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Have people always been fat? An historical enquiry.

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Abstract

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 fat an 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 of Paleolithic 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. **Health & Fitness Journal of Canada 2017;10(3):3-53.**

Keywords: Body Composition; Diet; Lifestyle; Obesity; Physical activity

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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.

Paleolithic and Neolithic communities

Paleolithic era.

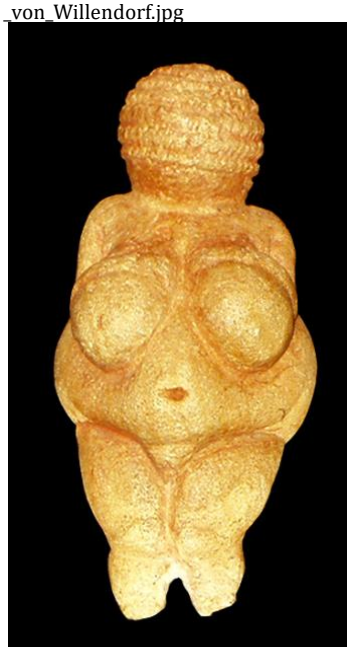
The Paleolithic era, also known as the Old Stone Age, was marked by the fashioning of tools formed from chipped stone and antlers. This phase of history extended from some 2.5 million years ago to about 10,000 BCE. Given the lack of written records, inferences about the likelihood of obesity in Paleolithic 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 (Figure 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*

Figure 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



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 were a 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.

***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 are 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 (Figure 2). Again, there is no strong reason to suppose that such representations of a Mother Goddess figure were in any way

Figure 2: Woman of Catalhöyük, Turkey, from about 6000 BCE.
Source: https://en.wikipedia.org/wiki/Seated_Woman_of_%C3%87atalh%C3%B6y%C3%BCk

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.

Daily energy expenditures. In Igloolik, energy expenditures during the specific activities involved in eight 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 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).

Cross-sectional data from other parts of North America reveal parallel trends, as comparisons of body fat content are drawn between indigenous peoples who are in regular contact with modern civilization and those who live in more isolated communities where traditional patterns of physical activity and diet have been better maintained (Young, 1994).

Other evidence. Anthropometric data for other continuing hunter-gatherers of today (the Baka, a pygmy group living in the tropical rain forests of Cameroon, the San communities of Botswana, other pygmy groups (Barnard, 2007), and the Batek people of Malaysia) in general reflect a small and extremely thin body build. The Baka, for example, have a height of a little over 1.5 metres, but a body mass of only about 48 kg, giving them an average body mass index of about 20.8 kg/m^2 (Devlin, 2017).

Although the rest of the body is not very fat, some women in hunter-gatherer societies [for example the Khoisan Bush-people of southern Africa (Barnard, 2007), the pygmies of Central Africa, and the Onge

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).

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

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/m^2)			
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

in the Andaman Islands of the Bay of Bengal (Sharma, 2003)] accumulate large amounts of adipose tissue in the buttocks and the thighs, a condition known as steatopygia (Figure 3). The condition is thought to be of genetic origin, and may be an adaptation to meet the energy demands of pregnancy and lactation in an environment where there are periodic shortages of food and/or water (Cohen, 2017; Marett, 1936). In a hot climate, Rensch's "*desert fat rule*" (Coon, Garn, and Birdsell,1950) suggests that the morphology of steatopygia allows some fat storage without impeding heat loss. Although the condition is seen mainly in women, it can occur to a lesser extent in men. The phenomenon may once have been more widespread, and it may have helped to inspire some of the voluptuous Paleolithic and Neolithic figurines found by archaeologists (Radmilli, 1950). However, its prevalence has probably been over-stated through the illustration of extreme cases, and Namibian rock-art suggests that most of the San population have had a relatively normal body build (Dowson, 1994). In any event, as a genetic variant, steatopygia is not particularly relevant to our overall discussion of obesity in Neolithic society.

Figure 3: The condition of steatopygia, as seen in a Khoisan woman. Source: https://en.wikipedia.org/wiki/Steatopygia

Mesopotamia

The appearance of obesity in early society was associated with the accumulation of sufficient wealth to allow a differentiation of labour. Development of an economic surplus often accompanied the transition from a hunter-gatherer to a settled agricultural lifestyle (Shephard, 2015). Opportunities for over-eating had been rare during the Paleolithic and Neolithic eras. The habitat had been harsh, and the tradition of sharing food as well as the very constituents of the diet militated against an excessive accumulation of body fat. However, the sharing of resources progressively disappeared in settled, urban societies. Moreover, the introduction of cattle raising, and the over-feeding of domestic animals and birds to enrich banquet tables profoundly changed nutritional patterns for the wealthy. The introduction of alcoholic beverages such as wine, mead, and beer also set the stage for drunken feasts where the nobility perceived consumption of food in excess of their immediate energy needs as a normal and pleasurable event.

At the height of its power, Mesopotamia was one such wealthy area, peopled firstly by the Sumerians (4500-1750 BCE), then by the Babylonians (1750-538 BCE), and finally by the Assyrians. Inferences about obesity in this region can be drawn from a knowledge of the overall economy, archaeological excavations, historical artifacts, medical records, and the reported lifespan of prominent individuals.

***Mesopotamian economy and archaeological discoveries*.** Mesopotamia was situated in the fertile Tigris/Euphrates river system, covering an area corresponding to modern Iraq and Kuwait. It was the site for the first cultivation of cereals, invention of the wheel and irrigation, and also saw the introduction of writing, mathematics, and astronomy. In the Babylonian era, Jewish scriptures tell of sumptuous feasts such as that of Belshazzar*: "Belshazzar the king made a great feast for a thousand of his lords, and drank wine in the presence of the*

thousand" (Daniel 5:1). Kramer (1956) quotes at least 5 instances of such feasting. The "*best fat and milk*" was found in the "*dining halls of the Gods*" (Kramer, 2010) as a part of the daily religious sacrifices, and *"feasts rich with abundance."*

There is archaeological evidence for the construction of luxurious temples, towering palaces and hanging gardens in the chief cities of the region such as Babylon and Susa, and also in Nineveh (the last featured on sculpture and drawings held by the British Museum). Although the majority of the population (including for a period a band of Jewish captives) continued to engage in hard physical labour as they built such wonders, other people in the higher ranks of this society enjoyed a relatively sedentary lifestyle. In addition to kings, princes, and warriors (between battles), a growing group of sedentary craftsmen were busy producing artifacts for the temples and the nobility, and various passive leisure pursuits such as the Royal Game of Uri and a form of backgammon were developed for this leisured class.

Artifacts. One terracotta artifact from around the 12th century BCE, discovered in the Elamite city of Susa, shows a grotesquely obese Mother Goddess (Figure 4) reminiscent of the Paleolithic and Neolithic artifacts, suggesting a continuation of this earlier tradition. However, a statuette of Sumerian King Ur-Nammu (2047-2030 BCE) held by the Oriental Institute of the University of Chicago shows a very trim-figured young man carrying the first brick used in the rebuilding of a temple. Other artifacts from the adjacent Elamite (pre-Iranian) civilization show quite slim individuals (Figures 5 and 6). Leonard Woolley (2009) writes of figurines unearthed at Ur and the Tell Al'Ubaid: *"the conventional bodies, slender as they are, are skillfully modelled..."* Thus, the discovery of one obese Mother Goddess artifact in Susa can hardly be considered good evidence for the prevalence of gross obesity throughout early Mesopotamia.

Medical records. Much of the history of medical practice in Sumeria and Babylon is recorded on some 600 medical tablets from the period 1000-600 BCE, conserved in the royal library of Ashurbanipal (668-627 BCE) in Nineveh (Thompson, 1923). The most extensive text is the *"Diagnostic Handbook,"* prepared by the scholar Esagil-kin-apli, and dating from ~1050 BCE (Heessel, 2004). The cuneiform records discuss problems such as epilepsy and consider various prognoses, but there is no mention of obesity, excess body fat, excess weight, or arterial disease (Finkel and Geller, 2007).

During the Persian period, Zoroastrianism became the dominant religion, and it placed considerable emphasis upon the dignity and importance of hard physical labour, reducing the likelihood of obesity. Moreover, from an age of 6 years, Zoroastrian boys underwent rigorous physical training for a succession of expansionist wars.

Figure 4: Terracotta figurine from Susa, in the Elamite kingdom, probably dating from the 12th century BCE. Source: https://s-media-cache-ak0.pinimg.com/originals/82/32/93/823293780cbbe92dc1cc7e0b8b4345fe.jpg

Reported life-spans. Certainly, some members of the Mesopotamian nobility failed to show the short lifespan that one would associate with gross obesity, although given the tendency of

people to exaggerate their age in antiquity, the ages recorded at death must be regarded with suspicion. Shulgi of Ur (2094-1999 BCE), a distance runner (Kramer, 1956), is known to have held the throne of Sumeria for 48 years, and Addagoppe of Harran, the mother of Nabonidus (556-539 BCE), the last king of the Neo-Babylonian empire, is reputed to have lived for a total of 104 years.

Conclusions. Despite the records of feasting by the Mesopotamian leaders and the discovery of one obese "Mother Goddess" figurine, other artifacts, medical records and reported life-spans offer little evidence for the widespread prevalence of obesity in ancient Mesopotamia.

Figure 5: Silver cup, showing a slenderly built Elamite individual. Source: https://en.wikipedia.org/wiki/Elam#/media/File:Elam_cool.jpg

Figure 6: Another example of a slim Elamite statuette. Source: https://en.wikipedia.org/wiki/Elam#Statuettes.

Ancient Egypt

Ancient Egypt was another region of the world where periodic flooding and irrigation schemes allowed primitive agriculture to flourish in a large river basin. Herodotus once called Egyptians the "*healthiest of all men*." Nevertheless, stone images, papyri, medical writings and post-mortem examinations of mummified royalty allow the inference that there were a few cases of obesity and dietary indiscretion among the elite of ancient Egyptian society.

Egyptian economy and archaeological discoveries. The early Pharaohs were generally proud to be athletic, and indeed at one time the ability to complete a 100 km race was seen as a tangible proof of their continued fitness to reign (Shephard, 2015). Early statues of notable men and women generally suggest a fit physique. Moreover, most of the general Egyptian population worked extremely hard on the construction of pyramids, massive temples and other public works in the Nile valley. A number of fat men, both the upper-class rulers and their immediate servants, are featured in Egyptian stone reliefs. However, it is less clear whether the obesity portrayed by the artist is an accurate representation of the individual concerned (Nunn, 2002). Specific examples of obese images include a doorman featured at the temple of Amon-Ra Khor-en-Khonsu, a cook depicted in the tomb of Ankh-ma-Hor, an obese harpist shown as playing for Prince Aki (Bray et al., 2003) and the Old Kingdom priest Ka-Aper (from around 2500 BCE) who is seen in a sycamore carving (Figure 7). From the same period, a sculpture of Hemiunu, architect of the Khufu pyramid (~2570 BCE) shows a double chin, heavy shoulders, and a fat waistline. Queen Hatshepsut came to the throne in 1478 BCE as the second female Pharaoh. She is depicted in a sculpture on the wall of the temple that bears her name, and although the statue is probably idealized, it does suggest that she also was heavily built (Figure 8). However, she is less obviously obese in the twin statues representing her at the entrance to her tomb. The Queen of Punt (from the Yemen region), featured on the tomb of Queen Hatshepsut, appears to have steatophygia

(above).

In the later phases of Egyptian history, when the country came under Macedonian rule, the puppet King Ptolemy VIII (170-163, 145-116 BCE) was nicknamed *Physcōn* ("fat stomach" or "sausage"). The common people of Alexandria mocked him for his obesity and his potbelly before he decided to flee to Cyprus. Nevertheless, he seems to have survived his exile through to the age of 64 years, despite his accumulation of body fat.

Medical writings. The Egyptian Imhotep, sometimes described as the Father of modern medicine, described some 200 diseases, including 16 conditions that affected the abdomen, but he did not judge obesity of sufficient importance to include in this list (Filer, 1995; Osler, 1921). Nevertheless, Darby et al. (1977) concluded that some Egyptians regarded obesity as objectionable. The Insinger papyrus (probably dating from the second century CE but reflecting earlier independent Egyptian thought) also speaks of personal responsibility for the moderation of diet: *"Illness befalls a man because the food harms him. He who eats too much bread will suffer illness..."* (Lichtheim, 2006). Moreover, Egyptian physicians saw an appropriate diet as a means of preserving health, and they recognized the importance of not only the quality but also the quantity of food ingested. According to the Sicilian historian Diodorus Siculus (90-20 BCE), Egyptian methods of limiting food absorption Included *"purging, vomiting or fasting every second, third or fourth day",* because *"the greatest part of the aliment we take is superfluous, which superfluity is cause of our distempers"* (Diodorus, 1721). The Greek historian Herodotus (480-429 BCE) had earlier reached a similar conclusion: "*Egyptians vomit and purge them- selves thrice every month, with a view to preserve their health, which in their opinion is chiefly injured by their aliment*" (MacKenzie, 1758).

The Ebers papyrus (c. 1550 BCE) suggests that Egyptian physicians may have encountered diabetes; they certainly described patients with excessive urination, and sought "*a medicine to drive away the passing of too much urine"* (Stapley, 2001).

During the Greek occupation of Egypt (from 332 BCE onwards), Alexandrian physicians such as Herophilus and Erasistratus recognized the therapeutic value of moderate exercise. They condemned "*plethora,*" apparently meaning an accumulation of blood rather than fat. They also related increased body dimensions to an excessive intake of food and its subsequent putrefaction (Magner, 1992; Shephard, 2015), but Erasistratus was unsure the association was causal in nature; in any event, the plethora was often local, speaking against an accumulation of fat as its cause.

Paleo-pathologic data. A variety of mummified bodies, mostly dating from the Old Kingdom (2663-2195 BCE) has allowed post-mortem examination of body composition in Egyptian rulers and their

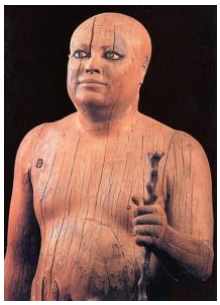


Figure 7: A sycamore carving of Ka-Aper, an Old Kingdom Egyptian priest. From around 2500 BCE. Source: http://www.globalegyptianmuseum.org/detail.aspx?id=14910

Figure 8: Depiction of the solid figure of the Egyptian Queen Hatshepsut, on the wall of her temple. Source: https://www.google.ca/imgres?imgurl=https://upload.wikimedia.org/wikipedia/commons/thumb/1/11/Hatshepsut.jpg/220px-Hatshepsut.jpg

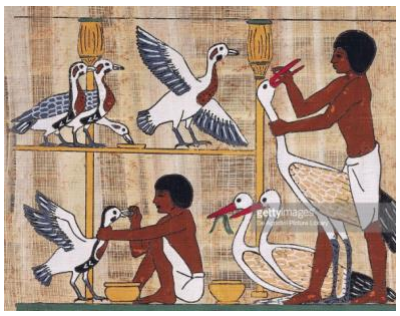
close servants. The mummies of Queen Hatshepsut (above), the Pharaoh Amenhotep III (who was born in 1411 BCE, and died at an age between 40 and 50 years) and Ramses III (1217-1155 BCE, who was assassinated at the age of 61 years) are all characterized by large reconstructed skin-folds, suggesting that in life these rulers were very fat (Bray et al., 2003; Lestrel, 2015). The identity of the mummies is not totally certain, and some archeologists have suggested that the individual identified as Hatshepsut was actually the palace "wet nurse." Hatnofer, the royal housekeeper, was an important figure in the court of Hatshepsut, and in their excavation of her tomb at Thebes, Lansing and Hayes (1937) suggested that although she had a frail build, she was "*distinctly fat.*" The mummy of Queen Duathathor-Henuttawy (20th dynasty, ~1060-992 BCE) also seems very stout. However, it is difficult to judge a person's physique from a mummy (Dunand and Lichtenberg, 2006), and in particular to be certain how far the superficial fat has been modified by the process of mummification.

Dissection (Ruffer, 1910-1911), radiography (Harris and Wente, 1980), and computed tomography (Allam, Thompson, and Wann, 2009) of mummies has provided evidence of substantial atherosclerosis in the arteries of some Egyptian royalty and their attendants such as a nursemaid (Figure 9). This probably reflects at least in part the dietary choices of wealthy individuals, including the eating of deliberately fattened livestock; as illustrated in the Harris papyrus (Figure 10); the Egyptians made a practice of force-feeding of cattle, lambs, goats, ducks, geese, pigeons, and cranes with milk bread-dough as banquet delicacies (Mehdawy and Hussein, 2010). It is less clear how far the local accumulation of cholesterol plaques associated with this rich diet was accompanied by obesity.

Conclusions. Statues and carvings suggest that at least some members of the Egyptian royal entourage were obese. This view is supported by the practice of fattening a variety of livestock and calls of Alexandrian physicians for moderation in diet. Further, examination of some royal mummies provides evidence of thick skin-folds and atherosclerotic lesions in major arteries. Nevertheless, it also appears likely that the general population were kept thin by a combination of hard physical work and a limited availability of food.

Figure 9: Radiographic evidence of atherosclerotic lesions in an Egyptian mummy. Source: https://www.google.ca/search?q=atherosclerosis+in+Egyptian+mummies+photos

Figure 10: Forced feeding of livestock in Ancient Egypt. Source: http://www.gettyimages.ca/detail/news-photo/force-feeding-geese-papyrus-reconstruction-of-a-relief-from-news-photo/182131940?#forcefeeding-geese-papyrus-reconstruction-of-a-relief-from-the-of-picture-id182131940.



Ancient Israel

Information on obesity in ancient Israel is drawn almost exclusively from Biblical references. Jewish scholars of the Old Testament spoke against feasting, drunkenness, and obesity, in part because such feasts were associated with their pagan contemporaries in Egypt and in Babylon. Nevertheless, warnings and condemnations of obesity occur with sufficient frequency to suggest that a significant fraction of the Jewish population were overweight.

In the Genesis version of the great flood

story, Noah is ridiculed by his son Ham, because as soon as the waters had subsided, he planted a vineyard and became disgustingly drunk (Genesis 9^{21-22}). Moses, looking forward to a prosperous Israel in a promised land of "*milk and honey*", warned that as they became more wealthy, the people would *"grow fat, stout, and sleek,"* turning from their God and His precepts (Deuteronomy 32^{15}) (note that the Jewish honey mentioned here was a syrup made from sweet fruits). Gluttony was specifically condemned in the 10 Commandments. The originator of the book of Deuteronomy (possibly Moses himself) also cautions *"This son of ours is stubborn and rebellious. He will not obey us. He is a glutton and a drunkard*" (Deuteronomy 21^{20}).

