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When man met meat: meat in human nutrition from ancient times till today

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Abstract

Meat is one of the most valuable sources of proteins, and also contains fats, B vitamin complex, vitamins A and D, large amounts of iron, zinc, and other mineral substances. Although nowadays meat consumption is associated with a number of diseases including cardiovascular disease, cancer and diabetes, meat has a significant role not only for maintenance of proper growth, development and health, but in human evolution as well. There is evidence that meat consumption has had an influence on cranial-dental and intestinal morphologic changes, human erect posture, reproductive characteristics, longer lifespan, and maybe most importantly, on brain and intellectual development.

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Keywords: evolution; meat; hunting; diet; health

1. Introduction

Meat is one of the most valuable foods from a nutritional viewpoint[1]. Although there are implications about the correlation between meat and some disorders, the role of meat in human diet during evolution should not be neglected[1,2,3]. In order to obtain sufficient data about human diet and meat consumption during evolution, scientists use indirect and direct approaches. The indirect approach is based on evidence from the fossil morphology and

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remains of plants and animals found in archaeological sites[4,5]. The direct approach includes isotope analysis in bones and teeth, because chemical composition of tissues in the body can reveal the chemical composition of ingested food. This approach is based on analysis and comparing presences and ratios of stable isotopes of carbon ($^{13}C/^{12}C$) and nitrogen ($^{15}N/^{14}N$). Relative measures of stable isotopes of carbon and nitrogen can be useful in insight in the relation of food of animal and plant origin in the diet[4,5].

The aim of this paper is to contribute to better understanding of the role of meat not only in human diet, but in evolution and how meat eating makes us what we are today, affecting our anatomy, physiology, emotions and social characteristics.

2. Impact of meat eating on human evolution

The diet of early hominin species was mainly based on plant (fruits, seeds, grasses, and tubers) supplemented with some animal foods. Results of paleontological and archaeological research supported theory that incorporation of larger amounts of animal proteins started with the earliest *Homo*. It is supposed that *H. habilis* obtained meat from scavenging and a smaller part by hunting, while hunting was the predominant method for *H. erectus* to obtain animal proteins, and it appears to be a major adaptive shift in human evolution[6].

Hunting and meat eating resulted in increased body size. *H. erectus/ergaster* males had an average body mass of 66 kg compared to *H. habilis* which weighed 37 kg, while body mass of females increased by 53%, from 32 kg for *H. habilis* to 56 kg for *H. erectus/ergaster.* The height increased, from 131 cm to 180 cm (by 33%) for males and from 100 cm to 160 cm (by 37%) for females[7].

Bipedalism, which distinguished ancient humans from other apes, appeared in the oldest known species of *Australopithecus*, who lived in Africa about four million years ago[8]. According to some investigations 'postural' bipedalism was found in *A. afarensis*, and locomotor bipedalism did not appear until the emergence of *H. ergaster* between 1.9 and 1.5 million years ago. Some authors consider that bipedalism in *H. ergaster* was associated with climate changes in Africa where more open habitat leaving food resources patchily distributed forced humans to move in order to find food. Moreover, bipedalism can be considered as one of the first strategies in human nutritional evolution[8,9].

As meat become more common in nutrition, it was inevitable for changes in the digestive tract to occur. Even though during evolution of the australopithecines, total surface area of the grinding teeth increased from 460 mm^2 in *A. afarensis* to 756 mm^2 in *A. boisei*, in early species from genus *Homo,* reduction in the posterior dentition is noted. The tooth surface area of postcanines decreased from 478 mm^2 in *H. habilis* to 377 mm^2 in early *H. erectus*[6]. While changes in decreases in molar teeth size and stronger front teeth could be contributed to diet changes and tearing and chewing meat, changes in intestinal morphology reflected the impact of high quality diet[10]. Generally, large primates have an expanded colon which is necessary for extraction of additional energy in the form of volatile fatty acids obtained by fermentation process from plant fibers. On the other hand, humans have a small colon and enlarged small intestine. These differences in intestinal morphology are result of adaption to easy digested animal proteins in human nutrition[6]. Along with body, brain size also increased, from 400 cm^3 in the earliest australopithecines to 1300–1400 cm^3 in modern humans, although the equal changes in brain size were not detected in regular periods during evolution. The greatest level of encephalization was found in *H. erectus* who had a larger brain compared to body mass than any other primate during evolution. *H. erectus* brain size reached 800 to 900 cm^3, which is about 200-300 cm^3 larger than *H. habilus* brain size[6].

Larger brains were needed for complex foraging behaviour and the use of tools[11]. There are some indications that *A. garhi* was the first stone tool-user and that *A. africanus* made Oldowan tools, but without doubt, *H. erectus* used stone tools[12]. Development of Oldowan industry tools allowed successful hunting and easier processing of carcasses and increased access to meat, bone marrow and brains[6]. Hunting needs a cooperative interaction which led to pantomiming and vocalisation which was a turning point in language development[11]. Archaeological findings indicate that after killing and butchering, animals were transported back to a central location where the resources were shared within foraging groups[6]. Cooperation in hunting and meat sharing was one of the first steps in sociogenesis. Even today, hunting can be considered as way to escape social tensions in the presence of close friends and meat- and general food-sharing remain a bonding mechanism[11,13]. Furthermore, origins of art are connected with hunting rituals and animals hunted as prey like aurochs, became indeed the first known objects of animal art during