Cooked Food and Human Evolution: An Appraisal of Bio Cultural Anthropology

Dr. Alok Chantia

Asstt. Prof, Dept. of Anthropology, Sri Jai Narain Post Graduate College, Lucknow

Abstract

For our body size, humans exhibit higher energy use yet reduced structures for mastication and digestion of food compared to chimpanzees, our closest living relatives. This suite of features suggests that humans are adapted to a high-quality diet. Although increased consumption of meat during human evolution certainly contributed to dietary quality, meat-eating alone appears to be insufficient to support the evolution of these traits, because modern humans fare poorly on raw diets that include meat. Cooking confers physical and chemical benefits to food that are consistent with observed human dietary adaptations. There are evidences showing that cooking facilitates mastication, increases digestibility, and otherwise improves the net energy value of plant and animal foods regularly consumed by humans. There is a likelihood that cooking was adopted more than 250,000 years ago , a period that we believe is sufficient in length for the proposed adaptations to have occurred. Present paper makes an appraisal of cooked food and human evolution in the context of bio cultural anthropology.

Introduction

The anthropological study of food is different from that of other disciplines as it focuses on food within a cultural and often cross-cultural context. Anthropologists study humans and human culture across space and evolutionary time; this includes the study of their own culture and social institutions. Subfields of the anthropological study of food include cultural, linguistic, biological, and archaeological anthropology. Researches in nutritional anthropology cut across these subfields. Food requires hunting, gathering, growing, storage, distribution, preparation, display, serving, and disposal, all of which are social activities. Topics for the anthropological study of food within a cultural system include economy, inequality, gender, status, hunter-gatherers, and food as a symbol.

The archaeologists are interested in the diet or subsistence pattern of the peoples they study. Since seasonal patterns of movement are often linked to subsistence regimes, archaeologists frequently study the overall settlement-subsistence pattern. Other major topics of study related to food are the morigins of agriculture, the process of plant and animal domestication, and the study of foodways (food in a social and cultural setting). With the help of interdisciplinary teams of specialists, archaeologists examine a variety of evidence such as animal bones (faunal analysis or zooarchaeology), plant remains (paleoethnobotany or archaeobotany), human bones (osteology), residues (chemistry), and the settlement system. Faunal and paleoethnobotanical analyses are able to determine diet (which animals and plants were eaten) as well as hunting, gathering, butchering, and preparation techniques, the identity of preferred or high-status foods, the seasonality of site occupation and diet items, and whether the animals/plants were domesticated. The phrase "You are what you eat" is true in that what we eat forms the bones and organs in our body, leaving behind chemical signatures. Human bones reflect the general health and nutrition of the individual, and may be chemically analyzed to reveal diet through isotopic (heavy element) or chemical signatures.

Cooked Food and Human Evolution

Present-day human eating behaviour in industrialised society is characterised by the consumption of high-energy-density diets and often unstructured feeding patterns, largely uncoupled from seasonal cycles of food availability. Broadly similar patterns of feeding are found among advantaged groups in economically-emerging and developing nations. Such patterns of feeding are consistent with the evolutionary ecological understanding of feeding behaviour of hominids ancestral to humans, in that human feeding adaptations are likely to have arisen in the context of resource seasonality in which diet choice for energy-dense and palatable foods would have been selected by way of foraging strategies for the maximisation of energy intake. One hallmark trait of human feeding behaviour, complex control of food availability, emerged with Homo erectus (1.9 x 10(6)-200000 years ago), who carried out this process by either increased meat eating or by cooking, or both. Another key trait of human eating behaviour is the symbolic use of food, which emerged with modern Homo sapiens (100000 years ago to the present) between 25000 and 12000 years ago. From this and subsequent social and economic transformations, including the origins of agriculture, humans have come to use food in increasingly elaborate symbolic ways, such that human eating has become increasingly structured socially and culturally in many different ways. (Ulijaszek SJ.,n.d.)