During the time of the Judges, Eglon, King of Moab, was one of the oppressors of the new Jewish state. One day, the Israelite judge Ehud called on Eglon, supposedly to present him with tribute money, but Ehud took the opportunity to stab Eglon (Figure 11). According to this legend, King Eglon was so obese that Ehud could not subsequently withdraw his sword (Judges 3^{12-30}).

The Book of Proverbs, possibly authored by King Solomon (970-930 BCE), warns repeatedly against gluttony: "*Put a knife to your throat if you are given to appetite"* (23^{2}), "*Be not among drunkards or among gluttonous eaters of meat, for the drunkard and the glutton will come to poverty, and slumber will clothe them with rags*" (23^{20-21}). "*If you have found honey, eat only enough for you, lest you have your fill of it and vomit"* (25^{16}). Two verses speak specifically to the association between gluttony and heathen practices: *"Do not be with heavy drinkers of wine, Or with gluttonous eaters of meat; For the heavy drinker and the glutton will come to poverty, And drowsiness will clothe one with rags"* (23^{20-21}), and "*He who keeps the law is a discerning son, But he who is a companion of gluttons humiliates his father"* (28^{7}).

Figure 11: Eglon, King o: Moab, was supposedly so fat that when he was stabbed by Ehud, the latter could not retrieve his sword. Source: https://en.wikipedia.org/wiki/Eglon_(king)

By the time of the prophet Amos (around 760 BCE), the problem of dietary excess had spread from royalty to a significant fraction of the Israeli upper and/or middle class, and Amos spoke plainly to his self-indulgent and wealthy parishioners in the northern kingdom: "*Listen to me, you fat cows living in Samaria, you women who oppress the poor and crush the needy, and who are always calling to your husbands, "Bring us another drink!*" (Amos 4^{1}). As in other parts of the world, being heavy of jowl and with sides bulging with fat was seen as a mark of evil prosperity (Job 15^{27}): *"These wicked people are heavy and prosperous; their waists bulge with fat."*

The second part of Isaiah's prophesy (~ 550 BCE) is addressed to the Jewish exiles in Babylon. The writer of this section of Isaiah asks rhetorically*: "Why do you spend your money for that which is not bread, and your labor for that which does not satisfy? Listen diligently to me, and eat what is good, and delight yourselves in rich food"* (Isaiah 55^{2}).

In the first and second centuries CE a number of prominent Jewish rabbis, including Ishmael ben Jose and Simeon ben Eleazar had such gross bellies that the Talmud queries whether they would ever be able to reproduce. The Talmudic

tractate "*Baba Metzia*" includes an account of surgery that was performed on Rabbi Eleazar (1st century CE) for the removal of excess fat. He apparently "*underwent an operation to remove much of his fat*" (Rosner, 2000). "Baskets of fat" were said to be ripped from his abdomen during this procedure (Gilman, 2008).

As Christianity spread across the Greek and Roman world, a healthy, fit body became seen as a gift of God. The New Testament thus contains many passages where gluttony and drunkenness are criticized as evidence of reversion to former pagan ways: *"Woe to you who are full now, for you shall be hungry"* (Luke 6^{25}); "*watch yourselves lest your hearts be weighed down with dissipation and drunkenness and cares of this life*" (Luke 21^{34}); *"walk by the Spirit, and you will not gratify the desires of the flesh"* (Galatians 5^{16}); *"those who belong to Christ Jesus have crucified the flesh with its passions and desires*" (Galatians 5^{24});*"Their end is destruction, their god is their belly, and they glory in their shame, with minds set on earthly things"* (Philippians 31^{9}).*"Older women likewise are to be reverent in behavior, not slanderers or slaves to much wine"* (Titus 2^{3}).

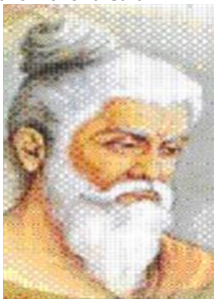
Conclusions. These various writings provide evidence that obesity was present in a number of the more wealthy people in ancient Israel, although gluttony and excessive body weight were regarded as manifestations of a lack of self-control and were roundly condemned by both Jewish and Christian scriptures.

Hindu and Buddhist India

There is a word ("*medas*") in the Sanskrit language that translates into excessive fatness, suggesting that obesity was a problem for at least some people in ancient India. Specific evidence of fat accumulation is again found mainly in sacred and medical writings. Indian doctors noted an association between the accumulation of body fat and diabetes mellitus and proposed specific treatments.

Around 600 BCE, the physician Sushruta (Figure 12) commented on two of the more important adverse medical consequences of obesity, diabetes mellitus and heart disease. He called diabetes "*Madhu-meha*," noting "*a sweet taste and smell like that of honey*" in the breath of affected patients. He further distinguished a congenital form of diabetes, where patients were emaciated, showed excessive thirst and a loss of appetite, and an adult form. With surprising accuracy, he associated the latter with the choice of an "*injudicious*" diet, and symptoms that included "*obesity, voracity, a soporific tendency, and an inclination for lounging in bed or on a cushion"* (Bhishagratna, 2006; Haslam, 2016). Sushruta recognized the contribution of a sedentary lifestyle. He thus advised exercise as well as fasting and other depletory measures (Dods, 2013), replacing lounging in bed or sitting on a cushion by exercise and adopting an Ayurvedic diet. The therapeutic physical activity had to be performed daily and at least a moderate intensity was needed, although he cautioned that the half-maximum limit for exhaustion should not be exceeded (Tipton, 1985).

Figure 12: Sushruta, Indian physician from c. 600 BCE. Source: https://www.google.ca/search?client=safari



One of the main subsequent exponents of Ayurvedic medicine and the 3 *doshas* was the physician Charaka (c .300 BCE) (Figure 13). He underlined that a poor lifestyle

shortened lifespan (Mondal, 2013). In his view, excessive corpulence was caused by "*an excessive intake of heavy, sweet, cooling and unctuous food, want of physical exercise, day sleep, uninterrupted cheerfulness, or a lack of mental exercise*." Diabetic individuals should practice regular physical exercise, including "*wrestling, riding on an elephant, long walks, pedestrian journeys, archery and casting javelins*." The Ayurveda also recommended the administration of testicular tissue as a cure for both impotence and obesity (Iason, 1946).

"*The Four Tantras*" (Alphen & Aris, 1997) was for long the basic book of Tibetan Buddhist medicine. It was written in the 12th century CE, and it incorporated elements of Indian, Arabic, Chinese, and Greek medical scholarship, with an emphasis on keeping 3 bodily humours in balance. The text noted that over-eating caused illness and shortened life span. In keeping with the passive and meditative philosophy of Buddhism, obesity was discussed as a problem that required catabolic treatment, to be sought through massage with pea flour, the eating of wolf flesh, and the use of enemas and compresses (Wolin and Petrelli, 2009). By the 12th century, many Buddhists also viewed obesity as evidence of moral failure (Stunkard, LaFleur, and Wadden, 1998).

Conclusions. Obesity was well-recognized in ancient India and Tibet, with an understanding of some of its complications and the prescription of specific exercise and dietary treatments.

The Chinese dynasties

Obesity was a problem among some of China's emperors, and it was sufficiently prevalent in ancient China that Chinese physicians and scholars proposed several remedies. On the other hand, comments in the available literature suggest it was an occasional problem of the wealthy, rather than a common occurrence in the average citizen. An examination of the 2200-year-old Terracotta Army of Chinese Emperor Qin reveals 8000 life-size figures, each with a unique face, clothing, and body build. Many are senior military officers, but others include accountants and administrators, and only one member of the group is obese- the Entertainer—clearly a passive occupation in the Royal Court.

In the Han dynasty, the mythical Yellow emperor Shen Nung (3000 BCE) (Figure 14) is said to have discovered green tea, and he urged its consumption as a method to reduce obesity. In the *Suwen*, or *Book of Plain Questions* (Unschuld and Tessenow, 2011), Shen Nung conducted a dialogue with his medical advisers. Chapter 28 ("*A discourse thoroughly deliberating on depletion and repletion"*), states *"If obesity occurs in the nobleman and rich people, they must be over consuming heavy and greasy foods*." Associated risk factors were said to include undesirable eating habits, under exercising, body constitution and mental state.

In more recent times, a general in the

Figure 13: Charaka, Indian physician from ~ 300 BCE. Source: https://www.google.ca/imgres?imgurl=http://www.brahmayurved.com/images/legendofayurveda/7624download.jpg

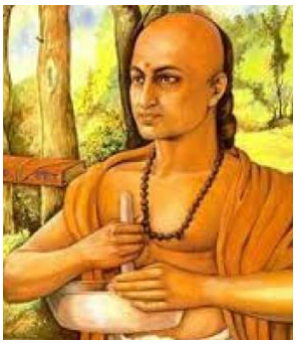


Figure 14: Shen Nung (c. 2695 BCE), considered as the father of Chinese medicine. Source: http://www.toxipedia.org/display/toxipedia/Shen+Nung

Tang dynasty (An Lushan, 703-757 CE) suffered from gross obesity and was reputedly so fat that he caused more than one horse to collapse beneath his weight. He developed diabetes and eventually became blind. And in the Ming dynasty, the Wanli Emperor (1572-1620 CE) also banqueted his way to gross obesity, so that in his latter years he was unable to stand without assistance.

The placing of sharp objects in the pinna of the ear was plainly a potent aide-memoire when at the dining table, and this form of acupuncture was claimed to reduce appetite (Wolin and Petrelli, 2009). Other therapeutic suggestions included two ideas borrowed from the Buddhists (a vigorous massage of the body with pea flour, and the eating of wolf flesh), together with administration of an extract from the Thunder-God vine (a preparation that reduced the patient's appetite, apparently by enhancing the action of leptin).

Conclusions. The texts cited above point to the development of gross obesity in some of the elite in ancient China, but on the other hand the physique of the terracotta warriors suggests that this was an uncommon problem.

Classical Greece and Rome

On the island of Crete, the Minoan civilization flourished from the 15th century BCE. Not much is known about the health of this community. Evidence of gallstones and gout suggest that some of the wealthy may have indulged in over-eating (Shephard, 2015). On the other hand, short average heights and periods of growth retardation indicate the common people may have experienced periodic food shortages (Arnott, 1996). There were claims of a secret that allowed wealthy Cretans to eat as much as they wished without getting fat; possibly, they used some form of toxic purgative (Kelly, 2006).

Obesity features regularly as a medical disorder in the writings of physicians in classical Greece and Rome (Haslam, 2007). The number of such references suggests that obesity was a fairly common complaint, at least among aristocratic patients throughout the classical Greek and Roman periods, perhaps because an enormous number of slaves undertook most of the heavy physical work for the wealthy elite. As in other early cultures, the problem was sufficient to merit both description and the proposal of remedies. Hippocrates discussed the issue frequently, and even Plato expressed concern about immoderation in food consumption, partly for ethical reasons, but also because of the resulting health problems.

On the other hand, the emphasis for the young Greek nobleman was on perfecting the body beautiful as an offering to the Gods. In Pindar's 11th Olympic Ode we read: *"Strength and beauty are the gifts of Zeus...natural gifts imply the duty of developing them with God's help*" (McIntosh, 1970). In general, because of the Greek emphasis on the balance of four body humours, for most physicians, the ideal body composition was found at the mid-point between fat and thin.

Spartan attitudes. Physical perfection was especially prized in Sparta. The legendary law-giver Lycurgus (c. 900-800 BCE) oriented Spartan society, both male and female, towards a tradition of life-long military fitness and austerity, based on guidance given by the Oracle of Apollos at Delphi (Figure 15). The laws of Lycurgus established firm measures against laziness, muscular weakness and obesity both in Spartan youth and in society generally. Shortly after their birth, the local elders inspected infants, and those that were puny or deformed were tossed

over the cliffs at Mount Taygetus. Throughout their childhood, all Spartans followed a rigid physical regimen, and at the age of 18 years both men and women had to pass a rigorous physical fitness test. Those with the misfortune to fail the test lost both their citizenship and their political rights. Thereafter, the men who passed this test were required to maintain a high level of fitness and remain in the military reserve until they reached the age of 60 years (Shephard, 2015); any who became fat were banished from Sparta.

Hippocratic medicine. Even before the coming of Hippocrates, the Ionian philosopher Pythagoras (570-495 BCE) had already recommended eating in moderation. He commented adversely on those of his fellow-citizens who over-ate and then vomited or fasted. In a life of Pythagoras, the biographer Diogenes Laertius (3rd century CE) noted that the philosopher had recommended the wiser alternative of moderation: "*No man, who values his health, ought to trespass on the bounds of moderation, either in labour, diet or concubinage"* (Paredes, 2011). To this recommendation was added unction, bathing and exercises to increase bodily strength (MacKenzie, 1758).

The physician Iccus of Taranto (5th century BCE), himself an Olympic athlete and victor in the Games of 444 BCE, advanced similar views. He combined exercise with a frugal diet in order to preserve health. The 6th century CE philosopher Stepnaus of Byzantium commented that the saying "*the repast of Iccus,*" probably originating with Herodicus (below), had become a proverbial watchword for a plain and temperate meal (MacKenzie, 1758).

The 5th century BCE physician Herodicus, one of the teachers of Hippocrates, and sometimes considered as the father of sports medicine, claimed success in prolonging life, not least his own. He, also, underlined the need to regulate diet and exercise, and indeed he was censured in Plato's *Republic* for *"keeping people with crazy constitutions alive to old age*" rather than letting them *" die out of the way"* (MacKenzie, 1758). Herodicus advocated a systematic and strenuous exercise programme; many of his patients were prescribed repeated brisk 42 km walks from Athens to Megara at progressively increasing speeds. However, both Hippocrates and Plato thought he demanded too much of his patients, and Herodicus was said to have caused the death of several individuals by submitting them to excessively long walks and forced exercise.

Hippocrates of Kos (460-370 BCE) (Figure 16) played a central role in revolutionizing Greek medicine, establishing it as a profession that was distinct from philosophy and the supernatural. He also seems to have been well aware of the harmful effects of obesity, noting the low resistance of the obese to febrile disease, and their increased risk of sudden death. Thus, he gave strict directions for the prevention and treatment of obesity. His remedies included severe physical labour before

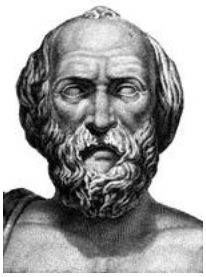
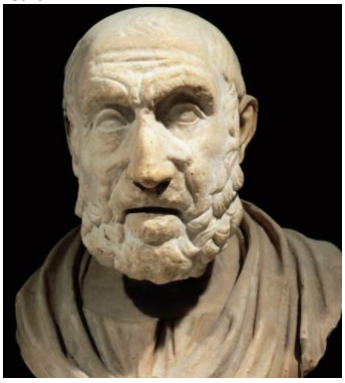


Figure 15: Lycurgus, the legendary Spartan lawgiver. Source: https://en.wikipedia.org/wiki/Lycurgus_of_Sparta#Education_of_children

Figure 16: Hippocrates of Kos (460-370 BCE). Source: https://www.google.ca/search?client=safari



breakfast, a hard couch, a hardening of the body in the open air, the prohibition of warm baths and the avoidance of wine unless it was largely diluted with water.

He wrote: *"One cause which made it necessary to study the art of restoring lost health, was the great difference to be observed between the diet of the healthy and that of the sick*" (Rossen and Rossen, 2011). *"The men lack sexual desire because of the moistness of their constitution and the softness and coldness of their bellies. ... In the case of the women, fatness and flabbiness are also to blame... sudden death is more common in those who are naturally fat than in the lean*" (Haslam and Rigby, 2010). *"it is very injurious to health to take in more food than the constitution will bear, when, at the same time, one uses no exercise to carry off this excess*" (Wells, 2009).

Moreover, Hippocrates seems to have recognized that android fatness was more harmful than a gynoid distribution, and that the latter might even help outcomes during prolonged illness: "*In all maladies, those who are fat about the belly do best; it is bad to be thin and wasted there*" (Little and Frayn, 1986; Raisborough, 2016).

Hippocrates was particularly scathing about the Scythians in Persia, where he perceived a lack of daily activity from an early age. He commented *"The male children, until they are old enough to ride, spend most of their time sitting in the wagons and they walk very little... The girls get amazingly flabby and podgy*" (Haslam & Rigby, 2010).

Colleagues and successors of Hippocrates. The advice of both Greek philosophers and the medical colleagues of Hippocrates was that overweight individuals should "*reduce food and avoid drinking to fullness*," engage in regular exercise, *"running during the night*" and take "*early morning walks*" (Christopoulou-Aletra and Papavramidou, 2004). Among the colleagues and successors of Hippocrates there are also recommendations of emetics. Thus hellebore plants and honey water were prescribed '"f*or the evacuation of the nourishment two or three times a month*"), along with cathartics (for example, scammony juice (bindweed), Cnidian berry and sea spurge) and laxatives (donkey milk with honey, wild parsley, dodder of thyme (*Cuscuta epithymum*), honey water and sweet wine) (Christopoulou-Aletra and Papavramidou, 2004).

Polybus. In treating obesity, the physician Polybus (c. 400 BCE) generally followed the treatment plans of his father-in-law Hippocrates: *"Persons of a gross relaxed habit of body, the flabby, and red-haired, ought always to use a drying diet... Such as are fat, and desire to be lean, should use exercise fasting; should drink small liquors a little warm; should eat only once a day, and no more than will just satisfy their hunger "* (Haslam, 2007).

Aristotle. The philosopher Aristotle (384-322 BCE) was a strong believer in moderation: "*You may not live solely pursuing your base desires. Rather, you must subordinate them to right reason, and your life must be determined by the intellect, not by base desire."* "*both eating and drinking too much or too little destroy health, whereas the right quantity produces, increases or preserves it*" (Engel, 2002).

Diocles. Diocles of Carystus (240-180 BCE), regarded by Pliny as a physician who was second in wisdom only to Hippocrates, recommended that those who were obese should eat only once per day (Sydenham, 1844).

Asclepiades. Asclepiades (120-40 BCE) practiced medicine in Rome. He was an advocate of strong friction for the obese

(Dublin University, 1861). Like Hippocrates, he believed that strong friction made the body harder.

Celsus. The Greek philosopher Celsus (~ 25 BCE) was sometimes criticized as *"a patron of gluttons and drunkards*" because he suggested that a person could *"indulge himself at feasts; . . . sometimes eat and drink more than is proper"* (Haslam, 2007). Nevertheless, Celsus advised an overall moderation in diet, and treated obesity by sea-bathing. He regarded a square, fit frame, neither thin nor fat, as optimal (Celsus, 1935). Like Asclepiades, he generally rejected purges and vomiting, but nevertheless he suggested that an excess of food could become corrupted, and then treatment by the induction of vomiting was indicated (Celsus, 1935).

Dioscorides. During the first century CE, the *De Materia Medica* of the physician Pedanius Dioscorides (40-90 CE) listed certain foods and herbal preparations that helped to reduce obesity; one particular recommendation included a mixture of Asian meadow, cheese, and mustard (Dioscorides, 2003).

