BCk



 ***Neolithic economy*.** In some areas, dogs, sheep and goats were domesticated, and groups began to experiment with the cultivation of crops. But many Neolithic communities maintained a hunter-gatherer lifestyle. Some populations had access to animal protein such as caribou or fish, but for many the diet was based upon fruits, vegetables, underground tubers, and, in some parts of Africa, honey. In general, game was scarce, and the traditional sharing of the proceeds of the hunt among the whole community reduced the likelihood of individual over-eating. Moreover, the physical energy expenditures demanded by many types of hunting were extremely high, militating against obesity.

 ***Neolithic artifacts*.** Caricature-like representations of an obese Mother Goddess continued into the Neolithic era.

 One example of such idols was found at Catalhöyük, a proto-city that flourished in southern Anatolia, around 5500 BCE. A clay figurine featured a naked woman seated between two lions. Her hips, belly and breasts qre exaggerated, and the genital areas are marked by a triangular decoration; possibly she was in process of giving birth at the time of the sculpture (**Fig. 2)**. Again, there is no strong reason to suppose that such representations of a Mother Goddess figure were in any way representative of the body build of the general female population.

 ***Direct evidence of habitual physical activity and body composition*.** During the 1960s, the Human Adaptability (HA) Project of the International Biological Programme (IBP) made detailed examination of many hunter-gatherer societies that were still relatively isolated from the modern world, and maintained something closely approaching a Neolithic lifestyle (Weiner, 1964). Among the mass of information that was collected during the IBP-HA project, objective data were obtained for the average heights, body masses, and skin-fold thicknesses for many "primitive" communities. These findings confirmed that in such populations the average stores of body fat were generally small. In some communities, evidence was also obtained of very high daily energy expenditures (Shephard, 1978).

 *Excess body mass*. In almost all of the populations that were examined by the IBP-HA, the average body mass showed a substantial deficit relative to actuarial ideals for white populations (Society of Acuaries, 1959), for example: Bantu, -4.7 kg; Tanzanians, -2.7 kg; Easter Islanders, -0.0 kg; Ethiopians, -10.3 kg; Jamaicans, -5.3 kg; Nigerians, -3.9 kg; Tanzanians, -2.7 kg; Trinidadians, -2.4 kg; and Zaireans -7.4 kg. Such findings suggest a low body fat content, although findings must be interpreted cautiously because of the low average standing height and unusual limb lengths in many of the populations examined (Shephard, 1978).

 *Skinfold thicknesses*. Perhaps more convincingly, an analysis of average skinfold thicknesses for populations continuing to follow a Neolithic lifestyle has shown much lower values than would be anticipated in a modern urban society. In young men, averages readings were for Alacalufe Indians, 7.9 mm; for Australian aboriginals, 7.0-9.1 mm; for Arctic Indians, 5.7-6.7 mm; for Inuit from Fort Chimo, Igloolik, and Wainwright, 5.5-6.5 mm; for Scandinavian Lapps, 7.7 mm; and for Hokkaido Ainu, 5.3 mm.

**Table 1**. Average skin-fold thicknesses and maximal oxygen intakes of traditional male Inuit hunters, compared with their transitional and acculturated peers living in the community of Igloolik, Nunavut, in 1970. Based on the data of Rode and Shephard (Rode and Shephard, 1973).

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| --- | --- | --- |
| **Current Lifestyle** | **Average skinfold thickness (mm)** | **Maximal oxygen intake [mL/(kg.min)]** |
| **Summer** | **Winter** | **Summer** | **Winter** |
| **Traditional hunters** **(n = 20)** | **5.8** | **6.4** | **56.6** | **56.2** |
| **Transitional (n = 22)** | **6.1** | **6.7** | **54.9** | **54.9** |
| **Acculturated (n = 18)** | **6.7** | **7.9** | **51.1** | **50.1** |

 *Daily energy expenditures*. In Igloolik, energy expenditures during the specific activities involved in 8 different types of hunting were measured in the field, using a Kofranyi-Michaelis respirator. Despite the relatively small size of the hunters, daily expenditures averaged as much as 15.3 MJ. Moreover, much of these very high totals was accumulated by prolonged periods of moderate physical activity, at an intensity of effort where a maximal fraction of energy would have arisen from the metabolism of body fat (Gmada et al., 2012). Energy expenditures were lower when the hunters were confined to the village by bad weather, or repairing their equipment, but nevertheless the field data argue strongly against a sedentary lifestyle and an accumulation of body fat.

 *Effects of acculturation to a "modern" lifestyle.* Many indigenous populations in North America have shown a growing prevalence of obesity as they have become acculturated to a "modern" lifestyle, with changes that have included a drastic decrease in their daily physical activity, and a shift from "country" to store- based foods.

 This trend has been documented in longitudinal studies of the Inuit living in Igloolik, Nunavut, from 1970 to 1990 (Shephard and Rode, 1996). The government organized concentration of the population into a single settlement of more than 1000 people facilitated the provision of health-care and schooling, but it also meant that local game resources were no longer adequate to allow traditional hunting and to sustain a diet of country foods. Dog-teams were abandoned, food (often of low nutritional value) was purchased from the village store, and the majority of the Inuit became unemployed, dependent on governmental welfare payments for their subsistence.

 There were corresponding negative changes in the body fat content and aerobic fitness of the Inuit people. Even in 1970, a gradient of obesity was apparent between those members of the community who were persisting in their traditional hunter-gatherer lifestyle (**Table 1**) and those who had settled in the village, either finding sedentary government employment or relying upon welfare payment for their subsistence. Moreover, all population sub-groups showed a

**Table 2.** Changes in average skin-fold thickness, body mass index and maximal oxygen intake of Igloolik Inuit from 1970 to 1990, as the community underwent a rapid transition from a hunter-gatherer to a sedentary economy (Shephard and Rode, 1996).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Age group (yr)** | **Men (1970)** | **Men (1990)** | **Women (1970)** | **Women (1990)** |
| **Average thickness of 3 skin-folds (mm)** |
| **20-29** | **5.5** | **7.1** | **8.5** | **12.0** |
| **30-39** | **6.3** | **8.4** | **9.2** | **13.5** |
| **40-49** | **5.4** | **10.1** | **7.0** | **16.4** |
| **50-59** | **7.9** | **8.6** | **19.0** | **11.2** |
|  | **Body mass index (kg/m2)** |
| **20-29** | **24.4** | **23.8** | **23.2** | **23.1** |
| **30-39** | **24.9** | **25.8** | **23.9** | **25.4** |
| **40-49** | **25.3** | **26.9** | **23.7** | **27.9** |
| **50-59** | **2f5.8** | **26.4** | **27.5** | **24.0** |
|  | **Maximal oxygen intake (mL/[kg.min])** |
| **20-29** | **58.4** | **51.1** | **48.1** | **41.0** |
| **30-39** | **55.5** | **46.0** | **46.3** | **35.2** |
| **40-49** | **51.6** | **41.5** | **40.8** | **30.7** |
| **50-59** | **41.6** | **35.2** | **36.4** | **27.7** |

small increase of sub-cutaneous fat and a corresponding decrease of aerobic power during the winter months, when adverse weather conditions kept everyone confined to the village for much of the time.

 The adverse effects of abandoning the hunter-gatherer lifestyle were yet more obvious when average data for the community were collected over the period from 1970 to 1990 (Shephard and Rode, 1996), as most of the Igloolik people underwent the transition from active hunting to a sedentary type of economy (**Table 2).**