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](http://news.bbc.co.uk/2/hi/africa/1879429.stm" \t "_blank), other pygmy groups (Barnard, 2007), and the [Batek](http://en.wikipedia.org/wiki/Batek" \t "_blank) people of Malaysia) in general reflect a small and extremely thin body build. The [Baka](http://en.wikipedia.org/wiki/Baka_(Cameroon_and_Gabon)" \t "_blank), 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/m2 (Devlin, 2017).

Steatopygia.tiff

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

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 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](http://en.wikipedia.org/wiki/Steatopygia" \l "cite_note-softpedia-0" \t "_blank) (**Fig. 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 were 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.

Elam2.tiff

**Fig. 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

**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.

**Cup.tiffFig. 5**. Silver cup, showing a slenderly built Elamite individual.

Source: https://en.wikipedia.org/wiki/Elam#/media/File:Elam\_cool.jpg

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."*

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

Elamite.tiff

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 p[eople 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 lesiured class.

***Artifacts***. One terracotta artifact from around the 12th century BCE, discovered in the Elamite city of Susa, shows a grotesquely obese Mother Goddess (**Fig. 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 (**Figs. 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 skilfully 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.

***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.

Sheikh.tiff

**Fig. 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

***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.

**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 arhaeological 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 tanhgible 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 (**Fig. 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 waist-line. 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 (**Fig. 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).

Hatshputut.tiff

**Fig. 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

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 pot-belly 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, including16 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 ).

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

Athero.tiff

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 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, amd 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.

**Fig. 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.

Ducks.tiff

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 (**Fig. 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 (**Fig.10**); the Egyptians made a practice of force-feeding of cattle, lambs, goats, ducks, geese, pigeons and cranes with milk bread-doughas 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.

**Fig. 11**. Eglon, King of 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)

Eglon.tiff

**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 myth, 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 (**Fig. 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"* (2320-21), and "*He who keeps the law is a discerning son, But he who is a companion of gluttons humiliates his father"* (287)..

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 1527):*"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 552.

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 625); "*watch yourselves lest your hearts be weighed down with dissipation and drunkenness and cares of this life*" (Luke 2134); *"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 524);*"Their end is destruction, their god is their belly, and they glory in their shame, with minds set on earthly things"* (Philippians 319).*"Older women likewise are to be reverent in behavior, not slanderers or slaves to much wine"* (Titus 23).

***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.