Plutarch. The essayist Plutarch (46-120 CE) commented on obesity and health, remarking that *"thin people are generally the most healthy; we should not therefore indulge our appetites with delicacies or high living, for fear of growing corpulent... The body is a ship which must not be overloaded"* (Sinclair, 1818).

Soranus. Soranus of Ephesus (98-138 CE) regarded obesity as a chronic disease in immediate need of treatment. He believed that obesity could narrow the birth passage and cause problems in childbirth, and by way of treatment he proposed a combination of diet and exercise, baths, venesection, purging, and a radical change in lifestyle (Soranus, 1991).

Views of Galen and his successors. It is plain from the above comments that many Greek and Roman physicians recognized that obesity was unhealthy. In some instances, they also recorded and treated occasional cases of morbid obesity. Oribasius (325-400 CE), author of a 70-volume Medical Encyclopaedia, believed that obesity reflected a combination of flabbiness and excessive moisture, and he argued that it arose from an inappropriate lifestyle: "*Non plus par nécessité, mais par suite du régime habituel, le corps des gens doué d'un tempéremant sec est plus dur et plus sec que celui des gens doué d'un tempéremant moyen. (Not only necessity, but also due to habitual lifestyle, the body of people with a dry temperament is harder and dryer than that of people with an average temperament)"* (Bussemaker and Daremberg, 1863). The condition required treatment by emaciati on and fat reduction, achieved through exercise, diet, medications, baths, massage, and provocation of what was termed *"mental anxiety."*

Galen (130- ~210 CE, Figure 17) was physician to several Roman Emperors. He classified overweight individuals as *pachis* (fat), *efsarkos* (overweight, a natural condition) and *polisarkos* (obese, a morbid condition, derived from poly (much) and sarka (flesh). A person with *polisarkos* was "exceeding fat". In *De Methodo Medendi,* Galen described the typical patient with polisarkos as *"unable to walk without sweating and unable to reach the table when*

Figure 17: The Greek physician Galen introduced the first classification of obesity. Source: https://www.google.ca/imgres?imgurl=http://www.thefamouspeople.com/profiles/images/galen-1.jpg

sitting due to the size of his stomach, with difficulty breathing, and unable to clean himself" (Papavramidou, Papavramidis, and Christopoulou-Aletra, 2004). He regarded *polisarkos* as due to a preponderance of phlegm, one of the 4 body humours in Greek medical thought, and he underlined the resulting dangers to life, particularly an increased risk of sudden death.

Galen gave a detailed description of his recommendations in *de Victu Attenuante*. He suggested that obesity should be treated by strenuous running, warm baths, a light meal and more physical work; affected individuals should eat only once per day, and then in proportion to the amount of exercise that they take. Proposed medications included various diuretics such as seed of wild rue with its tops, the round birthwort, the small centaury, gentian, poley, and Macedonian parsley (Bussemaker and Daremberg, 1863). Massage with oils containing these herbs was also thought to be helpful.

Galen claimed that he could make a "*sufficiently stout patient moderately thin by compelling him to do rapid running*" (Shell, 2003), and he reported in *De Sanitate Tuenda* (160 CE): *"I reduced a huge fat fellow to a moderate size in a short time, by making him run every morning until he fell into a profuse sweat; I then had him rubbed hard, and put into a warm bath; after which I ordered him a small breakfast, and sent him to the warm bath a second time. Some hours after, I permitted him to eat freely of food, which afforded but little nourishment; and lastly, set him to some work which he was accustomed to for the remaining part of the day"* (Haslam and Rigby, 2010).

Later Byzantine physicians. The idea of a linkage between a "moist" temperament and obesity persisted among Byzantine physicians.

Aetius. Aetius of Amida (5th century CE) authored a 16-volume medical text that was subsequently arranged as a 4-volume set, the *Tetrabiblos*. It drew heavily on the works of Galen and Oribasius. Aetius saw the optimum body temperament as a balance between extremes of leanness and obesity, of softness and hardness, of heat and cold, and of moisture and dryness. However, obesity could arise from a faulty lifestyle, as well as by inheriting a predisposing temperament (Olivieri, 1935).

Alexander. The physician and medical author Alexander of Tralles (~ 525-605 CE) suggested that obesity reflected an altered balance of the temperaments, which he located in the stomach. Most commonly, the problem was an extremely cold temperament; this led to a desperate need for food, and he recommended the counter-treatment of feeding "warm" foods, namely unmixed wine and very fatty protein such as legs of pheasants and pork meat; these caused satiation and appeased the underlying hunger. However, obesity could also reflect the opposite extreme, an excess of heat, with a need to correct the problem by ingesting food with cooling properties. A further possibility was an anomaly of retentive function (Trallianus and Goupyl, 1556).

Theophilus Protospatharius. Theophilus Protospatharius (9th century CE) discussed obesity in his comments on Hippocratic aphorisms (Papavramidis and Christopoulou-Aletra, 2007). Obesity was seen as an unhealthy situation, because the natural faculties did not "*calm down*." Such a situation eventually led to death. The body humors became jellied, causing hypertension and problems of digestion. There was no adhesion of food to the tissues, no assimilation and this ultimately brought about the death of the patient.

Longevity. Although obesity was described by many of the ancient Greek and Roman philosophers, and was well recognized amongst the aristocracy, it was often attracted negative attitudes, and its prevalence in the various strata of society remains unclear. Many Greek leaders appear to have lived what would have been an unusually long life for an obese individual, for example Thales (78 years), Anaximenes (57 years), Heraclitus (67 years), Solon (80 years), Empedocles (60 years), Pythagoras (75 years), Hippocrates (90 years), Asclepius (84 years), Aristotle (62 years), Plato (82 years), and Antisthenes (80 years).

A census conducted by the Roman Emperor Trajan (53-117 CE) claimed to find 11,000 centenarians (Oswald, 1878), but many of the group had probably exaggerated their age because the society of that era tended to venerate those who were very old.

References to obesity in classical literature and art. We may cite two specific examples of gross obesity from the classical literature of the Greco-Roman world- Dionysius and Magas. Dionysius is described by Claudius Aelianus (170-235 CE) in his "*Historical Miscellany"* (Bevegni and Adami, 2003) as the tyrant of Heraclea Pontica during the 4th century BCE. Dionysius became sufficiently fat that he earned the nickname of Pompikos ("stately, magnificent"). He could not eat food unless it was introduced into his stomach by artificial means and had difficulty in breathing. Moreover, he frequently fell asleep when conducting official business, to the point that his servants had to poke long needles into his skin to waken him. His outer layer of fat was relatively insensitive, but when the needle penetrated to healthy tissue, he was awakened. He became ashamed of his condition and lived secluded in a small tower from which only his head emerged to bark orders. In the opinion of Aelianus *"By the gods, that was an absurd way to cover himself: to prefer a sort of cage for wild beasts to a dress for human beings! "* Nevertheless, Dionysius did not renounce his gluttony, and he is reputed to have said that he wanted to die with his mouth full, "*rotting away in pleasure*" (Shell, 2003).

Magas, King of Cyrene (317-250 BCE), was also weighed down by monstrous masses of fatty tissue in his final days, and he is aid finally to have choked himself to death (Kryger, 1983), an incident that the historian Agatharchides, (2nd Century BCE), cited with great relish (Africa, 1961).

Some Greek authors satirized those who were obese. Thus, in the 5th century BCE comedy *Plutus*, the playwright Aristophanes described the grossly overweight as stupid gluttons, figures of mockery and disgust: *''bloated, gross and preseniled... they are fat rogues with big bellies and dropsical legs, whose toes by the gout are tormented*" (Allardyce, 2015).

The Roman representation of Dionysus, the God of wine and the personification of self-indulgence, is not particularly fat (Figure 18), but the Roman tutor of Dionysus, the mythical horse-like Silenus, did have a pot-belly, and obesity was a feature of the self-indulgent Bacchus/Dionysus, as seen for instance in the paintings of Rubens.

Pathological consequences of obesity. The recognition of a link between obesity and abnormal sleep patterns, as described in Dionysius and Magas, dates back to Hippocrates: "*Others, when their diet bears too great a proportion to their exercise, not only sleep well at night, but are likewise drowsy in the day; the repletion still increases, and their nights begin to grow restless; their sleep afterwards becomes disturbed with frightful dreams of battles*" (MacKenzie, 1758).

By the second century CE, Greek physicians were also aware of the link between obesity and diabetes mellitus. The celebrated Cappadocian physician Aretaeus wrote: "*Diabetes is a wonderful affection, not very frequent among men, being a melting down of the flesh and limbs into urine. Its cause is of a cold and humid nature as in dropsy*" (Aretaeus, 2010).

Conclusions. In classical Greece, the ideal body type was athletic, and the longevity of many leading thinkers suggests that they conformed to this phenotype. Obese individuals were satirized by playwrights, and because of public disapproval some were even reluctant to show themselves in public. But at the same time, the interest of a large number of physicians in the causes and treatment of obesity, and a knowledge of some of its complications suggests that a substantial number of wealthy patients carried an excess of body fat.

The mediaeval Arab world

Obesity was well-known to leading physicians of the mediaeval Arab world such as Al Razi, Avicenna, Ibn Hubal Al-Baghdady, and Ibn el Nefis. Most of these scholars were well aware of the medical complications attendant upon gross obesity, and they recommended treatment by a combination of vigorous exercise and dietary change.

Al-Razi (854-925 CE) was a Persian polymath who practiced medicine in mediaeval Baghdad. He wrote several books on nutrition, including one entitled "*Benefits of food and the warding off of its harmfulness*" (Nikaein, Zargaran, and Mehdizadeh, 2012). In his *Encyclopaedia of Medicine*, he also reviewed existing knowledge of obesity. He presented clinical case reports on the patients he had treated successfully; the therapy that he had recommended for the obese included diet, drugs, exercises, massage, hydrotherapy, and lifestyle changes. One new idea was that "*prolonged thinking that leads to sadness slims".*

Obesity was also well known to Abu Ali Ibn Sina (Avicenna, 980-1037 CE, Figure 19), another of the leading figures of early Arabic medicine (Nathan, 1992). He devoted a part of Volume 3 of the *Canon of Medicine* to a discussion of the drawbacks of excessive obesity, classifying it as a medical disorder, and noting associated health risks, including respiratory and cardiac problems, infertility, and sudden death. He was a strong advocate of a positive lifestyle (Avicenna, 1999), arguing: "*The regimen of maintaining health consists essentially in the regulation of 1) exercise, 2) food and 3) sleep. Once we direct the attention towards regulating exercise as to amount and time, we shall find there is no need for such medicines as are ordinarily required for remedying diseases."* if obesity was already established, he proposed treating it with hard exercise and lean foods. On

Figure 18: A second century Roman representation of Dionysus, the God of wine. Source: https://en.wikipedia.org/wiki/Dionysus

Figure 19. Avicenna, a leading figure of mediaeval Arabic medicine and advocate of a healthy lifestyle. Source: https://www.google.ca/imgres?imgurl=http://www.thefamouspeople.com/profiles/images/avicenna-2.jpg

occasion, he also prescribed an appetite suppressant for his obese patients, based on sweet almonds, beef suet, violets and marshmallow (Haslam, 2016).

Ibn Hubal Al-Baghdady (1121-1213 CE) also practiced medicine in Baghdad. Like Avicenna, he commented on the predisposition of "*hugely obese persons*" to fall ill quickly. He concurred with the idea of management by heavy exercises on an empty stomach, but he also stressed the importance of a gradually increasing the training regimen, because an excessively obese person could put himself at risk if he started abruptly on a programme of heavy physical activities.

The Damascus-born Ibn al Nafis (1207–1288 CE) practiced medicine in Cairo (Abdel-Halim, 2005)(Figure 20). He reported further on the association between excessive obesity and cardiovascular and cerebro-vascular accidents, respiratory, and endocrine disorders in his book *Al Mujaz Fit-Tibb (The Concise Book of Medicine)*, noting that "*Excessive obesity is a constraint on the human being limiting his freedom of actions."* He distinguished a special type of obesity in that some children were "obese by birth."

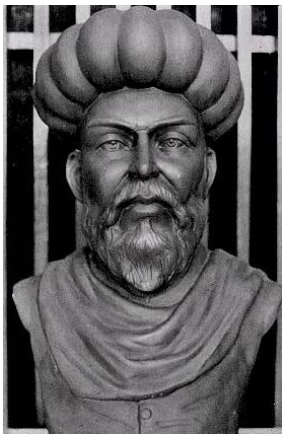


Figure 20: The Cairo-based physician Ibn al Nafis (107-1288 CE) noted the association between excessive obesity and cardiovascular and cerebro-vascular accidents, respiratory problems and endocrine disorders. Source: https://en.wikipedia.org/wiki/Ibn_al-Nafis

Conclusions. The writings of Persian doctors show that obesity and its complications were well known in this part of the world during the "Arab Spring" of mediaeval learning.

Mediaeval and Renaissance Europe

As Christianity became the dominant belief system in Europe, the idea grew that illness was a punishment of God, merited by a person's sinful behaviour. Nevertheless, obesity was not uncommon among the elite, and it was prized by some as a physical manifestation of their wealth (Bloomgarden, 2003).

Obesity among the wealthy elite. In much of Europe, the world of the 1300s was marked by hunger and severe food shortages. Episodes of famine seemed to recur at least once every five years. Throughout this era, degraded soils, inadequate storage of food products, slow and difficult transportation networks, and vulnerability to inclement weather contributed to an inadequate diet for most of the world population. Obesity thus became a visible sign of wealth and personal success. Rulers such as Charles III, Louis VI, and Henry VIII all became greatly overweight, as did many of their senior officials (Bloomgarden, 2003).

Charles III. Charles III, the Carolingian Emperor from 881-888 CE, was nicknamed "Charles the fat" (Figure 21). He is reputed to have shown an accompanying lethargy, although the cause of his death, at the age of 56 years is unknown.

Louis VI. Louis VI (1081-1137 CE) was king of France. He was nicknamed "*Le Gros*," and by the age of 40 he had become so obese that he had difficulty leading his army into battle. He died suddenly, supposedly of dysentery, but it seems likely the infection was complicated by his obesity.

Henry VIII. Henry VIII of England (1491-1547 CE) was very athletic as a

young man, and he built elaborate exercise facilities into many of his palaces. However, he abandoned exercise following a serious jousting injury, without curbing what was reputed to be a prodigious appetite. A study of his suits of armour shows a progressive increase in waist girth from 81 cm to 140 cm over adult life, with the body mass rising eventually to 178 kg (corresponding to a BMI of 52 kg/m^2) (Figure 22). In his final years, 4 strong men were needed to carry Henry from room to room on a padded chair known as "the King's tram" (Shephard, 2015).

Attitudes of the mediaeval church. The mediaeval Catholic church voiced strong public disapproval of obesity, viewing gluttony as one of the "seven deadly sins" (Shipley, 1875). Pope Gregory (6th century CE) noted five potential manifestations of gluttony:

1. Sin in the matter of time, eating before the appointed time.
2. Sin on a question of quality, seeking out delicacies.
3. Sin by the use of stimulant sauces and condiments.
4. Sin in relation to the quantity of food ingested.
5. Sin from eating with undue eagerness (Shipley, 1875).

Other mediaeval church leaders saw expressions of gluttony in:

- *Praeopere* (eating too soon);
- *Laute* (eating too expensively);
- *Nimis* (eating too much);
- *Ardenter* (eating too eagerly);
- *Studiose* (eating too daintily);
- *Forente* (eating wildly) (Wolin & Petrelli, 2009).

Shipley (1875) relates several anecdotes that illustrate the stern attitudes of the mediaeval church towards any hint of gluttony: *"A nun, walking in the garden of her convent... her eyes fell on a lettuce, and... she was tempted to the sin of gluttony. She yielded to the sin, plucked the lettuce, and ate it greedily. But ...as she was eating, a devil entered into her, and she became possessed, with torments." "A monk who gave up himself to the sin of gluttony...lived in a monastery of Lycaonia, and was held in great esteem ... But the unhappy monk was a slave to gluttony; so that, whilst others fasted, he took secret opportunities for eating. At length he was overtaken with a serious illness, which proved to be his last. As the hour of his departure drew near, the monks flocked around his bed, thinking to hear ... something for their soul's edification." "Brethren... when you fasted, I feasted in secret: for which cause I am given over to the infernal enemy, who has already coiled himself around my feet and knees, and is now reaching my heart."* With these words he expired." *"A saintly old monk, while sitting at table with other monks, was favoured by GOD with an inward vision, in which it was revealed to him that some of his brethren were eating sweet*

Figure 21: Charles the Fat, Carolingian Emperor from 881-888 CE. Source: https://www.quora.com/Why-is-Charles-the-Fat-called-Charles-the-Fat-and-not-some-more-appropriate-or-kingly-title-such-as-the-great

Figure 22: Henry VIII. Source: https://www.google.ca/search?q=Henry+VIII

honey, others were eating plain bread, and others, again, were eating uncleanness... Those who were eating for the sake of eating only, who gave up themselves to the sensual gratification and could think of nothing but their food, were they who fed on uncleanness."

Medical attitudes to obesity during the Renaissance. Renaissance physicians and other scholars in Britain, including Elyot, Cogan, Boorde, and Moffett, all advocated moderation and frugality of diet in both scholarly and popular writing.

Thomas Elyot. The diplomat and scholar Sir Thomas Elyot (1490-1546 CE) was one of the first Britons to promote the primary prevention of disease. In his treatise *The Castel of Health,* he offered simple rules for a healthy diet and overall lifestyle in a text that was accessible to all who could read Greek (Elyot, 2005). He warned specifically of the dangers to health from over-eating: *"abuse is heere in this realme in the continual gourmandise and dailye fèeding on sundrie meats at one meale, the spirit of gluttony triumphing among vs, in his glorious chariot called welfare, driving vs from him, as his prisoners into his dungeon of surfet, where we are tormented with catars, fevers, gouts, pluresies, fretting of the guttes, and many other sicknesses, and finally put to death by them, oftentimes in youth, or in the most pleasant time of our life.*"

Luigi Cornaro. Luigi Cornaro (1464-1566 CE) was a long-lived Venetian nobleman. He devised a personal diet and lifestyle at a relatively young age, when he was informed by doctors that his life of excess was killing him. He turned to temperance and frugality in order to treat his ill-health and laid down rules for good health in his "*Four Discourses on a Sober Life*" (Figure 23). His basic plan was a restriction of food intake to the minimum needed for survival, and to eat only food that agreed with his constitution. He claimed not only to have lived for somewhere between 98 and 102 years, but also to have retained full mental clarity, good eyesight and robust health until his death. He is said to have eaten about 340 g of food per day, supplemented with a little wine. At one point, his relatives persuaded him to increase his daily intake to 400 g/day, but he found: "*This increase, had, in eight days' time, such an effect upon me, that, from being cheerful and brisk, I began to be peevish and melancholy, so that nothing could please me. On the twelfth day, I was attacked with a violent pain in my side, which lasted twenty-two hours and was followed by a fever, which continued thirty-five days without any respite, insomuch that all looked upon me as a dead man"* (Cornari, 1993).