For our body size, humans exhibit higher energy use yet reduced structures for mastication and digestion of food compared to chimpanzees, our closest living relatives. This suite of features suggests that humans are adapted to a high-quality diet. Although increased consumption of meat during human evolution certainly contributed to dietary quality, meat-eating alone appears to be insufficient to support the evolution of these traits, because modern humans fare poorly on raw diets that include meat. Cooking confers physical and chemical benefits to food that are consistent with observed human dietary adaptations. There are evidences showing that cooking facilitates mastication, increases digestibility, and otherwise improves the net energy value of plant and animal foods regularly consumed by humans. There is a likelihood that cooking was adopted more than 250,000 years ago , a period that we believe is sufficient in length for the proposed adaptations to have occurred. Additional experimental work is needed to help discriminate the relative contributions of cooking, meat eating, and other innovations such as non thermal food processing in supporting the human transition toward dietary quality.

Hominid fossils showing morphological changes, archaeological remains, and direct chemical analysis of fossilized bones can help reconstruct the evolution of subsistence, particularly the introduction of animal protein in the diet. Fossil evidence of the four main hominid categories – from *Australopithecines* (and *Paranthropines*), to *Homo habilis*, to Neanderthals, to *Homo sapiens* – shows major morphological changes over four million years. These include an increased cranial capacity, loss of a sagittal crest, a reduction in mandible size, the introduction of brow ridges and chins, and a smaller face. The increasing gracilisation of mandibles and larger craniums are the two changes believed to be linked to diet – and point to the introduction of meat. The most widely accepted model used to explain the changes is the 'expensive tissue hypothesis'. The hypothesis is supported by various lines of evidence. Firstly, archaeological remains indicate that the first stone tools for butchering animals appeared at the same time as *Homo habilis* and became more sophisticated over time; faunal remains show butchering marks; and there is evidence of cooking, such as fireplaces. Second, we can compare hominids to other living primates. The larger mandibles and smaller brains of *Australopithecines* were similar to gorillas, which are vegetarian; while *Homo habilis'* smaller mandibles and larger brains were closer to chimpanzees, which eat a little meat. Third, the hypothesis can be supported by comparing our digestive systems to herbivores and carnivores. Finally, the newest and most reliable test is direct chemical analysis of fossil remains –Professor Richards' area of expertise. This method examines the bone protein using carbon and nitrogen stable isotope analysis. Collagen can be extracted to get a long-term record of dietary protein; carbon analysis helps distinguish between marine and terrestrial protein; and nitrogen analysis distinguishes between animal and plant protein. As collagen is preserved in bones of only up to 100,000 years, the earliest hominid that this analysis can be carried out on is the Neanderthal. Professor Richards' analyses show that Neanderthals were top-level carnivores with protein derived from meat. Bones of Paleolithic humans show similar protein ratios. The main source of protein in European Upper Paleolithic humans was animal meat, but also included fish.

The Neolithic revolution, around 10,000 years ago, brought about the next major dietary change within our species. Humans began domesticating plants and animals. "What happened with this was the move to the domination of lower quality [protein- and fat proof, but carbohydrate-rich] plant foods, such as cereals, maize and rice. This dietary change led to a sedentary lifestyle within villages and urban centres. "While this is associated with our decreased stature, and a decline in health, it's led to a major expansion of our species – geographically and in population size,"

Cooking of Food in Evolutionary Ecological Context

No human foragers have been recorded as living without cooking, and people who choose a 'raw-foodist' life-style experience low energy and impaired reproductive function. This suggests that cooking may be obligatory for humans. The possibility that cooking is obligatory is supported by calculations suggesting that a diet of raw food could not supply sufficient calories for a normal hunter-gatherer lifestyle. In particular, many plant foods are too fiber-rich when raw, while most raw meat appears too tough to allow easy chewing. If cooking is indeed obligatory for humans but not for other apes, this means that human biology must have adapted to the ingestion of cooked food (i.e.

food that is tender and low in fiber) in ways that no longer allow efficient processing of raw foods. Cooking has been practiced for ample time to allow the evolution of such adaptations. Digestive adaptations have not been investigated in detail but may include small teeth, small hind-guts, large small intestines, a fast gut passage rate, and possibly reduced ability to detoxify. The adoption of cooking can also be expected to have had far-reaching effects on such aspects of human biology as life-history, social behavior, and evolutionary psychology. Since dietary adaptations are central to understanding species evolution, cooking appears to have been a key feature of the environment of human evolutionary adaptiveness. Further investigation is therefore needed of the ways in which human digestive physiology is constrained by the need for food of relatively high caloric density compared to other great apes.

