

## The art of medicine

### Atherosclerosis and diet in ancient Egypt

Atherosclerosis is often considered a modern disease, yet it is evident in the remains of many ancient Egyptians. The mummification process was usually done for the more affluent members of society, and a rich legacy of archaeological and literary evidence, as well as the pathology preserved in both skeletal and mummified remains, has enabled disease studies to be undertaken. These studies not only provide information about this early society, but also establish a historical context for diseases found in modern populations.

Atherosclerosis and vascular calcification are usually regarded as circulatory phenotypes associated with advanced modern lifestyles. However, although rare, such conditions have been identified in human remains from some early societies. Examples occur in an elite Chinese burial (c. 700 BCE), and among Canadian Eskimos (c. 400 CE to c. 1520 CE) whose diet was almost entirely meat. They have also been reported since the early 20th century in the mummified remains of the rulers and elite of ancient Egypt. Marc Ruffer described arterial lesions in hundreds of Egyptian mummies in 1911 and Graham Shattock noted atheromatous deposits in the aorta of King Menephtah in 1909; these findings were later confirmed by John Harris and Edward Wente's radiological survey in 1980, which additionally reported vascular calcification in the mummies of Ramesses II, Ramesses III, Sethos I, Ramesses V, and Ramesses VI.

More recent multidisciplinary investigations of mummified remains have provided evidence of arteriosclerosis

among elite groups in Egyptian society, particularly those individuals with priestly status and their immediate family members. Last year, computed tomography was used to assess atherosclerosis in a selection of 22 mummies of Egyptians with high social status. In 16 of these where the hearts or arteries could be identified, nine mummies showed evidence of vascular calcification. However, although arteriosclerosis has been clearly identified in mummies, it seems to have been fairly uncommon in ancient Egypt. This perhaps reflects the life expectancy at the time of between 40 and 50 years, even among the more affluent members of society, but may also result from differences in intakes of foodstuffs between most Egyptians and the affluent elite.

The palaeopathological evidence can now be examined in conjunction with ancient texts to provide further insight into the occurrence of the disease among the ancient Egyptian elite. We have undertaken a new translation of hieroglyphic inscriptions on Egyptian temple walls that give details of the food offered daily to the gods. Since this food was subsequently eaten by the priests and their families, the inscriptions also provide details of their dietary habits. This has enabled an estimation of the fat content to be made. Interpretation of the hieroglyphs indicates that the diet consisted mainly of beef, wildfowl, bread, fruit, vegetables, cake, wine, and beer. Many of these food items would obviously have contributed to an intake of saturated fat, and our analyses of the individual meat and wildfowl they consumed would demonstrate that all provided greater than 35% of energy from fat. Goose, which was commonly consumed, contains around 63% energy from fat with 20% being saturated, while the bread that was eaten differed from that consumed today, often being enriched with fat, milk, and eggs. The cakes were typically made with animal fat or oil. Although it is difficult to calculate exactly how much was consumed in terms of portion size, variance in food storage, preparation, and cooking methods, it is still evident from a conservative estimate that the dietary energy was more than 50% from fat with a significant portion of this coming from saturated fat. Other components of the diet may have also increased the risk of cardiovascular disease: fruit and vegetables in addition to a reduction in fat intake are thought to play a key role in prevention. Current recommendations state that the daily energy intake should contain no more than 25–30% fat in total, with the saturated fat being less than 7% of this amount. It is difficult to establish whether the dietary intake of priests achieved this amount. Moreover, Egyptian priests consumed little fish, and while oily fish is a major source of omega 3 fatty acids, which are also advocated in

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for illustration

Foodstuffs offered in Egyptian religious rituals

cardiovascular disease prevention, it is unlikely that the intake would have achieved anything like that required. Finally, salt intake is likely to have been high, because it was often used as a preservative. Similarly alcohol, known to increase triglyceride levels, was a common feature of the diet and the intake would probably have exceeded today's recommendations.

It is important to point out that there was a marked difference between the mainly vegetarian diet most Egyptians ate and that of royalty and priests and their family members whose daily intake would have included these high levels of saturated fat. Mummification was practised by the elite groups in society, ensuring that their remains have survived to provide clear indications of atherosclerosis; by contrast, there is a lack of evidence that the condition existed among the less well-preserved remains of the lower classes. Since most mummies available for study will inevitably belong to the wealthier members of Egyptian society, most scientific data relate to the health of these people.

The priests functioned as a powerful bureaucracy in ancient Egypt: at certain historical periods it was customary for a man to combine a career as a lawyer, doctor, scribe, or teacher with part-time priesthood. The priests were organised around a system of alternating groups of officials who served the temple god in rotation with each man undertaking 4 weeks of continuous religious and ritual duties, thereby completing 3 months of annual service within the temple. The temple itself was never a place of congregational worship and accommodated and protected the resident god whose spirit was believed to reside in the cult statue in the sanctuary. The main function of the priests known as "servants of the god" was to perform regular rituals designed to ensure the wellbeing and comfort of the god who was believed to reciprocate by providing benefits for Egypt, its King, and the population at large.

The most important duty of the priest was his three times daily performance of this temple ritual during which the priests, while acting on behalf of the King who could not be present in every temple, cleansed, dressed, and fed the god's statue in the temple sanctuary. The foodstuffs offered to the gods were rich and varied but also included a selection of meat cuts. At the conclusion of the service, the priests removed the consecrated food from the altar and as part of their regular payment, it was divided up among the senior temple personnel who took it home to feed their families.

We have been able to show how temple inscriptions, which recorded daily rituals, can be combined with the palaeopathological investigation of mummies to provide additional evidence about the priests and their diet. Additionally, some inscriptions even indicate that sometimes unscrupulous priests took the divine rations

from the temple without first offering them to the gods. Inscriptions on coffins associated with individual mummies provide the owners' names and titles and this information can be used to associate the diseases discovered in these mummies with specific social groups, in this case the priests and their families.

The Leeds Mummy provides an example of how textual and palaeopathological evidence can be combined to demonstrate the interaction of aspects of the owner's life. This mummy, which belonged to a priest, was brought to Leeds, UK, in the early 19th century. Now owned by the City of Leeds Museum, it was the subject of a multidisciplinary investigation undertaken by the Manchester Egyptian Mummy Project in 1990. The priest had died in middle age and inscriptional evidence on the associated coffin provided his name and priestly titles. This evidence established that he would have participated in the daily temple offerings and therefore regularly received a portion of the god's meals as payment, and also that, as part of the team who prepared this food, he kept the inventories, reports, and administrative documents relating to the corn supplies for the sacred cattle. Kept in the temple precinct, these animals were destined to be slaughtered for the god's daily banquet. Histological examination of tissue samples taken from the femoral blood vessel during endoscopic investigation of the mummy showed well developed atheromatous plaques.

The vast bibliography associated with the examination of Egyptian mummies provides overwhelming evidence that atheroma was seen in a variety of vascular beds. Also there is clear evidence of vascular calcification, which has been increasingly linked as an adverse prognostic finding associated with accelerated atherosclerosis and an increased incidence of coronary artery disease. The presence of vascular calcification would suggest that these findings are true ante-mortem effects rather than those produced by the mummification agents such as natron. The explanation for these frequent pathological findings almost certainly resides in a diet rich in saturated fat that was confined to the elite, while most of the population remained vegetarian. In consequence, there is unequivocal evidence to show that atherosclerosis is a disease of ancient times, induced by diet, and that the epidemic of atherosclerosis which began in the 20th century is nothing more than history revisiting us.

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#### Further reading

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