Figure 23: Louis Cornaro's Four discourses on a sober life. Source: https://www.google.ca/search?q=Luigi+Cornaro

Thomas Cogan. The Tudor physician Thomas Cogan (1545-1607 CE) recounted the adages of Hippocrates and Galen, adding his own shrewd analogies. On exercise, he wrote: "*Flowing water does not corrupt, but that which standeth still; even so animal bodies exercised, are for the greatest part healthful; and such as be idle are subject to sickness*" (Cogan, 1596).

Andrew Boorde. The cleric and physician to Henry VIII Andrew Boorde (1490-1549 CE) wrote the *"Breviary of health."* This blamed obesity upon an excessive consumption of alcohol (Boorde, 1552): *"All sweet wines and grass wines*

doth make a man fat" Abstinence is *"the most perfectest medicine that can bee."* He also stated that repletion shortened a man's life, and two meals a day should suffice, except for a labourer. By the time of the publication of his book, he had abandoned the priesthood, and was living on Fleet Street in London, making a handsome living as a jocular purveyor of health foods that were nicknamed "Merry Andrew".

Thomas Moffett. The English naturalist and Paracelsian physician Thomas Moffett (1553-1604 CE) wrote the popular book *"Health's Improvement"* (Moffett, James, and Oldys, 1746). In this text, he noted that *"to sleep and sit too much... of itself procureth fatness." "in a Man too much fatness is both a causes of diseases and a disease itself."*

William Vaughan. William Vaughan (1575-1641) a doctor of Civil Laws and an early promoter of settlement in Newfoundland, first published his health education text ("*Directions for Health, Naturall and Artificiall*") in 1600 (Vaughan, 1607). He wrote: *"They that observe a good diet, neede no artificiall Physicke." "For how is it possible, that the smoaky vapours which breathe from a fat and full paunch, should not interpose a thick mist of dullness between the body, and the body's light!'* He criticized 17th century gourmandises, suggesting that health was better before Noah's flood, when food was much simpler. *"They were ignorant of our delicate inventions and multiplied compounds. They knew not of our dainty cates [delicacies], our marchpanes [fancy cakes], nor our superfluous flibber [flighty] sauces."*

Literary criticism of the obese during the Renaissance. Criticism of the fat and sedentary person was becoming increasingly prevalent in the fifteenth and sixteenth centuries. Obesity had become associated with slowness, laziness, and ignorance about things and people, and this was reflected in the literature of the period (Haslam and Haslam, 2009).

William Langland. In the 14th century allegory *Piers Plowman*, William Langland (1332-1386 CE) has the sin of gluttony excite visceral horror (Levy-Navarro, 2008).

Giovanni Boccaccio. The *Decameron* offers 100 tales written by the Italian novelist Giovanni Boccaccio (1313–1375 CE). St. Thomas Aquinas (1225-1274 CE), a brilliant Italian theologian and Dominican friar, was reputed to have been colossally fat and hugely fond of his food; perhaps for this reason, he wrote strongly against gluttony. He may also have provided the inspiration for Friar Rinaldo, one of the stereotypically fat clerical characters in the Decameron.

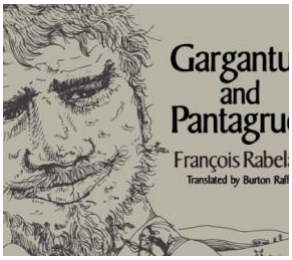
Giovanni de Medici. Giovanni de Medici (1421-1463 CE), Cosimo de Medici's libidinous, cultured and favourite son was a typical child of the Renaissance. He cared for art, music and beautiful views. However, he is also known for being grossly overweight.

Geoffrey Chaucer. The English story-teller Geoffrey Chaucer (1343-1400) reiterated the advice of Hippocrates: ''*Agonys glotonye, the remedie is abstinence*." However, he recognized that for some of his contemporaries, being *"full fat"* was a status symbol. The church had relaxed some of its dietary restrictions during the 14th century, and in the Monk's tale, Chaucer highlights the obesity, the sweating faces, and the rich food and wine that were being enjoyed by many of the clergy. "*Steaming like a furnace*, " the monk *"stood in goodly case. His bulging eyes he rolled about, and hot. They gleamed and red, like fire beneath a pot...He was not as pale as some tormented ghost, a fat swan loved he as best as any roast."*

Marguerite of Navarre. The *Heptaméron* is a collection of 72 short stories, written by Marguerite, Queen of Navarre (1492-1549 CE). One tells the tale of a fat cleric, a Grey Friar. When he tried to run from the perceived danger of slaughter by a butcher *"who... would think no more of slaughtering him than if he were an ox or any other beast."* Listening to the conversation of his hosts, he heard the words: *"I must rise betimes in the morning, sweetheart, and see after our Grey Friars. One of them is very fat and must be killed; we will salt him forthwith and make a good profit off him*." An attempt to jump from the window led to a fall and impeded his escape; the butcher discovered him hiding in a pig sty, and the friar begged for his life (Figure 24).

Figure 24: The obese Grey Friar imploring the butcher to save his life, from the *Heptaméron.* *Source:* https://ebooks.adelaide.edu.au/m/marguerite_de_navarre/heptameron/chapter35.html

Figure 25: Gragantua, from François Rabelais. Source: https://www.google.ca/imgres?imgurl=https://images-na.ssl-images-amazon.com/images/I/81o27BXYIoL.jpg



Gargantua. François Rabelais (c. 1483-1553 CE) was the author of the *Life of Gargantua and Pantagruel*, a pentalogy of satiric novels (Rabelais, 2005). Gargantua was pictured as a huge baby, calling for ale immediately after his birth, and drinking the milk of 17,913 cows. As an adult, he had 18 chins (Figure 25), and when mocked by a crowd in Paris, he drowned many of them in a flood of urine. It looked as though the poor man might burst. *"Why don't you swaddle him round with good girths, or secure his natural tub with strong sorb apple tree hoop? Nay, why don't you iron-bind him, if need be? This would keep the man from flying out and bursting."*

Martin Luther. As a young man, Luther fought stubbornly against the temptations of the flesh, and became haggard from studying and worrying about many supposed transgressions, but later he became quite obese. Catholics ridiculed Luther (1483-1556 CE), with images of Bibles crushed under a stomach so huge that a wheelbarrow was needed for him to get around (Figure 26). Several days before his death, Luther joked to his friends that he would shortly return to Wittenberg and "*give the worms a fat doctor to feast on*" (Wright, 1864).

William Shakespeare. Shakespeare makes numerous references to obesity in his plays. We may cite from *the Merchant of Venice (Act 1, Sc. II): "They are as sick that surfeit with too much as they are that starve with nothing;"* from the *Comedy of Errors (Act 3. Scene 2)*: "*How dost thou mean a fat marriage? Marry, sir, she's the kitchen wench and all grease; and I know not what use to put her to but to make a lamp of her and run from her by her own light;"* from *Henry IV (Part 1, Act Ii, Scene 4: "There is a devil that haunts thee in the likeness of an old fat man, a tun of man is thy companion;"* from *Julius Caesar, Act I, Scene 2: "Upon what meat doth this our Caesar feed, That he is grown so great?"* and from *"As You Like it" (Act II, Scene 7): "then the justice, In fair round belly with good capon lin'd."*

Figure 26: Cartoon of Martin Luther and wheelbarrow. Source: https://www.google.ca/search?q=Cartoon+of+Luther+and+wheelbarrow

Conclusions. During the mediaeval period and the Renaissance, both the church and physicians spoke strongly against gluttony, and much of the literature from this era satirized those who were obese. Nevertheless, they did not themselves always heed these injunctions, and various examples of extreme obesity can be found among rulers and senior prelates.

The enlightenment

By the 17th century, the tide of public opinion had turned even more strongly against the obese. The physician Thomas Short wrote: *"I believe no Age did ever afford more Instances of Corpulency than our own"* (Short, 1727). He argued strongly the need for exercise in the fight against corpulency, but also had some bizarre ideas about environmental risk factors, advising against living near "*Marshes, fens, ponds or stagnant waters*" and warning against the dangers of flannel shirts; the latter were *"exceedingly injurious to weak people*" because they increased sweating.

Medical attitudes. Enlightenment physicians in general continued to treat their patients within the constraints of the classical Greek understanding of physiology, although many recognized that an adverse lifestyle could contribute to obesity, and that its treatment was important in the quest for a long and healthy life-span. Little new was discovered about the pathogenesis or treatment of obesity, but some surgeons made heroic efforts to excise the excess fat. One Parisian surgeon reported excising 4.5 kg of fat from the abdomen of a woman in 1718 CE, with at least temporary relief of her obesity, but often such operations had fatal consequences.

Edward Baynard. Edward Baynard (1641-1719 CE) practiced medicine in London and in Bath. His *"'Health, a Poem. Shewing how to procure, preserve, and restore it. To which is annex'd The Doctor's Decade"* (Baynard, 1719) contained much practical advice on dietary moderation, for example: "*Fly all excess and first take care of wine and women to beware." "A little breakfast you may eat, but not so as to satiate.*" "*Accustom early in your youth to lay embargo on your mouth.*"

Tobias Venner. Tobias Venner (1577-1660 CE)(Figure 27) was a medical practitioner who attended some of the socialites who were flocking to the thermal springs and Pump Rooms in Bath. He himself lived to the age of 83 years. He subscribed to Galen's theory of the four body humours but argued that these could be thrown out of balance by six non-natural factors (environment, diet, sleep, exercise, excretion, and the passions of the mind).

He was the first physician to use the word "*obesity*" in a medical context, and he called specifically for its treatment in his *Treatise,* published in 1620. He underlined that obesity was a condition of the elite, and that it could be cured by the combination of an exercise regimen and a balanced diet with regular use of the mineral waters of Bath (Venner, 1620): *"to make slender such bodies as are too grosse . . . let those that feare obesity, that is, would not wax grosse, be careful to come often to our Baths: for by the use of them, according*

as the learned Physician shall direct, they may not only preserve their health, but also keep their bodies from being unseemly corpulent."

Thomas Sydenham. Thomas Sydenham (1624-1689 CE) was a physician who practiced in the city of Westminster. He wrote a textbook of medicine ("*Observationes Medicae"*) which became a reference standard for two centuries. He acknowledged the multifactorial nature of obesity, but also recognized that its origins had a strong lifestyle component: He emphasized "*moderation in eating and drinking is to be observed, so as on the one hand to avoid taking in more aliment than the stomach can conveniently digest, and of course increasing the disease thereby, and on the other hand defrauding the parts by immoderate abstinence*" (Rush, 1809).

George Cheyne. George Cheyne (1671–1743 CE)(Figure 28) was born in Aberdeen, and became one of the leading physicians of his day. He himself suffered from gross obesity. A self-indulgent youth had left him *"excessively fat, short-breath'd, lethargick and listless,*" and despite some weight reduction during two periods of adherence to a milk and vegetable diet, he returned to meat-eating and regained the lost pounds. Seeking to build up his medical practice, he was constantly *"Dineing and Supping in Taverns, and in the Houses of my Acquaintances of Taste and Delicacy.*" The consequences were a peak weight of 32 stone (203 kg), taking refuge in the "*poison of opiates*," and finding a servant who walked behind him, carrying a stool on which he could recover his breath every few paces (Porter, 2005).

Cheyne wrote of *"The fat, unwieldy and overgrown,"* noting *"tis easier to preserve Health than to recover it, and to prevent Diseases than to cure them . . . without due Labour and Exercise, the Juices will thicken, the Joints will stiffen, the Nerves will relax, and on these Disorders, Chronical Distempers, and a crazy old Age must ensue*" (Cheyne, 1724).

Personal experience had taught Cheyne about the associated depression: *"a disgust or disrelish of Worldly Amusements and Creature Comforts . . . tumultuous, overbearing hurricanes in the mind*" (Guerrini, 2000). Cheyne also suffered from a skin disorder that he termed *"skorubtick ulcers"* – and linked his obesity with a poor circulation; his blood had become "*one impenetrable Mass of Gle*w'," with "*every vein and artery like so many black puddings*" (Haslam, 2007).

The poet Alexander Pope (1688-1744 CE) was one patient that Cheyne treated for obesity during the 1730s, and Pope was persuaded to follow a regimen of light wine, few suppers and much water.

James Mackenize. In 1758, the Scottish physician James Mackenzie wrote: "*I determined to prevent [illness], by acquainting those that will restrain their appetites, and hearken to reason, with the most effectual rules to preserve health: For certain it is, that from men's ignorance, or contempt of such rules,*

Figure 27: Tobias Venner (1577-1660 CE), a physician in Bath, was the first person to use the term obesity in a medical context. Source: https://en.wikipedia.org/wiki/Tobias_Venner

Figure 28: George Cheyne (1671-1743), a physician who reached a weight of 203 kg. Source: https://en.wikipedia.org/wiki/George_Cheyne_(physician)

thousands never arrive at that period of life which their strength of constitution would have reached with proper care."

William Cullen. William Cullen (1710-1790) was a physician who later became professor of chemistry in Edinburgh. He is well known for his classification of diseases. He termed obesity "*polysarcia*," from the Greek for much flesh, placing the condition in his "Order II" of diseases ("Intumescentiae', or swellings"). Cullen proposed treating obesity by creating a saline and acid state of the blood, although Wadd (below) questioned whether such an initiative might have *"worse consequences than the corpulency it was intended to cure, and that no person should hazard these while he may have recourse to the more certain means of abstinence and exercise "* (Wadd, 1816).

François Boissier de Sauvages. François Boissier de Sauvages (1706-1767 CE) was a physician and a botanist who served as professor of physiology and pathology at the University of Montpellier, in southern France. He also developed a classification of diseases, listing polysarcia (Young, 1813).

John Armstrong. In 1744, the London-based physician and poet John Armstrong (1709-1797 CE) wrote a lengthy poem where he engagingly discussed "*The Art of Preserving Health*." He stated: "*Unless with exercise and manly toil You brace your nerves, and spur the lagging blood. The fat'ning clime let all the sons of ease Avoid; if indolence would wish to live*" (Armstrong, 1744). He contributed material to James Thomsen's the "*Castle of Indolence.*"

Jean Anthelme Brillat-Savarin. The Parisian author Anthelme Brillat-Savarin (1755-1826 CE) wrote a notable book on Gastronomy (*Physiologie du goût; "The Physiology of Taste"*). Although a lawyer rather than a physician, Brillat-Savarin distinguished an android from a gynoid distribution of body fat: *"There is one kind of obesity that centres round the belly; I have never noticed it in women: since they are generally made up of softer tissues, no part of their body is spared when obesity attacks them. I call this type of fatness Gastrophoria, and its victims Gastrophores. I myself am in their company; but although I carry around with me a fairly prominent stomach, I still have well-formed lower legs, and calves as sinewy as the muscles of an Arabian steed"* (Brillat-Savarin, 1854).

William Wadd. William Wadd (1776-1829 CE) was a British surgeon and physician practicing in central London. He unequivocally considered obesity as a disease: *"corpulency may be ranked amongst the diseases arising from original imperfections in the functions of some of the organs, yet it must be admitted also, to be most intimately connected with our habits of life"* (Wadd, 1816)(Figure 29). He wrote scathingly of "*some poor victim, too ponderous to be brought down the staircase*." of a brewmaster who "*became too big to pass up the brewhouse staircase*," of Tunisian maidens fattened for marriage, of a girl who weighed eleven stones (69.5 kg) by the age of eleven, and of a child who was so fat at the age of six that the public were willing to pay a shilling to view her... He speculated that some of these people might even be at risk of spontaneous combustion. Sometimes obesity also caused fatal

Figure 29: One of the patients of William Wadd (1776-1829 CE). Source: https://www.google.ca/search?q=William+Wadd

difficulties in breathing. Further, he made valuable post-mortem observations on the obese (below).

William Buchan In 1795, the Scottish physician William Buchan (1729-1805 CE) wrote the very successful *"Domestic medicine, or a treatise on the prevention and cure of disease,*" at the modest price of six shillings (Buchan, 1776). A total of 19 editions were published. In this popular work, he stressed the link between healthy eating, body mass, and health. He warned *"such girls as lead an indolent life, and eat great quantities of trash, are not only subject to obstructions of the menses, but likewise glandular obstructions; as the scrophula or king's evil.*" For *"women of a gross or full habit," "a spare thin diet"* was required, with only a small beer to enliven it.

Robert Thomas. Robert Thomas, an Enlightenment physician practicing in Salisbury, Wiltshire, wrote "*The Modern Practice of Physic*" (Thomas, 1802). He linked "paralysis" or stroke with a "full plethoric habit." He commented: *"It is found to attack men much more frequently than women, particularly those who have short necks, who are inclinable to corpulency, and who at the same time lead an inactive or sedentary life . . . he should endeavour to counteract any disposition to obesity, which has been considered a predisposing cause."* Robert Thomas described the link between obesity and endometrial cancer; writing of menstrual discharges, he noted "*When they happen to disappear suddenly in women of a full plethoric habit, such persons should be careful to confine themselves to a more spare diet than usual; they should likewise take regular exercise, and keep their body open by a use of some mild laxative . . . Should any scirrhous or cancerous affection of the uterus take place...all that can be done in such a case is to have recourse to palliatives, such as opium, hyoscyamus, and hemlock*."

Shadrach Ricketson. In 1806, the Quaker physician Shadrach Ricketson (1768-1839 CE) produced the first American book on hygiene and preventive medicine, entitled *"Means of preserving health and preventing diseases"* (Ricketson, 1806). This text emphasized the hidden acquired diseases and eventual death that resulted from over-eating: "*Let not the drunkard, the epicure, or the voluptuary say, that because he feels no immediate bad effects from his excesses, none are ever to follow: he may be assured, that if he persevere, weakness, disease, and, perhaps death, will, sooner or later, be the inevitable consequence . . . Fullness of blood, and corpulency, are the disagreeable effects of gluttony, which progressively relaxes the stomach, and punishes the offender with headache, fever, pain in the bowels, diarrhoea, and other disorders.*"

Public attitudes and Enlightenment authors. The popular denunciation of corpulence was particularly marked in Enlightenment France (Gilman, 2017), where there was a vigorous social critique of those who were judged to be "profiteering" for themselves and "starving" others. This condemnation even had a negative effect upon employment opportunities. Although examples of gross obesity were recorded, among the nobility, authors, actors and even physicians, its prevalence seems to have remained sufficiently low that the public was willing to spend substantial sums at fairgrounds in order to view individuals who were excessively fat.