Cooking As a Biological Trait

Calculating the exact time of the advent of cooking on a wide basis is extremely difficult, as such evidence from Palaeolithic times is virtually nonexistent, and what evidence exists is easily prone to misinterpretation. Evidence for the use of fire is not the evidence of the use of fire for cooking. Also, many assumptions have been made concerning the effects on humanity as a result of cooking. How accurate are some of these claims? (Proc Nutr Soc. 2002)

Fire has been part of the environmental landscape of Earth for about 400 million years, and volcanoes and lightning have been sources of wildfires for eons. [Pyne, Stephen J. 2001] When and how homonids evolved to eventually acquire the use, then subsequently the control, and finally the production of fire is subject to much speculation. It is erroneous to assume that any evidence of fire from millennia ago, must be of human origin, and then further jump to conclude that humans have been cooking for millions of years. Yet that is exactly what zoologist Richard Wrangham suggests.[Gorman, Rachael Moeller, 2007] (It should be noted that he specializes in chimpanzee research, not human evolution.) In fact, as has been pointed out by various anthropologists, wildfires caused by lightning-strikes are quite common in East Africa, and have been long before our human ancestors evolved to the point of using these natural fires. Another problem with Wrangham’s notion that the advent of cooking was much earlier than generally accepted and supposedly led to larger human brains is that you need a high degree of intelligence in order to invent and control the use of fire, as it is such a complex process. In other words, it takes a big, smart brain to make the fire, not the other way around. Evidence is also clear that humans are the only species to have developed this skill. Considering no antecedent existed for early humans and the high intellect required, it is reasonable to conclude that pyrotechnology was a slow going process historically.

It is inaccurate to assume that human pyrotechnology coincided with the invention of cooking as it makes much more sense, on an evolutionary and logical level, to assume that fire was first used as a way of keeping warm, burning brush and warding off dangerous wildlife. Furthermore, interaction with and use of fire preceded the production of it in early humans. It is interesting that the long-term use of home-based caves circa 400,000 to 350,000 years ago was probably the result of the use of controlled fire for light, warmth and warding off predators, as fire residues are first found around this period.[Rolland, Nicolas, n.d.]

Actual hard evidence, in the form of cooking hearths, is found 250,000 years ago. One source cites a figure of 125,000 years as the beginning of the controlled use of fire by humans for the purpose of cooking food.[www.beyoundveg.com] Most others cite, on average, a figure of about 250,000 years, as being more or less established.[Gorman, Rachael Moeller, 2007] Only a mere handful of scientists, claim the far less reliable figures of 790,000 to 2.6 million years ago for the advent of cooking. The first modern form, Homo Sapiens, appeared between 140,000 to 110,000 years ago, which also coincides with the beginning of the last ice age. This drastic change in climate may well have been the trigger for the widespread use of fire for warmth and cooking. [www.beyoundveg.com] It is certainly a more reasonable assumption than millions of years prior.

Adaptation to Cooked Foods

Another issue to consider with the history of cooking is the length of time needed for the body to adapt to it. Some geneticists think that it takes circa 1 million years for a particular species to fully adapt, on an evolutionary level, to an entirely new diet (eg: from a Fruitarian to a largely meat-based one) and this view is reflected in our own ancestral, pre-human dietary past where extreme dietary-changes were pretty slow, taking many millions of years in some cases.[www.beyoundveg.com]

Given that cooked food involves a much more drastic change to one's diet than simply switching from one type of raw food to another – such as fruit to meat – it's obviously going to take a much longer time to adjust to it, by comparison. Chemical alterations caused by cooking are many, and many of them are known to be. Plus, given that no other animal has ever gone in for cooking its own food, we don't really know whether any species can ever fully adjust in all ways to such a food. We may be able to tolerate them to some extent, but they are not optimal choices.

Indeed, it has been stated that the advent of cooking also led to us having certain unique dental problems, such as malocclusion, due to eating softer cooked foods; whereas other species seem to be unaffected by these particular problems, due to having a more natural, raw diet.[Pickrell, John,2005]

Switching to the consumption of foods which were softer than before, possibly caused human jaws to become smaller on average, due to lack of natural selection for tougher jaws; but the number of teeth remained the same, thus explaining why a number of humans often need to have their wisdom teeth removed. Some predict that, eventually, human teeth, due to lack of natural selection and a lack of a harder, uncooked, unprocessed diet, might eventually disappear altogether, from our descendants. [Wilford, John Noble, 1988]