Francis Bacon. Sir Francis Bacon (1561-1626 CE), the Lord High Chancellor of England, recounts the visit of his father Nicolas Bacon (the Lord Keeper) to his barber, with attendant sleepiness (Bacon, 1803). He *"ordered a window before him to*

be thrown open. As he was become very corpulent, he presently fell asleep in the current of fresh air, " Sir Francis developed a theory that strict moderation in diet was necessary to keep *"the vital spirits of a person's intelligence aflame*" (Sanders, 2010).

de Vauban. The military engineer and Marshal of France (Sebastian Le Prestre de Vauban, 1633-1707 CE) refused to give appointments to big eaters and fat people (Vigarello, 2013). Such individuals were judged as incapable of good service and not to be trusted with important affairs. This criticism of the bourgeoisie persisted during the Restoration (1815–1830) and the July Monarchy (1830–1848).

Queen Anne. The last of the Stuart monarchs, Queen Anne (1665-1714 CE) had 18 pregnancies between 1684 and 1700, with only one child surviving beyond infancy. The *" seventeen pregnancies – all resulting in miscarriages or young deaths – took a heavy toll"* and her *"anxieties grew in proportion to her corpulence*" (Stubbs, 2017). From her mid-thirties, Anne became so obese that she could walk only a short distance without help.

Ben Jonson. The English actor and playwright Ben Jonson (1572-1637 CE) was obese, and on one occasion he tried to correct this by walking from London to Edinburgh (Sanders, 2010).

George Herbert. George Herbert (1593-1633 CE) was the Anglican priest of the small parish of Bemerton, in Wiltshire. He translated Luigi Cornaro's "*A treatise of temperance and sobriety.*" advocating a reduction of food consumption as the key to a long and happy life (Sanders, 2010).

John Dryden. In the mock heroic satirical poem *Mac Flecknoe*, John Dryden (1631-1700 CE) presented the British poet laureate Thomas Shadwell (1642-1692 CE) as a dull poetaster, a corpulent man with a "*mountain belly*" and a plagiarist (Dryden, 1709).

William Congreve. The satirical playwright William Congreve (1670-1729 CE) is said to have been crippled by a combination of gout and obesity, to the point where he could no longer engage in stage management (Gosse, 1888).

Jonathan Swift. The satirist Jonathan Swift (1667-1745 CE) wrote derogatively about the wordiness of a fellow author: *"after this you are presented with a foot-race of mountains and woods, where the woods distance the mountains, that, like corpulent pursy fellows, come puffing and panting a vast way behind them"* (Macbeth, 1876).

Samuel Johnson. James Boswell described a conversation between himself and the writer Samuel Johnson (1709-1784 CE) on the subject of obesity: BOSWELL: *"I don't know, Sir; you will see one man fat who eats moderately, and another lean who eats a great deal."*
JOHNSON: "*Nay, Sir, whatever may be the quantity that a man eats, it is plain that if he is too fat, he has eaten more than he should have done*" (Boswell, 1847).

David Hume. The Scottish philosopher, historian and empiricist David Hume (1711-1776 CE)(Figure 30) was a favourite with duchesses and countesses, but it is said that his corpulence and weakness for port and cheese left him ridiculed by their swains (Finch, 2018). His corpulence was already evident in a portrait by Ramsay dating from 1754, and Diderot also commented on the roundness of his face in a letter from 1769.

David Garrick. By mid-century, like other London celebrities, the actor and theatre impressario David Garrick (1717-1779 CE) was euphemistically using Hogarth's "Line of Beauty" to describe his own corpulence (Goggin and Hassler-

Forest, 2010).

Niccolò Jommelli. The Italian musician Niccolò Jommelli (1714-1774 CE)(Figure 31) retired to his native Aversa, and is said to have spent there his "*opulent corpulence*" (Durant and Durant, 2011).

James Thomsen. The Scottish 18th century poet James Thomsen, author of the "*Castle of Indolence*" was a bulky man. Whether his bulkiness was the result of indolence, or indolence resulted from his corpulence, it matters not; but at any rate it seems that Thomson was rather lazy. Lyttleton described him as "more fat than bard" (Hawick Archaeological Society, 1863).

Lord Byron. George Gordon Byron (1788-1824 CE) called obesity "*an oily dropsy*." He himself seems to have been a weight cycler, with his body mass swinging between 60 and 89 kg over his adult life. Occasionally, he would eat huge meals and then purge himself or engage in violent bouts of exercise (Baron, 1997). In 1811, Byron bought a copy of Wadd's book on corpulence.

Byron is famous for his promotion of a vinegar diet (Bijlefeld and Zoumbaris, 2014). Reports of his nutritional advice range from "*Drink some vinegar with meals*" to "*Drink some vinegar as your meal,*" with associated claims about how vinegar could help with weight loss. At one point, Byron ate only potatoes dipped in vinegar, with some disastrously unpleasant side effects. He also tried programmes that involved obsessively weighing himself, of subsisting on biscuits and soda water, and of wearing heavy clothes to induce excess sweating. Moreover, he advocated these dangerous lifestyles to his wealthy friends.

Anatomical study of obesity. The Restoration and enlightenment saw the first anatomical dissections of obese individuals by Bonet, Morgagni, Haller, Wadd and Haller.

Théophile Bonet. Théophile Bonet (1620-1689 CE) (Figure 32), a Geneva-based physician (Bonet and Manget, 1679) described the post-mortem findings on obese individuals in his text "*Sepulchretum, sive anatomia practica, ex cadaveribus morbo denatis, proponens historias omnium humani corporis affectuum" ("Practical anatomy from dead bodies relative to all conditions affecting the human body")*(Bonet and Manget, 1679).This monograph included the accumulated findings from some 3000 autopsies performed by Bonet and his contemporaries, including Harvey's report on Thomas Parr, a man who was alleged to have died at the age of 152 years (Shephard, 2015).

Bonet's insights into the pathological anatomy of many clinical conditions are widely acknowledged to have laid the groundwork for studies by the Italian pathological anatomist Giambaptista Morgagni (below).

Figure 30: David Hume (1711-1776 CE). Source: https://www.google.ca/search?q=David+Hume

Figure 31: Niccolò Jommelli. (1714-1774 CE). Source: https://en.wikipedia.org/wiki/Niccol%C3%B2_Jommelli

Figure 32: Théophile Bonet performed the first post-mortems on the pathologically obese. Source: http://hardluckasthma.blogspot.ca/2011/11/brief-history-of-copd.html

Giambaptista Battista Morgagni. In 1765, Giambaptista Battista Morgagni (1682-1771 CE) gave some extended case descriptions of patients with severe obesity. He recognized that the accumulation of substantial amounts of fat was linked to an increased risk of disease, and by anatomical dissection he demonstrated that the location of this fat was a crucial issue. In his *Epistola anatoma clinica XXI*, he describes one female with severe abdominal obesity ("*virili aspectu"* – a manly, distribution). "*The limbs were not lean, but they did not correspond in fatness with the extreme obesity of the abdomen and thorax*." *"Her abdomen was prominent, and a large amount of fat had accumulated. Her abdomen was prominent, and a large amount of fat had accumulated in the intra-abdominal spaces and at the mediastinal level, with a raised diaphragm*" (Morgagni, 1761).

Morgagni also commented on a hardening of the arteries in the post-mortem examination of a severely obese male.

William Wadd. William Wadd (1776-1829 CE) was a British doctor practicing in London, who was appointed as Surgeon-extraordinary to King George IV. Wadd became celebrated for his *Cursory Remarks on Corpulence or Obesity Considered as a Disease* (Figure 33) (Wadd, 1816)**,** a publication that went to four editions. The text included a graphic description of one post-mortem examination: *"The heart itself was a mass of fat. The omentum was a thick fat apron. The whole of the intestinal canal was embedded in fat, as if melted tallow had been poured into the cavity of the abdomen...So great was the mechanical obstruction to the functions of an organ essential to life, that the wonder is, not that he should die, but that he should live."*

In a second book entitled "*Comments on corpulence: Lineaments of leanness*" (Wadd, 1829), Wadd presented details on 12 cases of obesity; two had been examined at post-mortem, and their bodies were found to contain enormous accumulations of fat. On microscopic examination: *"The first striking appearance was the degree to which the cellular membrane was loaded with fat."* In our present context, perhaps the most interesting of Wadd's cases was a "*Fat sportsman."* This particular patient claimed to have gone through great exertion every morning, but to have rewarded this virtue by eating, drinking and sleeping throughout the afternoon. The morning's exertions waned as obesity began to impede his movements, and the "*sportsman's*" weight at examination was 121 kg. A country practitioner had referred another case of gross obesity to Wadd; with a height of only 1.52 m, but an initial body mass of 146 kg, this person had a BMI of 63.2 kg/m^2.

Albrecht Haller. Albrecht Haller 1708-1777 CE), the Swiss anatomist and physiologist, is himself reported to have suffered from obesity associated with bipolar disorder (Kretschmner, 1948); in later life he became addicted to opium. He provides further post-mortem descriptions of obesity in his book *Elementa physiologiae corporis humani (Physiological elements of the human body)*(Haller, 1757). He linked obesity to gastric disorders: "*Among the diseases which are discovered by frequent dissections, I have found some very terrible ones of the stomach, of which I shall give a concise account*" (Haller, 1756),

Studies in energy balance. The Venetian physiologist Santorio Santorio (1531-1636 CE) was an interesting if somewhat eccentric character from the early part of this era. He added to our understanding of metabolic balance by

constructing a weighing chair on which he sat for much of the day, recording changes in his body mass relative to his food intake and excretory losses (Figure 34). He noted that for every eight pounds of food that he ate, only 3 pounds of waste were excreted, with at least a part of the difference in the two weights being due to insensible perspiration (Eknoyan, 1999).

Conclusions. By the end of the Enlightenment, gross obesity was still sufficiently rare as to prove a fairground attraction. At the same time, there was public disapproval, satire, and in some cases denial of employment to those who were fat. Nevertheless, a growing number of wealthy people, including physicians, authors and actors, showed substantial accumulations of body fat. Physicians still had a limited knowledge base, although their understanding of obesity was now helped by post-mortem studies of the grossly obese. A growing number of complications were recognized, and moderation in diet and regular exercise remained the most common recommendations to affected individuals.

The Victorian era

Quantification of obesity. At the beginning of the Victorian era, there were many shady insurance companies, and little understanding of weight for height norms even by the more reliable concerns. Charles Dickens featured an unscrupulous company (the "*Anglo-Bengalee Disinterested Loan and Life Assurance Company"* in his novel "*The Life and Adventures of Martin Chuzzlewit."* However, attempts to quantify an individual's excess weight in ways that were appropriate to clinical and pathological practice developed in Victorian times, with Adolphe Quételet, John Hutchinson, Cesare Lombroso, and Louis Dublin leading in this research.

Adolphe Quételet. Adolphe Quételet (1796-1874 CE) (Figure 35) was a Belgian statistician who founded and directed the Brussels observatory. In our present context, he developed the concept of the "*average man*" characterized by the mean of height and weight values that follow a statistically normal distribution, and he argued that the normal variation in anthropometric characteristics provided one basis for the operation of natural selection (Quetelet, 1835).

Quetelet suggested that a person's weight divided by the square of his or her height provided a measure of fatness that corrected for inter-individual differences in height. This measure, although now termed the Body Mass Index (BMI) in

Figure 33: Frontispiece to Wadd's book "Comments on corpulence: Lineaments of leanness."

Figure 35: Adolphe Quételet (1796-1874 CE) was a Belgian statistician who developed early weight for height tables. Source: https://en.wikipedia.org/wiki/Adolphe_Quetelet

Figure 34: Santorio Santorio (1531-1636 CE) studied energy balance by spending much of his time in a chair where he could weigh changes in body mass with ingestion of food and excretion. Source: https://www.google.ca/search?q=Santorio+Santorio

North America, is still recognized as the 'Quételet Index' (QI) in some European countries.

John Hutchinson John Hutchinson (1811-1861 CE) is perhaps best known as inventor of the clinical spirometer. In 1836, he was appointed as physician to the Britannia Life Assurance Society, and in this role he developed a keen interest in relationships between body mass and life expectancy (Spriggs, 1977). His published an early population survey of vital capacity, height, and body mass, based on a relatively representative sample of British society (Hutchinson, 1846)**.**

***Cesare Lombroso*.** In Italy, the criminologist Cesare Lombroso (1835-1909 CE) accumulated statistics on the height and body mass of a large sample of the Italian population ("*Sulla statura degli Italiani*" 1873), and he used this data in his attempt to substantiate the hypothesis that prostitutes and other criminals were more obese than their honest peers (below).

***Louis Dublin*.** Louis Dublin (1882–1969 CE), a statistician and vice president of the Metropolitan Life Insurance Company in New York, built on this earlier work to develop tables of normal weights, based on the average weight for a given height reported by American applicants for life insurance (Eknoyan, 2008).

Medical attitudes. Efforts to provide appropriate clinical care for the fat person were intensified during the Victorian era, often with recommendations to supplement exercise and dietary restrictions by physical constraints such as belts and corsets. Many doctors began to apply the new understanding of physiology to rational forms of treatment, although surprisingly the lead was taken by an undertaker named William Banting, who proposed what was essentially a forerunner of the Atkins diet.

William Banting. William Banting (1798- 1878 CE) was a notable British undertaker of the period (Figure 36). He was initially very obese himself and knew of the breathlessness that this obesity caused. He also described associated joint pains, often described by his medical contemporaries as "gout." The co-morbidity of deafness led him to consult the surgeon William Harvey, who identified Banting's hearing loss as arising from the fat around his neck compressing the airways. Banting became slim through adherence to a low carbohydrate diet, as prescribed by Harvey, and he wrote the first commercially available diet programme, a low *"farinaceous"* diet that was the forerunner to the Atkins diet (Banting, 1964). An article in the London *Daily Telegraph* recounts his story: *"On the August morning that he began his diet, 26 years into the reign of Queen Victoria, the short and very fat William Banting heaved himself out of bed at 8 a.m., hoisted a corset around his bulging stomach and struggled into his three-piece suit. Unable to reach his laces, he gingerly eased his feet into his shoes with a boot-hook - taking care as he stooped not to stress the angry boils on his buttocks. As he negotiated the stairs in reverse (a method, he found, that eased the crushing pressure on his knees), he was looking forward to the cooked breakfast awaiting in the dining room below - but*

Figure 36: A case for William Banting. Source: https://www.google.ca/search?q=William+Banting

dreading the effect it would have on his ever-ballooning bulk. Twelve months later, the 5ft 5in Mr Banting had shed more than three stone, to be a slightly portly 11 stone" (Edwardes, 2003). Finally, Banting believed that he had reached "*the standard natural at my age (10 stone 10 or 150 lbs), as my weight now varies only to extent of one lb, more or less, in the course of a month. According to Dr.Hutchinson's tables, I ought to lose still more, but cannot do so without resorting to medicine.*"

Banting's name entered into the popular culture of his day, beloved of Mr Punch, and even becoming the subject of a theatrical comedy and music hall songs (Haslam and Rigby, 2010).

William Harvey. William Harvey was the Ear, Nose, and Throat surgeon who advised Banting; he praises the Banting method of weight reduction in his book: "*On corpulence in relation to disease with some remarks on diet*" (Harvey, 1872). Harvey regretted that people viewed obesity as a curiosity, rather than as a condition requiring treatment: *"Corpulence is an abnormal body condition that has been ... observed and described, mainly as being a curious phenomenon; ...nobody had studied this constitution with the inconveniences, the accidents, the infirmities and the diseases which it produces or maintains."*

***Julian Watson Bradshaw*.** The English naval surgeon Julian Watson Bradshaw (1824-1907 CE) offered many insights into Victorian medical practice. In his pamphlet "*On Corpulence*" (Bradshaw, 1864) he wrote: *"to carry a certain amount of flesh, as it is termed, is by many considered not necessarily a standard of beauty, but an indication of health. This is a grave mistake. Augmentation of fatty tissues leads to very alarming results." "fat to an immoderate extent...is a disease." "the diaphragm cannot act with natural ease and the heart may lose its power." "more can be done by diminishing the quantity of food than by any other method.*"

Wilhelm Ebstein. Wilhelm Ebstein (1836-1912 CE) discussed a rational physiological basis for the treatment of obesity in an address to the Lower Saxon Medical Association (Ebstein, 2015). He was initially critical of Banting's ideas on diet, suggesting that such a regimen led to inanition, but he later became a strong supporter of the a high fat, low carbohydrate diet, contending that albuminous and fatty matter checked the deposition of fat in the body.

Max Joseph Oertel. MaxJoseph Oertel (1835-1897) was a physician who operated a sanatorium in Munich. He advocated a diet of lean beef, veal or mutton and eggs in the treatment of obesity. He was also a proponent of the terrain cure (Oertel, 1886), arguing the need to strengthen the weakened muscular substance of the heart by a limitation of the amount of fluid in food and drink, and by graduated exercise for the muscles. Spa trails were marked in numbers and colors on a scale of increasing difficulty, depending on their length and slope. The 244-pound Prince Otto von Bismark responded to this regimen by the loss of 60 pounds over the course of a year.

William Osler. Sir William Osler (1849-1919 CE)– the Canadian physician who became one of the four founding fathers of Johns Hopkins Hospital, saw over-eating and a lack of exercise as dominant causes of obesity. In the 1882 monograph "*Obesity and its Treatment*" Osler wrote: *"With few exceptions, persons over forty eat too much."* He recommended treatment with a diet that was low in refined carbohydrate, and where meat and eggs predominated (Osler, 1892); he insisted that fatty foods were crucial in

counteracting obesity, because they increased feelings of satiety.

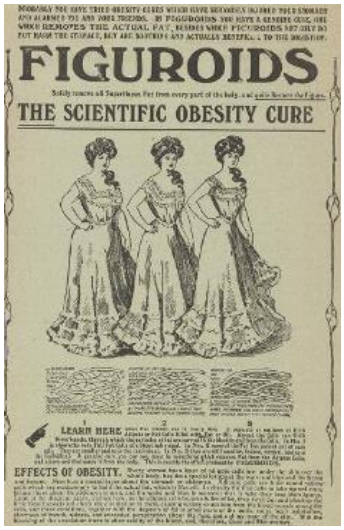
Harvey Cushing. Shortly before his retirement, the brain surgeon Harvey Cushing (1869-1939 CE) developed an interest in the neuro-endocrinology of obesity, with a particular focus upon Cushing' s syndrome (Bray, 1994).

Quack Remedies. The prosperity of the Victorian middle class and growing opportunities for popular advertising allowed a wide range of unscrupulous quacks, commercial organizations, and even less well-informed doctors to offer an arsenal of quack remedies supposed to correct obesity and fortify the flesh. Many had catchy names, such as Figuroids, Gordon's Elegant Pills, Bile Beans, Corpulean, and Slim.

As examples, we will comment briefly on several "slimming" pills, deliberate tapeworm infection, prolonged mastication of food, temperate food choices, magnetic and electroconvulsive therapy, hydrotherapy, spa treatment, acupuncture, and homeopathy. Many of the drugs that were marketed contained substantial quantities of laxatives and were relatively harmless although ineffective. Others were quite dangerous to health. Dinitrophenol raised body temperature and sometimes caused blindness, and although thyroid extract increased metabolic rate, it could cause heart problems.

Figuroids. The advertisement for Figuroids (Figure 37) promises "*If you are like the STOUT girl—you will become like the MEDIUM girl—and finally like the DAINTY girl—by taking Figuroids."* Release of this advertisement in various magazines and newspapers coincided with the 1908 introduction of the sheath dress (Rance, 2013). An analysis of the pills by the British Medical Association found them to consist of bicarbonate of soda, tartaric acid, sodium hexamethylinetetramine, talc, and gum, none of which would have had any effect on obesity.

Figure 37: Advertisement for the slimming preparation "Figuroids" from the Windsor magazine of 1908. an illustrated magazine for men and women. Note the progressive decrease in dimensions of the woman.



F.C. Russell's Cure. A self-published book by F.C. Russell, a London Chemist (Russell, 1894), made extravagant claims , supposedly based upon the reports of users, concerning the weight losses achieved by his regimen. This was said to include a "*purely vegetable*" treatment, with no noxious drugs and no drastic dietary restrictions.

Dr. Grey's Fat Reducing Pills. A magazine advertisement from 1894 offered Dr.Grey's fat-reducing pills. These apparently contained a substantial amount of sulphur (Corless, 2011), and were said to be an "*Absolutely safe, permanent and rapid cure for obesity. A special preparation for hunting men, jockeys, and stubborn cases (either sex) which have resisted other treatment. Abdominal obesity a speciality...plain*

wrapper, post free to any part of the world."

Trilene Tablets. Trilene tablets contained small amounts of seaweed and starch, but in order to appeal to those with a sweet tooth their main constituent was sugar (Corless, 2011). Quotes from satisfied customers included Mr. Gillespie of Forest Gate: *"I have just lost 3 stone,"* and Mr. William Usher: *"A sister of mine, who was 17 stone, was greatly reduced by your Tablets to 15 stone."*

The Tapeworm Diet. The tapeworm treatment involved ingesting a pill that contained a beef tapeworm egg (Figure 38). Once hatched, the parasite grew in the gut, consuming a part of whatever food the individual ate, and thus (in theory) it brought about weight loss without the patient worrying about the amount of food that he or she was ingesting. The opera singer Maria Callas is one person reputed to have followed this regimen. However, it is a dangerous approach to weight reduction, with many potential complications (Boese, 2006).

Prolonged mastication. Horace Fletcher (1849-1919), nicknamed *"the great masticator,"* was an American health food proponent. He argued that food must be chewed at least 100 times before swallowing; and composed special songs to accompany his chewing. The process of mastication even extended to the ingestion of liquids, ensuring that they were well mixed with the saliva. In Fletcher's view, food should ideally be chewed until it disappeared entirely. Thus, he wrote: "*One-fifth of an ounce of the midway section of the young garden onion, sometimes called 'challot,' has required 722 mastications before disappearing through involuntary swallowing"* (Chrichton-Browne, 1910). Fletcher claimed that with such thorough chewing, a person could subsist on half as much food. Some public institutions saw Fletcherism as a way of reducing food consumption and thus of saving money. Like the Grahamites (below), Fleucher favoured a low protein diet, and he saw mastication as a cure for his own obesity (Wolin and Petrelli, 2009), claiming that he could subsist on 45 g/day of food by using this approach.

Figure 38: Advertisement for a "sanitized" tapeworms.

Temperate food choices. Sylvester Graham (1794-1851 CE) was a Connecticut Presbyterian minister, health reformer and temperance lecturer, best known for the "*Graham Cracker*." He probably formed his ideas in close contact with two other strong advocates of a vegetarian diet: the divine William Metcalfe (1788-1862 CE) and the physician and educator William Alcott (1798-1859 CE). The group believed that a vegetarian diet would, in essence, restore the idyll of the Garden of Eden (Graham, 1872). Graham condemned not only alcohol and beverages other than water, but also spices, condiments and meat, and also a sedentary life, as well as *"unnatural things*" such as "white" flour. As a fellow Grahamite, Alcott published a short satirical prayer (Wolin & Petrelli, 2009): "*Give us this day our daily bread and cakes and pies besides, To load the stomach, pain the head, And choke the vital tides*."

Graham specifically condemned the obesity of the Leicester jail-keeper Daniel

Lambert (1770-1809 CE), who finally attained a weight of 355 kg (Figure 39): *'In some rare instances... the body continues to grow in bulk till it becomes an enormous and shapeless mass, as in the case of Daniel Lambert"..."all obesity or corpulence is a form of disease, and denotes a want of integrity in some functions of the system*" (Graham, 1872).

Graham gained fame when followers of his diet seemed to be spared during a cholera epidemic. However, this support faltered when Graham himself died at the relatively young age of 57 years. Nevertheless, his ideas were perpetuated by the Battle Creek corn-flakes manufacturer William Keith Kellogg (1860-1951 CE) and his family.

Figure 39: Daniel Graham (1770-1809 CE, keeper of Leicester jail, who ultimately attained a weight of 335 kg. Source: https://en.wikipedia.org/wiki/Daniel_Lambert

Electromagnetism and electroconvulsive therapy. The discoveries of Benjamin Franklin led to a vogue for the electrical treatment of a variety of disorders, including obesity, Among the exponents of electrotherapeutic fads we may include James Graham (1745-1794 CE), Franz Anton Mesmer (1734-1815 CE) and John Wesley ((1703-1794 CE).

There have been occasional attempts to exploit exposure to strong magnetic fields, but there is no conclusive evidence that such exposure influences the course of obesity (Braschi, 2017). John Wesley used electroconvulsive therapy in an attempt to treat various medical disorders among his parishioners; however, they were mostly physical labourers, and there is no mention of treating obesity by this means. Nevertheless, there has been some subsequent evidence that electroconvulsive shock may help patients where obesity was secondary to a depressed mood state (Moss and Vaidya, 2006).

Acupuncture. The Chinese practice of acupuncture became popular in the Western world during the 20th century, and it has found its advocates for the treatment of obesity. Postulated mechanisms of action include a serotonin-induced enhancement of intestinal motility, a reduction of stress and depression via an increased secretion of endorphin and dopamine, and an endorphin-induced mobilization of body fat depots (Cabýoglu, Ergene, andTan, 2006).

Sweat treatments. Daniel G. Brinton, author of "*Personal Beauty*" developed a treatment for the morbidly obese based on the popular 19th century belief that fat was "only water" and thus could be driven out of the system by perspiration (Brinton and Napheys, 1870).

Miraculous bath powders. The makers of "Healthone-obesity Bath Powder" claimed that a twice daily hot soak with their perfumed sodium carbonate bath powder quickly washed away obesity.

Hydrotherapy and spa treatment. A visit to a spa town such as Bath or Vichy was a common practice for over-weight Victorians. This typically involved periods

of immersion in hot or cold springs, and the drinking of the mineral-rich water. Often, the spa provided sumptuous meals, which militated against any weight loss, but if facilities for strenuous exercise were also included, benefit was sometimes seen. The warm spa waters themselves commonly increased metabolism a little, and there was a little evidence that this had a positive effect upon obesity (Hazim et al., 2015; Mooventham and Nivethitha, 2014). Some authors have claimed that similar benefits can be obtained by wrapping a person in hot hay.

***Homeopathy*.** The idea of homeopathy was introduced by Samuel Hahnemann (1756-1843 CE) of Meissen, Germany. A homeopathic hospital opened at Leipzig in 1833, treating a variety of chronic ailments. Any benefits observed in obese patients were probably due to *"gravel pathways and spaces...where the patients might procure sufficient exercise and fresh air"* (Shephard, 2015)

Public attitudes. In early Victorian times, many people took an indulgent attitude towards those who were somewhat overweight, and sometimes they even despised those who very lean. Because chronic tuberculosis was widely present, plumpness was seen as evidence of good health. But perhaps in part as an expression of "*muscular Christianity*" (Shephard, 2015), during the latter part of the Victorian era, many people became strident in their condemnation of the obese; there was fierce satire, and some claimed associations between obesity and a low level of intellect or a propensity for prostitution and other types of criminal activity. Nevertheless, plumpness remained better tolerated among a "Bohemian" coterie of authors and actors.

***Early tolerance of obesity*.** Health and beauty authors such as the American writer Daniel Brinton (1837-1899 CE) were indulgent towards those who were overweight, and despised those who were very lean (Brinton and Napheys, 1870). Brinton wrote: a "scrawny bony figure" is *"intolerable to gods and men."* *"The only lady who we ever heard derived advantage from such an appearance (leanness) was Madame Ida Pfeiffer. She relates that somewhere in her African travels the natives had a mind to kill and eat her, but she looked so unpalatably lean and tough that the temptation was not strong enough, and thus her life was saved."*

An unidentified correspondent of the Washington Post described politician Daniel Webster (1782-1852 CE) as *"broad in body as well as in mind,"* and noted that former President Grover Cleveland and Secretary William Taft both had *"corpulence and brains"* (Segrave, 2008).

Charles Dickens (1812-1870 CE) created one of the most well-known of obese characters, the fat boy in the "*Pickwick Papers*," a character who consumed great quantities of food and was substantially affected by sleep apnoea, continually dozing off throughout the day (Figure 40). But in the same book Tony Weller, the cockney father of Mr. Pickwick's man-servant opined approvingly: *"Vidth and Visdom go together."*

Louisa Alcott (1833-1888 CE) apparently had no problem with the plumpness of young women. In "Little Women," Margaret, the eldest of the four girls, was said to be "*sixteen and very pretty, being plump and fair, with large eyes, plenty of soft brown hair, a sweet mouth, and white hands, of which she was rather vain. ..."* (Alcott, 1880)

Later disapproval of obesity. Later during the nineteenth century, many people no longer saw plumpness as synonymous with health and beauty. Indeed, they began to view excess

weight as a sign that a woman was inconsiderate, stupid, lazy, and—in some cases—even promiscuous or insane. The stereotype was reinforced by some overweight characters who were featured as dim-witted and lazy in popular plays and novels. An 1893 edition of Charles Dickens' weekly literary magazine "*All the Year Round"* addressed this issue (Dickens, 1893), with the brief commentary accompanied by an advertisement for F.C. Russell's remedy for obesity (above). In a section headed "*Home Notes,*" the magazine stated: *"People have rather an erroneous idea, probably gathered from Dickens's Fat Boy in 'Pickwick,' that corpulent people have none of the finer feelings and are of a lethargic and dull comprehension. This is altogether a mistake, as many a poor corpulent lady can tell you. When she ascends a crowded omnibus on a hot summer's day every one of the indignant glances levelled at her by her more fortunate sisters are as so many little dagger thrusts of mortification, though her ruddy complexion and defiant stentorian breathing may seem to belie the truth of these words."*

On the other hand, bitingly adverse comments on the obese appeared in books such as "The Body Beautiful" (Fletcher, 1901). *"All defects are in the nature of ugliness, but certain ones are more degrading than others; and of these obesity, which is a deformity, is signally ignoble." "Wherever the fat woman finds herself in a crowd—and where can she avoid it in the metropolis? —she is in effect an intruder. For, she occupies twice the space to which she is entitled, and inflicts upon her companions, through every one of her excessive pounds, just so much additional fatigue and discomfort. Too often, this so redundant flesh seems to serve as a bullet-proof armor, repelling all consciousness of the rights of others. The woman who makes a god of her stomach is incorrigible, and I fear no word of mine will avail to induce her to reform. She is the innately selfish woman who makes her very existence an offense."* At one point, Fletcher acknowledged that "corpulency" was a disease. However, this did not stop her from accusing obese women of "*indolence of mind*" and categorizing overeaters as a lower order of beast.

Satirical comment on the obese is well exemplified by Victor Géruzez (1840-1906 CE) a French author and illustrator who worked under the pseudonym of "Crafty"). His drawings mocked the pear-shaped bellies of authority figures. An illustration in *Paris à Cheval* from 1884 (Géruzez, 1884) shows a heavy female rider being lifted with difficulty into the saddle. The helper has his hands full, literally, and the caption reads, "*One of the thousand reasons why women over fifty kilos should give up horseback riding*" (Figure 41). Géruzez further argued that it was unreasonable to expect a 14-15 kg bicycle to support a person who weighed more than 70 kg

Figure 40: The fat boy from the Pickwick Papers. Source: https://www.google.ca/search?q=Fat+boy+from+Pickwick

Figure 41: A mocking Parisian illustration by Crafty shows a heavy woman being helped onto her horse. Source: http://www.biodiversitylibrary.org/bibliography/29409#/summary

(Vigarello, 2013).

Numerous Victorians looked for abnormalities in the anthropometry of prostitutes, including du Chatelet (1836), Salsotto (1889) and Tarnowsky (1889), often claiming a linkage between obesity and immoral living. du Chatelet (1836) commented on prostitutes: it *"strikes those who look at them en masse..." "this obesity only begins at the age of 25 to 30 years" "a simple explanation lies in the great number of hot baths to which these women are accustomed to take throughout the year, and above all to their inactive lives and abundant nourishment."* However, the data supporting these ideas is suspect. Body mass indices calculated from the height and weight data of Salsotto (1889) yield averages of 22.9 kg/m2 for prostitutes and 23.8 k/m^2 for "moral" women. Tarnowsky commented further that although 19% of prostitutes were below normal weight, they were also shorter than "moral" women (Tarnowsky, 1889). The forensic pathologist Cesare Lombroso was particularly vociferous in his viewpoint concerning the body build of miscreants. The book "*The Female Offender*" (Lombroso & Ferrero, 1895) compared the published anthropometric data of Fornasari for prostitutes and slimmer "moral" women, arguing that: *"This greater weight among prostitutes is confirmed by the notorious fact of the obesity of those who grow old in their vile trade, and who gradually become positive monsters of adipose tissue."* He claimed that 59% of prostitutes were above average weight, and some reached values in the range 90-130 kg. Taking his analysis a step further, Lombroso looked for similar traits among women committed to insane asylums, writing: *"In conclusion, I would remark that in prisons and asylums for the insane, the female lunatics are far more often exaggeratedly fat than the men."*

However, the actual data cited by Lombroso do not bear out his claims (Table 3). Calculating the body mass index for prostitutes and "moral women," the respective averages are 22.3 and 22.1 kg/m^2. Moreover, only one woman in each of the two categories is slightly overweight. Further, any search for systematic differences in body mass would have been complicated by the large doses of mercury that many prostitutes of the Victorian period ingested as a prophylactic against venereal diseases.

Probably in response to these theories, Guy de Maupassant (1850-1893 CE) entitled a prostitute in his first story about the Franco-Prussian war *"Boule de Suif "("Ball of Fat"*)(Maupassant, 2014).

Table 3: A comparison of heights and weights between prostitutes and "moral" women published by Cesare Lonroso (Lombroso & Ferrero, 1895).The body mass indices for the two categories of women have been calculated by the present author.

Prostitutes			"Moral" women		
Age (yr)	**Height (m)**	**Weight (kg), BMI (kg/m^2)**	**Age (yr)**	**Height (m)**	**Weight (kg), BMI (kg/m^2)**
27	1.445	44.3 (21.2)	15	1.445	42.0 (20.1)
22	1.415	45.0 (22.4)	31	1.50	43.0 (19.1)
24	1.523	48.15 (20.8)	25	1.54	47.5 (20.0)
24	1.510	48.2 (21.1)	26	1.45	48.0 (22.8)
22	1.604	52 (20.2)	30	1.544	51.5 (21.6)
24	1.58	52 (20.8)	22	1.40	52.4 (26.7)
26	1.50	58 (25.8)	19	1.50	55.2 (24.5)
20	1.584	59 (23.5)			
30	1.690	67 (23.5)			

The idea that obesity was incompatible with intelligence and mental acuity also became widespread in late Victorian times. As the 1900 edition of the *Dietetic and Hygienic Gazette* reported: *"Obesity always carries with it physical and often mental weakness, and is in excess always a disease…"* (Keatinge, 1900)

The Bohemian contingent. In a book entitled "*Modern Paris,*" originally published in 1923, Robert Sherard (2009) suggested a link between obesity and literary genius, listing Balzac, Dumas, Rossini, Victor Hugo, and Sainte Beuve among a long list of fat and jolly authors.

Honoré de Balzac (1799-1850 CE) was particularly interested in the impact of obesity upon gait, as can be seen in many of his books. In "*The Vicar of Tours*," he described the walk of an old maid: *"…her movements were not equally distributed over her whole person, as they are in other women, producing those graceful undulations which are so attractive. She moved, so to speak, in a single block, se eming to advance at each step like the statue of the Commendatore." "While it is true that dignity, in the sense of majesty, requires a certain fullness of flesh, it is nonetheless impossible to claim this to be true of a man walking, since his belly throws the rest of his body off balance. Walking ability disappears with obesity. An obese man finds himself forced to surrender to the ungainly movements imposed on him by his rotund belly… "*

Alexandre Dumas (1802-1870 CE) seemed to blame his obesity on the heavens. He had Chicot complain in "*Chicot the Jester*": "*Because the Lord in His anger has struck me with obesity, and I could not pass where the others did*." The physician and philosopher William James (1842-1910 CE) once described a female acquaintance: "*We found the old girl herself, a type for Alexandre Dumas, obese, jolly, wicked, intellectual, with no end of go*" (James, 2008).

Emile Zola (1840-1902 CE) is said to have written best when he was very fat, and when his bulk diminished, so did his talents.

The Russian novelist Ivan Turgenev (1818-1883 CE) wrote of "*strong men and monsters of obesity...the deacon who ate no less than thirty-three herrings for a wager...Ezyedinov, renowned for his corpulence... a peasant woman who at her death weighed half a ton and some pounds*..." (Turgenev, 2013).

Gioachino Rossini (1792-1868 CE) had a love of food shown not only by his ever-expanding waistline (Figure 42), but also by the number of dishes that were named after him. Other musicians also were quite obese, including Handel, Sibelius, and Stravinsky.

The American actress and singer Lillian Russell (1860-1922 CE) was one of the reigning sex symbols of Victorian England, and her photos were prominent in many newspapers. By the turn of the 20th century, her weight was reputed to be in excess of 90 kg (Figure 43), but her

Figure 42: Rossini.
Source: https://sites.psu.edu/mckenzie/2016/05/25/composer-profile-gioachino-rossini-2/

Figure 43: The Victorian actress Lillian Russell, who attained a weight of over 90 kg. Source: https://en.wikipedia.org/wiki/Lillian_Russell#Later_years

popularity continued, and she remained busy writing articles on health and beauty.