The research of American dentist Weston Price was conducted in the 1930s on twelve traditional tribes of the modern era, who were isolated from civilized peoples. All twelve ate some raw animal foods as part of their regular diet, some more than others. [Fallon, Sally, n.d.] The Eskimos he visited were traditional hunter-gatherers, untouched by agriculture, who just happened to show a most impressive bone structure with wide faces, ample enough for all teeth, and rarely were any dental caries found in any of their teeth.[Price, Weston A, 2003]A description of their general diet follows:

"For the Eskimos of Alaska the native diet consisted of a liberal use of organs and other special tissues of the large animal life of the sea, as well as of fish. The latter were dried in large quantities in the summer and stored for winter use. The fish were also eaten frozen. Seal oil was used freely as an adjunct to this diet and seal meat was specially prized and was usually available. Caribou meat was sometimes available. The organs were used. Their fruits were limited largely to a few berries including cranberries, available in the summer and stored for winter use. Several plant foods were gathered in the summer and stored in fat or frozen for winter use. A ground nut that was gathered by the Tundra mice and stored in caches was used by the Eskimos as a vegetable. Stems of certain water grasses, water plants and bulbs were occasionally used. The bulk of their diet, however, was fish and large animal life of the sea from which they selected certain organs and tissues with great care and wisdom. These included the inner layer of skin of one of the whale species, which has recently been shown to be very rich in vitamin C. Fish eggs were dried in season. They were used liberally as food for the growing children and were recognized as important for growth and reproduction. This successful nutrition provided ample amounts of fat-soluble activators and minerals from sea animal life."

Vegetables have a rich content of nutrition, right from protein, vitamins, potassium, phosphorus, magnesium, calcium to selenium, iron, manganese, copper and zinc. A high vegetable diet definitely assures a relief from all the major and minor problems of the body. According to experts, people consuming greater amounts of vegetables in their diet are high on energy and feel less lethargic or stressed out. The nutrition provided, helps body perform all the activities, by providing the body cells and organisms, all the necessary requisites for supporting life.

Nutritional Value of Vegetables

Item	**Serving**	**Fat**	**Fiber**	**Prot.**	**Carb.**	**Sod.**
Asparagus	3 med. spears	0	1g	1g	2g	1mg
Beans, Kidney	1 cup	1.5	45g	43g	110g	44mg
Beans, Lima	1 cup	1g	33g	38g	113g	32mg
Beans, Snap	1 cup	0	3.5g	2g	8g	6.5mg
Beans, Soy	1 cup	17g	11g	33g	28g	38mg
Broccoli	1 bunch	2g	18g	18g	32g	164mg
Brussels Sprouts	1 sprout	0	0.5g	0.5g	1.5g	4.5mg

Cabbage	1 med	2.5g	21g	13g	49g	163mg
Carrot	1 med.	0	2g	0.5g	6g	21mg
Cauliflower	1 med.	1g	14g	11g	30g	172.5mg
Cucumber	1 med.	0	2g	2g	8g	6mg
Garlic	1 clove	0	0	0	1g	0.5mg
Mushrooms	1 cup sliced	0	1g	1.5g	3.2g	2.8mg
Onion	1 med.	0	2g	1g	9.5g	3mg
Peas	1 cup	0.5	7g	8g	21g	7mg
Potato	1 med.	0	2g	2.5g	22g	7mg
Radish	1 med.	0	0	0	0	1mg
Spinach	1 bunch	1	9g	9.5g	12g	268.5mg
Tomato	1 med.	0.5g	1.5g	1g	5.5g	11mg

Calorific Value and Nutritive Values of Vegetables

Foodstuff	Energy (kcal)	Protein (g)	Carbohydrate (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)	Sodium (mg)
Amaranth leaves	45	4	6.1	0.5	1	397	3.49	230
Bathua	30	3.7	2.9	0.4	0.8	150	4.2	
Bengal gram leaves	97	7	14.1	1.4	2	340	23.8	
Cabbage	27	1.8	4.6	0.1	1	39	0.8	20
Colacasia Leaves	56	3.9	6.8	1.5	2.9	227	10	
Coriander Leaves	44	33	6.3	0.6	1.2	184	1.42	58.3
Fenugreek	49	4.4	6	0.9	1.1	395	1.93	76.1
Lettuce	21	2.1	2.5	0.3	0.5	50	2.4	58
Mint	48	4.8	5.8	0.6	2	200	15.6	
Mustard Leaves	34	4	3.2	0.6	0.8	155	16.3	
Raddish Leaves	28	3.8	2.4	0.4	1	265	0.09	
Spinach	26	2	2.9	0.7	0.6	73	1.14	58.5