Conclusions. During the Victorian era, the quantification of obesity began, with the calculation of weight to height ratios, and physicians advocated increasingly rational treatments of fat accumulation. But at the same time, the public was attracted to a multiplicity of widely advertised but ineffective and sometimes dangerous remedies. Early in Victorian times, many of the public saw plumpness as a manifestation of good health, but later opinion shifted to satirical and moral condemnation, with obesity linked to a low level of intelligence and various manifestations of immoral behaviour, including prostitution. Nevertheless, a tolerance of overweight persisted among the Bohemian company of actors, authors and musicians.

Discussion

The answer to the question posed at the beginning of this historical review seems that in fact there have always been at least a few obese individuals in settled communities from the earliest points in the history of humankind. This suggests that the body's capacity to store nutrients in excess of immediate metabolic needs may have been a factor in evolutionary selection (Kopelman, Caterson, and Dietz, 2005; Prum, 2017). When facilities for external food storage were limited, stores of body fat could have offered a valuable protection against times of famine, and provided the added energy needed to sustain pregnancy and lactation.

The prevalence of obesity seems to have increased steadily over the millennia, despite edicts of the church against gluttony, health warnings from physicians, public criticism, employment sanctions, and biting satire. Initially, the problem of excess body weight was limited to the rulers and a few of their relatively sedentary servants, but obesity has spread progressively throughout the various strata of society, with this trend speeded by emergence of a middle class boasting leisure time, surplus income, and a desire to demonstrate their good health and prosperity through a large paunch.

The epidemic of obesity affecting all social classes has been a new feature of the late twentieth century (Deurenberg-Yap & Sediell, 2003; Flegal, Carroll, & Kuczmarski, 1998; World Health, 2014). Various factors have probably contributed to this phenomenon (McAlister, Dhurandhar, & Keith, 2009); correlates include an ever-decreasing need for physical activity in daily life (Brownson, Boehmer, & Luke, 2005; Church, Thomas, & Tudor-Locke, 2011), a growing limitation of opportunities for voluntary physical activity as mega-cities have grown in size and population density (Fan et al., 2017; Lake & Townshend, 2006), and deliberate attempts by some food manufacturers to encourage the over-eating of unhealthy pre-packaged food (Ledikwe et al., 2005; Livingstone and Pourshahldi, 2014).

It is interesting to speculate how far a change in public attitudes may have been a further contributing factor. Obesity has apparently evolved from a condition that in the Victorian era provoked public disapproval, satire, and even denial of employment, to become almost an accepted feature of modern life in North America. U.S. surveys by the consumer research firm NPD found that over a 20-year period, the proportion of people finding overweight individuals as unattractive dropped from 55% to 24% (Associated Press, 2006). In some countries, commercial airlines are now required by law to provide obese clients with a second seat at no additional charge.

Many people fail to recognize that they are overweight and have only a limited knowledge of the health risks that their excess body fat imposes. Moreover, obesity is regarded as a problem for physicians and affected individuals rather than society as a whole (Curtice, 2016). In all, an excessive body mass is now regarded as an unfortunate medical condition for which the affected individual bears no personal responsibility. Admittedly, there are rare instances where some hormonal abnormality is responsible for an excessive body weight, but for most people the causes are over-eating and a lack of adequate habitual physical activity; sympathetic medicalization rather than a challenge to greater self-discipline could well have played a role in encouraging the obesity epidemic.

General Conclusions

With the probable exception of hunter-gatherer communities, there is evidence that at least a few obese individuals were living in most settled communities from early in the story of humankind. This brief historical survey points towards a growing prevalence of obesity as an economic surplus allowed emergence of a ruling class with no imperative to engage in vigorous physical activity, a body of artisans who engaged in sedentary work to manufacture the luxury trinkets demanded by high society, and the growth of a middle class with the means to purchase food in excess of their immediate survival needs. Almost all of the available evidence points to causation by a level of habitual physical activity that is inadequate to match the individual's food intake. Moreover, the adoption of regular vigorous exercise and a moderation of diet have been recognized as effective remedies for obesity throughout most of history. The growing prevalence of excessive accumulations of body fat, and public acceptance of this phenomenon seem new features of the late twentieth century. Potential causes include an ever-decreasing necessity for physical activity during daily life, limited opportunities for active leisure in mega-cities, deliberate attempts by food manufacturers to promote over-eating, and (particularly in the U.S.) a growing public acceptance of obesity.

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References

Abdel-Halim, R.E. (2005). Obesity: 1000 years ago. *Lancet 366 (9481),* 204 (letter).

Africa, T. (1961). *Phyllarchus and the Spartan Revolution. University of California Publications in History, Vol. 68-69.* Berkeley, CA: University of California Press, pp.1-92.

Alcott, L.M. (1880). *Little Women: Or, Meg, Jo, Beth and Amy, Volume 1*. Boston, MA: Roberts Brothers, pp. 1-341.

Allam, A.,Thompson, R.C., Wann, S., Miyamoto, M.T., and Thomas, G.S. (2009). Computed tomographic assessment of atherosclerosis in Egyptian mummies. *JAMA. 302(19)*, 2091-2094. https://doi.org/10.1001/jama.2009.1641

Allardyce, C.S. (2015). *Fat chemistry: The science behind obesity.* Cambridge, U.K.: RSC Publishing, pp.1-330.

Alphen, J.A., and Aris, A. (1997). *Oriental medicine: An illustrated guide to the Asian arts of healing*. London, U.K.: Serindia Publications, pp 1-272.

Aretaeus. (2010). *De causis et signis acutorum morborum (lib. 2)*

Causes and symptoms of chronic diseases (Vol. 2). Chicago, IL: University of Chicago, Perseus translations, pp. 1-373.

Armstrong, J. (1744).*The Art of Preserving Health: A Poem.* London, U.K.: Millar, pp.1-99.

Arnott, E. (1996). Health and medicine in the Aegean Bronze Age. *J Roy Soc Med. 89(5)*, 265-270.

Associated Press. (2006). *Americans are more accepting of heavier bodies http://www.nbcnews.com/id/10807526/ns/health-fitness/t/americans-are-more-accepting-heavier-bodies/#.Wlas-a2ZOuU*. Site accessedJanuary 14th, 2018.

Avicenna (1999). *On healthy living- exercising, massaging, bathing, drinking, sleeping and treating fatigue*. Chicago, IL: Kazi Publications, pp. 1-103.

Bacon, F. (1803). *The Works of Francis Bacon: Baron of Verulam, Viscount St. Alban, and Lord High Chancellor of England, Volume 1*. London, U.K.: J. Johnson, pp.1-575.

Banting, W. (1964). *Letter on corpulence. Addressed to the general public, 3rd ed.* London, U.K.: Harrison, pp. 1-50.

Barnard, A. (2007). *Anthropology and the Bushman.* Oxford, U.K.: Berg, pp.1-192. https://doi.org/10.26530/OAPEN_390770

Baron, J.H. (1997). Byron's appetites, James Joyce's gut, and Melba's meals and mésalliances. *Br Med J. 315,* 1697-1703. https://doi.org/10.1136/bmj.315.7123.1697

Baynard, E. (1719). *Health, a Poem. Shewing how to procure, preserve, and restore it. To which is annex'd The Doctor's Decade*. London, U.K.: J. Roberts, pp.1-40.

Beller, A.S. (1977). *Fat and thin. A natural history of obesity*. New York, NY: Farrar, Strauss & Giroux, pp. 1-310. PMid:406684.

Bevegni, C., and Adami, G.F. (2003). Obesity and obesity surgery in ancient Greece. *Obes Surg. 13*, 808-809. https://doi.org/10.1381/096089203322509471

Bhishagratna, K.K. (2006).*The Sushruta Samhita: An English translation. Based on original texts*. Delhi, India: Cosmo Publishing, pp. 1-412.

Bijlefeld, M. and Zoumbaris, S.K. (2014). *Encyclopedia of diet fads: Understanding science and society, 2nd Edition*. Santa Barbara, CA.: ABC Clio, pp. 1-296.

Bloomgarden, Z. (2003). Prevention of obesity and diabetes. *Diabetes Care. 26(1)*, 3172–3178. https://doi.org/10.2337/diacare.26.11.3172

Boese, A. (2006). *Hippo eats dwarf: a field guide to hoaxes and other B.S*. Orlando, FL: Harcourt, pp.1-279.

Bonet, T., and Manget, J-J. (1679). *Sepulchretum, sive anatomia practica, ex cadaveribus morbo denatis, proponens historias omnium humani corporis affectuum (Practical anatomy from dead bodies relative to all conditions affecting the human body).* Geneva, Switzerland: Cramer & Perachon, pp. 1-916.

Boorde, A. (1552). *The Breviary of Health: For All Maner of Sickenesses and Diseases the which May be in Man Or Woman, Doth Folowe. Expressyng the Obscure Termes of Greke, Araby, Latyn, and Barbary, in Englishe Concernyng Phisicke and Chierurgerie*. London, U.K.: Robert Wyer, pp.1-301.

Boswell, J. (1847). *Life of Samuel Johnson, Comprehending an account of his studies, and numerous works, in chronological order: With his correspondence and conversations*. London, U.K.: Henry Washbourne, pp.1-540.

Bradshaw, J.W. (1864). *On corpulence.* London, U.K., Philip and Son, pp. 1-22.

Braschi, M. (2017). *Weight Loss & Fitness Encyclopedia: Safe & healthy tips on losing weight*. Toronto, ON.: Rakuten Kobo pp.1-350.

Bray, G.A. (1994). Harvey Cushing and the neuroendocrinology of obesity. *Obes Res. 2*, 482-485. https://doi.org/10.1002/j.1550-8528.1994.tb00096.x

Bray, G.A, Bouchard, C., and James, W.P.T. (2003). *Handbook of Obesity: Etiology and Pathophysiology, Vol. 1*. Boca Raton, FL: CRC Press, pp.1- 1064. https://doi.org/10.3109/9780203913376

Brillat-Savarin, A. (1854). *The physiology of taste, or transcendental gastronomy.* Philadelphia, PA: Lindsay-Blakiston, pp.1-323.

Brinton, D.G., and Napheys, G.H. (1870). *Personal Beauty*. New York, NY: Applewood, pp.1-309.

Brownson, R.C., Boehmer, T.K., and Luke, D.A. (2005). Declining rates of physical activity in the United States: What are the contributors? *Annu Rev Public Health. 26*, 421-443. https://doi.org/10.1146/annurev.publhealth.26.021304.144437

Buchan, W. (1776). *Domestic medicine: or, A treatise*

on the prevention and cure of disease by regimen and simple medicines: With an appendix, containing a dispensatory for the use of private practitioners. London, U.K.: Strahan, Cadell, Balfour and Creech, pp.1-712.

Bussemaker, U.C., and Daremberg, C.V. (1863). *Oeuvres d'Oribase (Works of Oribasius), Vol. 5.* Paris, France: Imprimérie Nationale, pp.1-727.

Cabýoglu, M.T., Ergene, N., and Tan, U. (2006). The treatment of obesity by acupuncture. *Int J Neurosci. 116(2)*,165-175. https://doi.org/10.1080/00207450500341522

Celsus, A.C. (1935). *De Medicina*. Cambridge, MA: Harvard University Press, Book 2, Chapter 1, p.5.

Cheyne, G. (1724). *An essay of health and long life.* London, U.K.: George Strahan, pp.1-232.

Crichton-Browne, J. (1910). Delusions in diet, or parsimony in nutrition. New York, NY: Funk and Wagnalls, pp. 1-111.

Christopoulou-Aletra, H., and Papavramidou, N. (2004). Methods used by the Hippocratic physicians for weight reduction. *World J Surg. 28*, 513-517. https://doi.org/10.1007/s00268-004-7373-9

Church, T.S., Thomas, D.M., Tudor-Locke, C., Katzmarzyk, P.T., Earnest, C.P., Rodarte, R.Q., Martin, C.K., et al. (2011). Trends over 5 decades in U.S. occupation-related physical activity and their associations with obesity. *PLoS ONE. 6(5), e19657.* https://doi.org/10.1371/journal.pone.0019657

Cogan, T. (1596). *The haven of health.* Stratford - upon Avon, U.K.: R. Field, pp. 1-346.

Cohen, Y.A. (2017). *Human adaptation: The biosocial background*. Abingdon, OX: Routledge, pp.1-533

Colman, E. (1998). Obesity in the Paelolithic era? The Venus of Willendorf. *Endocrin Pract. 4(1)*, 58-59. https://doi.org/10.4158/EP.4.1.58

Coon, C.S., Garn, S.M., and Birdsell, J.B. (1950). *Races: A study of the problems of race formation in man*. Springfield, IL: C.C. Thomas, pp.1-153.

Corless, D. (2011). *You'll ruin your dinner. Sweet memories from an Irish chidhood*. Dublin, Ireland: Hachette, pp. 1-256. PMid:20974052.

Cornari, L. (1993). *Discorsi della vita sobria (Discourses on a sober life: How to live 100 years)*. Pomeroy, WA: Health Research Books, pp. 1-64.

Curtice, J. (2016). *British social attitiudes. Attitudes to obesity.* London, U.K.: Public Health England, pp.1-25.

Darby, W.J., Ghalioungi, P., and Givetti, L. (1977). *Food: The gift of Osiris.* New York, NY: Academic Press, pp.1-877.

Deurenberg-Yap, M., and Seidell, J.C. (2003). Diet, nutrition and the prevention of chronic diseases: Report of a joint FAO/WHO expert consultation. *WHO Tech Rept. 916,* 1-419.

Devlin, L. (2017). Baka Pygmies. Site accessed January 15th, 2018: http://www.pygmies.org/baka/introduction.php.

Dickens, C. (1893). Home Notes. "*All the Year Round," Page not indicated*.

Diodorus, S. (1721).*The Historical Library of Diodorus the Sicilian in Fifteen Books to which are added the Fragments of Diodorus.* London, U.K.: W.Taylor, pp.1-833.

Dioscorides, P. (2003). *De Materia Medica* (Dioscorides Pedanius, ed.). Athens, Greece: Georgiadis, Book 2, pp. 71-80, and Book 5, pp. 293-294.

Dods, R.F. (2013). *Understanding diabetes: A biochemical perspective.* New York, NY: Wiley, pp. 1-426. https://doi.org/10.1002/9781118530665

Dowson, T.A. (1994). Reading art, writing history: Rock art and social change in Southern Africa. *World Archaeol. 25(3)*, 332-345. https://doi.org/10.1080/00438243.1994.9980249

Dryden, J. (1709). *Mac Flecknoe: a Poem*. London, U.K.: H. Hills, pp.1-16.

du Chatelet, A. (1836). *De la prostitution dans le ville de Paris (Prostitution in the city of Paris).* Paris, France: Ballière, pp.1-781.

Dublin University Magazine. (1861). *Thermae Antiquae Redivivae (Ancient baths recycling)* (Vol. 57). Dublin, Ireland: William Robertson, Vol. 57, p. 32.

Dunand, F., and Lichtenberg, R. (2006). *Mummies and death in Egypt*. New York, NY: Cornell University Press, pp.1-256.

Durant, W., and Durant, A. (2011). *Rousseau and Revolution: The story of civilization*. New York, NY.: Simon & Schuster, pp.1-1093. PMid:22022636

Ebstein, W. (2015). *Corpulence and its treatment on physiological principles* London, U.K.:

Forgotten Books, pp. 1-112.

Edwardes, C. (2003). Mr. Banting's old diet revolution. http://www.telegraph.co.uk/news/uknews/1441407/Mr-Bantings-Old-Diet-Revolution.html London *Daily Telegraph*, Accessed January 5th, 2018.

Eknoyan, G. (1999). Santorio Sanctorius (1561-1636) - founding father of metabolic balance studies. *Am J Nephrol. 19(2),* 226-233.

Eknoyan, G. (2008). Adolphe Quetelet (1796–1874)—the average man and indices of obesity. *Nephrol Dial Transplant. 22(1),* 47-51. https://doi.org/10.1159/000013455

Elyot, T. (2005). *The Castell of Helth*. Ann Arbor, MI: University of Michigan Press, Book 2, pp. 66-67.

Engel, S.M. (2002). The study of philosophy. San Diego, CA: Collegiate Press, pp.1-415.

Fan, P., Wan, L., Xu, L., Park, H., Xie, Y., Liu, Y., et al. (2017). *Evolving walkability of major cities in the People's Republic of China. ADBI Working Paper 645*. Tokyo, Japan Asia Development Bank Institute. https://doi.org/10.2139/ssrn.2955569

Filer, J. (1995). *Disease (Egyptian bookshelf series).* London, U.K.: British Museum Press, pp.1-591.

Finch, C. . (2018). David Hume at 300. http://www.artnet.com/magazineus/features/finch/david-hume-at-300.asp Web site accessed 4th January 2018. .

Finkel, I.L., and Geller, M.J. (2007). *Disease in Babylonia*. Leiden, Netherlands: Brill, pp. 1-226.

Flegal, K.M., Carroll, R.J., Kuczmarski, R.J., and Johnson, C.L. (1998). Overweight and obesity in the United States; prevalence and trends, 1960-1994. *Int j Obes. 22,* 39-47. https://doi.org/10.1038/sj.ijo.0800541

Fletcher, E.A. (1901).*The Woman Beautiful: A practical treatise on the development and preservation of woman's health and beauty, and the principles of taste in dress.* New York, NY: W.M.Young, pp. 1-535.

GBD 2013 Obesity, Collaboration. (2014). Global, regional and national prevalence of overweight and obesity in children and adults 1980-2013: A systematic analysis. *Lancet 384(9945),* 766-781.

Géruzez, V. (1884). *Paris à Cheval (Paris on Horseback)*. Paris, France: Librairie Plon.

Gilman, S.L. (2017). The fat person on the Edgware Road omnibus: Fat, fashion, and public shaming in the British long Eighteenth Century. *Lit Med. 35(2),* 431-447. https://doi.org/10.1353/lm.2017.0013

Gilman, S.L. (2008). *Fat: A cultural history of obesity.* Cambridge, UK.: Polity Press, pp.1-248.

Gimbutas, M. (1991).*The Civilization of the Goddess*. San Francisco, CA: Harper, pp. 1-529.

Gmada, N., Marzouki, H., Haboubi, M., Tabka, Z., Shephard, R.J., and Bouhlel, E. (2012). The cross-over point and maximal fat oxidation in sedentary healthy subjects: methodological issues. *Diabetes Metab. 38*(1), 40-45. https://doi.org/10.1016/j.diabet.2011.07.004

Goggin, J., and Hassler-Forest, D. (2010). *The rise and reason of comics and graphic literature*. Jefferson, NC: McFarland, pp. 1-244.

Gosse, E. (18l8). *Life of William Congreve*. London, U.K.: W. Scott, pp.1-192.

Graham, S. (1872). Lectures on the science of human life: Containing three lectures--Eighth, the organs and their uses; Thirteenth, man's physical nature and the structure of his teeth; Fourteenth, the dietetic character of Man. Battle Creek, MI: Health Reformer, pp.1-184.