Foodstuff	Energy (kcal)	Protein (g)	Carbohydrate (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)	Sodium (mg)
Ashgourd	10	0.4	1.9	0.1	0.8	30	0.8	
Bittergourd	25	1.6	4.2	0.2	0.8	20	0.61	2.4
Bottlegourd	12	0.2	2.5	0.1	0.6	20	0.46	1.8
Brinjal	24	1.4	4	0.3	1.3	18	0.38	3
Capsicum	24	1.3	4.3	0.3	1	10	0.56	
Cauliflower	30	2.6	4	0.4	1.2	33	1.23	53
Cucumber	13	0.4	2.5	0.1	0.4	10	0.6	10.2
Drumsticks	26	2.5	3.7	0.1	4.8	30	0.18	
French Beans	26	1.7	4.5	0.1	1.8	50	0.61	4.3
Jack Fruit, Tender	51	2.6	9.4	0.3	2.8	30	1.7	35
Karonda (Fresh)	42	1.1	2.9	2.9	1.5	21		
Ladies Finger	35	1.9	6.4	0.2	1.2	66	0.35	6.9
Lotus Stem (Dry)	234	4.1	51.4	1.3	25	405	60.6	438
Peas	93	7.2	15.9	0.1	4	20	1.5	2
Plaintain, Green	64	1.4	14	0.2	0.7	10	6.27	15

Foodstuff	Energy (kcal)	Protein (g)	Carbohydrate (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)	Sodium (mg)
Beetroot	43	1.7	8.8	0.1	0.9	18.3	1.19	59.8
Carrot	48	0.9	10.6	0.2	1.2	80	1.03	35.6
Colacasia	97	3	21.1	0.1	1	40	0.42	9
Onion	59	1.8	12.6	0.1	0.6	40	1.2	4
Potato	97	1.6	22.6	0.1	0.4	10	0.48	11
Raddish	17	0.7	3.4	0.1	0.8	35	0.4	33
Sweet Potato	120	1.2	28.2	0.3	0.8	46	0.21	9
Turnip	29	0.5	6.2	0.2	0.9	30	0.4	
Yam	111	1.4	26	0.1	1	35	1.19	9

Source: www.indiadiets.com/foods/food_values/nutritive_values.asp

It is impossible to accurately estimate what proportion of raw to cooked animal foods and plant foods were in the diet of our more recent ancestors during the Palaeolithic Era. It surely would be most interesting to see a long-term scientific study performed of people following a 100% cooked food diet, which may include cooked fruit and cooked vegetables. It would be fascinating to see what the effects would be over a decade or more.

Cooked Food and Size of Brain

Enlarged brains are only favored when the species will greatly benefit from the adaptation due to the energy cost of maintaining a large brain. The brain extracts a disproportionate amount of glucose from food, which makes large-brained animals dependent on high-quality, glucose-rich foods, such as ripe fruit. Spider monkeys experienced pressure to obtain sparse, high-quality foods which encouraged greater brain power to identify edible foods, remember their location, and know what foods are ripe. This pressure is necessary for the natural selection of larger brains due to the energy costs of maintaining them.

Katharine Milton's "Diet and Primate Evolution" indicates a relationship between brain size and gut size by examining two species of primates with a one common ancestor. Spider monkeys seem to be very intelligent animals and possess large brains. Howler monkeys have a similar body size, but the spider monkey's brain weighs twice that of the howlers. A large brain is advantageous in a tree dwellers life because it allows for memory and recognition. Fruit-bearing trees are sparse in the specific Panama forest Milton was studying in and spider monkeys have an advantage over other species if they are able to remember where fruit-bearing trees are located. Fruit-dependent species must also know when the fruit is ripe. Spider monkeys also show an ability to recognize members of their particular social unit and communicate through food-related calls to other members in their region. These food-related calls allow the spider monkeys to take advantage of all fruit-bearing trees over a large area. In general, primates who eat high quality and dispersed foods like the spider monkeys also exhibit larger brains than those who rely primarily on an abundant source of leaves.