Guerrini, A. (2000). *Obesity and depression in the enlightenment: the life and times of George Cheyne*. Norman, OK: University of Oklahoma Press, pp. 1-289.

Guthrie, D. (2006).*The nature of Paleolithic art.* Chicago, IL: University of Chicago Press, pp.1-519.

Haller, A. (1756). *Corpulence ill-cured: Large cryptae of the stomach etc. Path Observ. (Gerhard Armster).* pp. 44-49.

Haller, A. (1757). *Elementa physiologiae corporis humani (Physiological elements of the human body).* Lausanne, Switzerland: Marci-Michael Boursquet, pp.1-626.

Harris, J.E., and Wente, F. (1980). *An x-ray atlas of the royal mummies*. Chicago, IL: University of Chicago Press, pp. 1-403.

Harvey, W. (1872). On Corpulence in relation to disease: with some remarks on diet. London, U.K.: Renshaw, pp. 1-148.

Haslam, D. (2007). Obesity: A medical history. *Obes Rev. 8 (Suppl. 1)*, 31-36. https://doi.org/10.1111/j.1467-789X.2007.00314.x

Haslam, D. (2016). Weight management in obesity-past and present. *Int J Clin Pract. 70(3)*, 206-217.

https://doi.org/10.1111/ijcp.12771

Haslam, D., and Rigby, D. (2010). A long look at obesity. *Lancet. 376(9735),* 85-86. https://doi.org/10.1016/S0140-6736(10)61065-3

Haslam, D.W., and Haslam, F. (2009). *Fat, gluttony and sloth. Obesity in literature, art and medicine.* Liverpool, U.K.: Liverpool University Press, pp. 1-326. PMid:19674966

Hautin, R.J.R. (1939). *Obesité: Conceptions actuelles (Obesity: current conceptions)*. Bordeaux, France: Imprimerie Bier, pp.1-61.

Hawick Archaeological Society. (1863). *Transactions of the Hawick Archaeological Society*. Hawick, Roxburghshire. James Haining.

Hazim, M., Noordin, M., Ahmad, H., and Baharin, S. (2015). Hydrotherapy: An innovative treatment for obese Malaysians. *AIP Conference Proceedings, 1691, 020003*. https://doi.org/10.1063/1.4937018

Heessel, N.P. (2004). Diagnosis, divination and disease: towards an understanding of the rationale behind the Babylonian Diagnostic Handbook. *Stud Anc Med. 27,* 97-116. PMid:17152169.

Hutchinson, J. (1846). On the capacity of the lungs and on the respiratory function with a view of establishing a precise and easy method of detecting disease by the spirometer. *Med ChirTrans.(Lond). 29,* 137-252. https://doi.org/10.1177/095952874602900113

Iason, A.H. (1946). *The Thyroid Gland in Medical History.* New York, NY: Frobin Press, pp.1-130.

James, W. (2008). *The letters of Willian James*. New York, NY: Cosimo, pp.1-399.

Jozsa, L. (2012). Obesity of women in Paleolithicum. *J Obes Wt Loss. 2:5*. https://doi.org/10.4172/2165-7904.1000136

Keatinge, H.C. (1900). Athletics and patriotism. *Dietetic and Hygienic Gazette, 16(1),* 57.

Kelly, E.B. (2006). *Obesity*. Westwood CN: Greenwood Press, pp.1-220. PMCid:PMC4781259

Kopelman, P., Caterson, I.D., and Dietz, W.H. (2005). *Clinical obesity in adults and children.* Oxford, UK.: Blackwell, pp.1-493. https://doi.org/10.1002/9780470987087

Kramer, S.N .(1956). *History begins at Sumer*. New York, NY: Doubleday, pp.1-347.

Kramer, S.N. (2010). *The Sumerians: Their history, culture and character.* Chicago, IL: University of Chicago Press, pp.1-372.

Kretschmner, E. (1948). *Korperbau und Charakter (Body build and character)*. Berlin, Germany: Springer, pp.1-387.

Kryger, M.H. (1983). Sleep apnea. From the needles of Dionysius to continuous positive airway pressure. *Arch Intern Med. 143,* 2301-2323. https://doi.org/10.1001/archinte.1983.00350120095020

Lake, A., and Townshend, T. (2006). Obesogenic environments: exploring the built and food environments. *J R Soc Promot Health. 126(6),* 262-267. https://doi.org/10.1177/1466424006070487

Lansing, A., and Hayes, W.C. (1937). The Museum's excavations at Thebes. *Bull Metrop Mus Art. 32(1),* 4-39.

Ledikwe, J.H., Elio-Martin, J.A., and Rolls, J. (2005). Portion sizes and the obesity epidemic. *J Nutr. 135(4)*, 905-909. https://doi.org/10.1093/jn/135.4.905

Lestrel, P.E. (2015). *Biological shape analysis: Proceedings of the 4th International Symposium.* Hackensack, NJ: World Scientific, pp. 1-456.

Levy-Navarro, E. (2008). *The culture of obesity in early and late modernity.* Basingstoke, U.K.: Palgrave Macmillan, pp.1-238. https://doi.org/10.1057/9780230610439

Lichtheim, M. (2006). *Ancient Egyptian literature Vol. 3.The Late Period*. Berkeley, CA: University of California Press, pp.1-253.

Little, R.A., and Frayn, K.N. (1986). Manchester, U.K.: Manchester University Press, pp.1-329.

Livingstone, M.B.E., and Pourshahldi, L.K. (2014). Portion size and obesity. *Adv Nutr. 5*, 829-834. https://doi.org/10.3945/an.114.007104

Lombroso, C., and Ferrero, G. (1895). The female offender. New York, NY: Appleton, pp. 1-313. https://doi.org/10.1037/14150-000

Macbeth, J.W.V. (1876). *The might and mirth of literature: A treatise on figurative language*. New York, NY: Harper, pp.1-542.

MacKenzie, J. (1758). *The history of health and the art of preserving it.* Edinburgh, Scotland: W. Gordon, pp. 1-436.

Magner, L.N. (1992). *A history of medicine*. Boca Raton, FL: CRC Press, pp.1-400.

Marett, J.R. de la H. (1936). *Race, sex and environment: A study of mineral deficiency in human evolustion.* London, UK.: Hutchinson Scientific & Technical Publications, pp. 1-342.

Maupassant, Guy de. (2014). *Boule de Suif (Ball of Fat)*. Vancouver, BC: Read Books, pp. 1-62.

McAlister, E.J., Dhurandhar, N.V., Keith, S.W., Aronne, L.J., Barger, J., Baskin, M., et al. (2009). Ten putative contributors to the obesity epidemic. *Crit Rev Food Sci Nutr. 49(10),* 868-913. https://doi.org/10.1080/10408390903372599

McIntosh, P.C. (1970). An historical view of sport and culture. In: M.L. Howell (ed.), *First Canadian Symposium on the history of sport and physical education.* Edmonton, AL: University of Alberta, pp. 1-649.

Mehdawy, M., and Hussein, A. (2010).The Pharaoh's kitchen: Recipes from ancient Egypt's enduring food traditions. Cairo, Egypt: American University in Cairo Press, pp. 1-240.

Moffett, T., James, RN., and Oldys, W. (1746). Health's improvement or, Rules comprizing and discovering the nature, method and manner of preparing all sorts of foods used in this nation. London, U.K.: T. Osborne, pp. 1-398.

Mondal, S. (2013). Science of exercise. Ancient Indian origin. *J Assoc Physicians India 61*, 560-562. PMid:24818341.

Mooventham, A., and Nivethitha, L. (2014). Scientific evidence-based effects of hydrotherapy on various systems of the body. *N Am J Med Sci. 6(5),*199-209. https://doi.org/10.4103/1947-2714.132935

Morgagni, G.B. (1761). *De sedibus, et causis morborum per anatomen indagatis libriquinque (A book on the seats and causes of disease inevstigated by anatomy).* Venice, Italy: Remordiniana, pp.1-629.

Moss, L.E., and Vaidya, N.A. (2006). Electroconvulsive therapy as an alternative treatment for obese patients with mood disorders. *J Elec Convuls Ther. 22(3)*, 223-225. https://doi.org/10.1097/01.yct.0000230363.04240.9c

Nathan, B.. (1992). A mediaeval medical view on obesity. *Obes Surg. 2*, 217-218. https://doi.org/10.1381/096089292765560060

Nikaein, F., Zargaran, A., and Mehdizadeh, A. (2012). Rhazes' concepts and manuscripts on nutrition in treatment and health care. *Anc Sci Life. 3(4,)* 160-163.

Nunn, J.F. (2002). Ancient Egyptian Medicine. Norman, OK: University of Oklahoma Press, pp. 1-240. PMid:12616335.

Oertel, M.J. (1886). *Ueber Terrain-Curorte (On the terrain cure)*. Leipzig, Germany: F.C.W. Vogel, pp. 1-86.

Olivieri, A. (1935). *Aet II Ami deni libri medicinales (Annals of Medical books), I-IV.* Leipzig, Germany: Teubner, Section 8.1.

Osler, W. (1892). *The Principles and Practice of Medicine*. New York, NY: Appleton, pp.1-1087.

Osler, W. (1921). *The evolution of modern medicine*. New Haven, CN: Yale University Press, pp. 1-243.

Oswald, F.L. (1878). The age of gymnastics. *Pop Sci Monthly. 23(6)*,129-139.

Papavramidis, S.T., and Christopoulou-Aletra, H. (2007). Greco-Roman and Byzantine views on obesity. *Obes Surg. 17(1),*112-116. https://doi.org/10.1007/s11695-007-9017-2

Papavramidou, N.S., Papavramidis, S.T., and Christopoulou-Aletra, H. (2004). Galen on obesity: etiology, effects, and treatment. *World J Surg. 28,* 631-635. https://doi.org/10.1007/s00268-004-7458-5

Paredes, J.O.Z. (2011). *Obesity Public Enemy #1 or Death.* Bloomington, IN: XLibris Corporation, pp. 1-96.

Porter, R. (2005). *Flesh in the age of reason*. London, U.K.: Penguin Books, pp. 1-592.

Prum, R.O. (2017). The evolution of beauty: How Darwin's forgotten theory of mate choice shapes the animal world and us. New York, NY: Knopf-Doubleday, pp.1-448.

Quetelet, A. (1835). *Sur l'homme et le developpement des ses facultés (On man and the development of his faculties)*. Paris, France: Bachelier, pp. 1-332.

Rabelais, F., and Motteux, P.A. (2005). *Gargantua and Panguela*. New York, NY: Barnes & Noble, pp. 1-707.

Radmilli, A.M. (1950). *Steatopygia in the prehistoric female figure.* Cagliari, Sardinia: Rassegna Medica Sarda, pp.1-5.

Raisborough, J. (2016). *Fat bodies, health and the media*. Basingstoke, U.K.: Palgrave Macmillan, pp. 1-187. https://doi.org/10.1057/978-1-137-

28887-5

Rance, C. (2013). *Quack Doctor: Historical remedies for all your ills*. Stroud, Gloucestmershire: The History Press. pp.1-224.

Ricketson, S. (1806). *Means of preserving health and preventing diseases*. New York, NY: Collins, Perkins and Company, pp.1-298.

Rode, A., and Shephard, R.J. (1973). Fitness of the Canadian Eskimo: The influence of season. *Med Sci Sports Exerc. 5*, 170-173. https://doi.org/10.1249/00005768-197323000-00014

Rosner, F. (2000). *Encyclopedia of medicine in the Bible and theTalmud*. Northvale, NJ: Jason Aronson, pp.1-360. PMid:10661364.

Rossen, L.M., and Rossen, E.A. (2011). *Obesity 101*. New York, NY: Springer, 1-303.

Ruffer, M.A. (1910-1911). On arterial lesions found in Egyptian mummies. *J Pathol Bacteriol.15*, 453-462. https://doi.org/10.1002/path.1700150403

Rush, B. (1809).*The works of Thomas Sydenham on acute and chronic diseases with their histories and modes of cure: With notes.* Philadelphia, PA: B & T. Kite, pp.1-473.

Russell, F.C. (1894). *Corpulency and the cure.* London, U.K.: Author.

Salsotto, G. (1889). Sulla donna deliquente: studi antropologici (On delinquent women: anthropologial studies). *Rivista di discipline carcerarie. 19,* 90-199.

Sanders, J. (2010). *Ben Jonson in context*. Cambridge, U.K.: Cambridge University Press, pp.1-365.

Segrave, K. (2008). *Obesity in America, 1850-1939: A history of social attitudes and treatment*. Jefferson, NC: McFarland, pp.1-208.

Sharma, A.N. (2003). *Tribal development in Andaman Islands*. New Delhi, India: Sarup & Sons, pp.1-88.

Shell, E.R. (2003). *The hungry gene: The inside story of the obesity industry*. New York, NY: Grove Press, pp. 1-294.

Shephard, R.J. (1978). Human physiological work capacity. Cambridge, U.K.: Cambridge University Press, pp. 1-303. https://doi.org/10.1017/CBO9780511735684

Shephard, R.J. (2015). *An illustrated history of health and fitness, from prehistory to our post-modern world.* Cham, Switzerland: Springer, pp.1-1057. PMid:25366252.

Shephard, R.J., and Rode, A. (1996). *The health consequences of modernization*. Cambridge, U.K.: Cambridge University Press, pp.1-306.

Sherard, R.H. (2009). *Modern Paris; Some sidelights on Its inner life*. Charleston, SC: Bibliobazaar, pp.1-334.

Shipley, O. (1875). *A theory about sin in relation to some facts of daily life, Lent Lectures on the 7 Deadly Sins*. London, U.K.: Macmillan, pp.1-343.

Short, T. (1727). *A discourse concerning the causes and effects of corpulency: Together with the method for Its prevention and cure.* London, U.K.: J. Roberts, pp.1-93.

Sinclair, J. (1818). *Code of health and longevity, Part II, Chapter 5.* Edinburgh, Scotland: Abernethy & Walker, pp. 1-23.

Society of Actuaries. (1959). *Build and blood pressure study*. Chciago, IL: Society of Actuaries, pp.1-234.

Soranus. (1991). .*On women*. Athens, Greece: Kaktos, Book 4, pp. 109-111.

Spriggs, E.A. (1977). John Hutchinson, the inventor of the spirometer-his north country background, life in London, and scientific achievements. *Med Hist. 21*, 357-364. https://doi.org/10.1017/S0025727300039004

Stapley, L. (2001). The history of diabetes mellitus. *Trends Endocrinol Metab. 12(6)*, 277. https://doi.org/10.1016/S1043-2760(01)00453-2

Stéphen-Chauvet. (1936). *La médecine chez les peuples primitifs [préhistoriques et contemporaines] (Medicine with primitive people [prehistoric and contemporary]))*. Paris, France: Libraire Maloine, pp. 1-170.

Stone, M. (2012). *When God was a woman*. New York, NY: Knopf Doubleday, pp.1-265.

Stubbs, J. (2017). *Jonathan Swift: The reluctant rebel*. New York, NY: W.W. Norton, pp.1-752.

Stunkard, A.J., LaFleur, W.R., and Wadden, T.A. (1998). Stigmatization of obesity in medieval times: Asia and Europe. *Int J Obes Relat Metab Disord. 22(12),*1141-1144. https://doi.org/10.1038/sj.ijo.0800753

Sydenham, Society. (1844).*The Seven Books, Vol. 1.* London, U.K.: Sydenham Society, pp.1-688.

Tarnowsky, P. (1889). Etude Anthropométrique sur les prostitués et les voleuses. (Anthropometric study of prostitutes and thieves). *Prog Méd*. Paris, France: Bureaux du Progrès Médical, pp. 1-226.

Thomas, R. (1802). *The modern practice of physic*. London, U.K.: John Murray, pp. 1-662.

Thompson, P.C. (1923). *Assyrian medical texts from the originals in the British Museum.* Oxford,

U.K.: Oxford University Press, pp.1-107.

Tipton, C.M. (1985). Susruta of India, an unrecognized contributor to the history of exercise physiology. *J Appl Physiol. 104(6)*,1553-1556. https://doi.org/10.1152/japplphysiol.00925.2007

Trallianus, A., and Goupyl, J. (1556). *Alexandri Tralliani medici libri duodecim: Graeci et Latini, multo quam antea auctiores & integriores*.(*Alexander Tralliani: 12 medical books, Greek and Latin, with more authors than previously*). Basel, Switzerland: P.H. Petrum, pp.1-859.

Turgenev, I. (2013). *Delphi Collected Works of Ivan Turgenev (Illustrated)*. On Line: Delphi Classics, pp. 1-3491.

Unschuld, P.U., and Tessenow, H. (2011). *Huang Di ne jing su wen: An annotated translation of Huang Di's classic- Basic questions.* Berkeley, CA: University of California Press, pp.1-754.

Vaughan, W. (1607). *Directions for health, naturall and aqrtificiall.* London, U.K.: Roger Jackson, pp.1-38.

Venner, T. (1620). *Via Recta ad vitam longam (a Plaine Philosophicall Discourse of the Nature, Faculties, and Effects of all such things as by way of Nourishments and Dieteticall Observations made for the Preservation of Health*. London, U.K.: James Flesher, pp.1-417.

Vigarello, G. (2013). *The metamorphosis of fat: A history of obesity*. New York, NY: Columbia University Press, pp.1-296.

Wadd, W. (1816). *Cursory remarks on corpulence; or Obesity considered as a disease*. London, U.K.: J. Callow, pp.1-129.

Wadd, W. (1829). *Comments on corpulence: Lineaments of leanness; Mems on diet aand dietetics.* London, U.K.: John Ebers, pp. 1-170.

Weiner, J.S. (1964). *Proposals for International research. Human Adaptability Project Document 5.* London, UK.: Royal Anthropogical Institute.

Wells, J.C.K. (2009). *The evolutionary biology of human body fatness: Thrift and control.* Cambridge, U.K.: Cambridge University Press, pp. 1-381. https://doi.org/10.1017/CBO9780511691843

Wolin, K.Y., and Petrelli, J.M. (2009). *Obesity.* Santa Barbara, CA: Greenwood Press, pp. 1-163.

Woolley, L. (2009). *Excavations at Ur: a record of twelve years work.* Abingdon, OX: Routledge, pp. 1-262.

World Health Organisation. (2014). Obesity and overweight fact sheet from World Health Organsation, http://www.who.int/mediacentre/factsheets/fs311/en/ accessed August 1st 2017.

Wright, T. (1864). History of cariicature and of grotesque in art. *Art J. 26,* 137-139.

Young, T. (1813). *An introduction to medical literature, including a system of practical nosology: Intended as a guide to students, and an assistant to practitioners*. London, U.K.: B.R. Howlett, pp.1-586.

Young, T.K. (1994). *Human obesity and arctic adaptation; epidemiological patterns, metabolic effects and evolutionary implications.* D.Phil.Thesis, Oxford University. Oxford, U.K.: Oxford University, pp.1-251.