Enlarged brains are only favored when the species will greatly benefit from the adaptation due to the energy cost of maintaining a large brain. The brain extracts a disproportionate amount of glucose from food, which makes large-brained animals dependent on high-quality, glucose-rich foods, such as ripe fruit. Spider monkeys experienced pressure to obtain sparse, high-quality foods which encouraged greater brain power to identify edible foods, remember their location, and know what foods are ripe. This pressure is necessary for the natural selection of larger brains due to the energy costs of maintaining them.

The evolution of a larger brain is accompanied by digestive tract adaptations, which is shown by comparing spider and howler monkeys in typical diet and digestive features. Spider monkeys consume fruits as 72% of their diet, leaves as 22%, and flowers as 6%. Forty-two percent of the howler monkey's diet is fruit, 48% leaves, and 10% of their nutrients are derived from flowers. To accommodate for diet differences, spider monkeys pass food quickly through a small colon. This speed allows for spider monkeys to move masses of food through their GI tract and extract all of their required nutrients. Fruit is easily digested and calorically dense, so fruit is a good choice for this digestive strategy. On the other hand, howler monkeys have a slow passage of food through a large colon. This is an adaptation to leaf dependence, which requires a long gut residence time for efficient fermentation and nutrient extraction. A large gut also offers more surface area for calorie uptake, which would be a necessity due to the low calorie content in leaves. A smaller gut with less surface area can extract enough nutrients to sustain an individual when foods contain a high amount of readily accessible calories, such as in fruit.

The progression from *Australopithecus* to *Homo Sapien* is typified by increase in brain size and reduction in gut size and complexity. Energy from food must be allocated to either a large brain or complex digestive tract which causes differences in anatomy based on food pressures. Our hominid ancestors used brain power to solve dietary problems which has led to humans' current dependence on high quality foods that require advanced food acquisition methods. Milton's article also points out the function of our ancestor's short gut residence time for foods. More fiber in the modern human diet facilitates quick food passage through the GI tract and adhering to our ancestor's digestive cycles, characterized by short gut residence time, may positively impact human digestive health. (Katharine,2000)

As for Wrangham's claim that cooked food consumption led to bigger human brain-size, is easily debunked.[Gorman, Rachael Moeller, 2007] His claims are that Homo Habilis gained brain-size due to including more (raw) meat in the diet, but that Homo Erectus gained extra average brain-size due to eating cooked-foods. Given that the increase in average brain-size was roughly similar for both species (~300cc for each, or roughly 500 to 800cc for Homo Habilis, 900-1200cc for Homo Erectus), it's far more likely that the increase in either pre-human brain-size was due to one sole, common reason, namely eating meat, especially since Homo Erectus ate a diet much higher in meat than Homo Habilis, who, in turn, ate more meat than previous ancestors. Also, Homo Erectus was a larger animal than its predecessor, and thus, their relative brain sizes are actually quite similar [Jurmain, Robert, et el, 2004] and less noteworthy than the brain size without consideration to overall body size. So, Wrangham doesn't really have any basis for his 'cooked foods increased brain size' argument, and in fact his ideas often contradict the available evidence. Most other anthropologists oppose this by stating that cooking fires began in earnest barely 250,000 years ago, when ancient hearths, earth ovens, burnt animal bones, and flint appear across Europe and the Middle East. Back 2 million years ago, the only sign of fire is burnt earth with human remains, which most anthropologists consider coincidence rather than evidence of intentional fire.[Pennisi, Elizabeth, 1999]

Wrangham suggests that it is the consumption of cooked tubers in particular that led to brain expansion by providing an increase in energy in the diet, but this would place the control of fire much, much earlier than established. It also fails to account for DHA, a vital constituent to brain development, not found in tubers, but found in meat and fat. Also brain-size has decreased by some 8% since the advent of the Agricultural Revolution, which coincided with a massive increase in the consumption of cooked starchy foods [www.beyoundveg.com], so this contradicts Wrangham's ideas completely. An increase in cooked starches, grains and the introduction of dairy to the human diet, coupled with a decrease in meat has caused great detriment to our species, especially regarding brain size. As stated previously, the invention of fire requires a great deal of intelligence to implement in the first place, and this is why it makes much more sense to assume that human evolution preceded the use/invention of fire, than the ridiculous claim that the invention of cooking, and specifically the cooking of tubers led to larger human brain-size.

Wrangham has claimed that Homo Erectus (being of roughly similar size to modern humans) would have needed to eat 12 pounds of raw plant food or 6 pounds of raw plant and raw animal food each day just in order to survive.[Gorman, Rachael Moeller, 2007]

He also claimed that eating mostly raw meats would not help as Homo erectus would have needed to chew raw meat for 5.7 to 6.2 hours a day to get enough energy. Unfortunately, Wrangham is basing these claims on the chewing-rate of chimpanzees (who he claims chew meat very slowly), and it should be obvious that chimpanzees are quite different from Homo Erectus populations, on an evolutionary level, so that this is not a valid comparison (after all Homo Erectus populations were far more evolutionarily adapted to meat- eating than chimpanzees are today, both are of different sizes etc.). Also, plenty of anecdotal evidence from the Raw-Foodist community indicates that those on 100% raw diets simply do not need to eat anywhere near the kind of vast, unnecessary quantities that Wrangham has supposedly claimed – and they certainly don't need to chew from 5.7 to 6.2 hours a day in order to get sufficient calories. It is very common for Raw-Animal-Foodists to need to eat amounts of raw food on a Raw-Animal-Food Diet which are significantly lower in quantity than the amounts of cooked-food they ate previously on standard, cooked diets. And raw-foodists certainly don't need to chew for long periods which Wrangham has claimed – indeed, it's often claimed by Raw-Foodists who follow partially raw diets that cooked food needs to be chewed for a longer period than raw food as they claim cooked food is so poorly digested by their bodies, by comparison.

Conclusion

It can be concluded that probably it is safest to trust the experts in human evolution who have set the advent of cooking at 250,000 years ago, even though there are some credible claims for as little as 125,000 to as long as 300,000 years ago, dates much older than these have no basis given current archaeological evidence. Furthermore, there is no evidence whatsoever that cooking was instrumental regarding human brain-development though undoubtedly, in terms of cultural development.

References

1. Fallon, Sally, Ancient Dietary Wisdom for Tomorrow's Children Weston A, Price Foundation website.
2. Fire and Cooking in Human Evolution, Rates of Genetic Adaptation to Change, Hunter-Gatherers, and Diseases in the Wild, Beyond Vegetarianism; www.beyoundveg.com.
3. Gorman, Rachael Moeller, "Cooking up Bigger Brains," Scientific American, December 2007.
4. Jurmain, Robert, Kilgore, Lynn, Trevathan, Wenda and Nelson, Harry. Essentials of Physical Anthropology, 5th Edition. Thomson Wadsworth, 2004.
5. Milton, Katharine(2000) . "Diet and Primate Evolution." Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition. Ed. Alan Goodman, Darna Dufour, & Gretel Pelto. Mountain View, CA: Mayfield Publishing Company, . 46-54.
6. Pennisi, Elizabeth, Human Evolution: Did Cooked Tubers Spur The Evolution Of Big Brains?. Science, Volume 283, Number 5410 Issue of 26 Mar 1999, pp. 2004 – 2005; www.beyoundveg.com.
7. Pickrell, John Human 'dental chaos' linked to evolution of cooking, New Scientist, February 19, 2005.
8. Price, Weston A., Nutrition and Physical Degeneration, 6th Edition, Price-Pottenger Nutrition Foundation, 2003; www.ppnf.org.
   -Proc Nutr Soc., 2002 Nov;61(4):517-26.
9. Pyne, Stephen J., Fire: A Brief History, University of Washington Press, 2001.
10. R Michel (2006),The evolution of human diets, seminar highlights, Australia
11. Rolland, Nicolas, Was the Emergence of Home Bases and Domestic Fire a Punctuated Event? A Review of the Middle Pleistocene Record in Eurasia, Asian Perspectives: the Journal of Archaeology for Asia and the Pacific pp. 248-280.
12. Timeline of dietary shifts in the human line of evolution, Beyond Vegetarianism; www.beyoundveg.com.
13. Ulijaszek SJ.,n.d., Comp Biochem Physiol A Mol Integr Physiol. 2003 Sep;136(1):35-46.
14. Wilford, John Noble. Human Teeth, Small Already, Keep On Shrinking New York Times, August 30, 1988.
15. www.beyoundveg.com.
16. www.indiadiets.com/foods/food_values/nutritive_values.asp