

Capuchin Monkey Foodways

Overview

Capuchins are also new world monkeys, living in central and south america, frequently in the same jungles as howlers and spiders. However, they inhabit different niches within those forests, eating some of the same foods as spiders in particular but also many foods not eaten by either of these monkeys. Whenever spiders and capuchins are competing for the same food, the spiders easily scare them away because they are so much bigger. As noted before, animals rarely eat the same foods in the same ecosystems because those conditions generate so much competition that one species usually annihilates the other. Both diurnal, arboreal and social, they are tiny with the males weighing about eight pounds and the females weighing around five. (Fleagle 1999, Primate adaptation and evolution and Fragaszy, Visalberghi, & Fedigan p.13). Although there are different species of Capuchins, I will present a general overview that seems to apply to most of them. In prior times, they were frequently used as pets and were seen with organ grinders wearing tiny hats.

DIET

They eat foods remarkably similar to our own--which is one of the reasons I have chosen to focus on them. They eat mostly fruit, like the spiders, but instead of focusing otherwise on leaves, like the spider and chimpanzee, they focus on more refined foods, typically richer in protein, including all kinds of seeds, buds, leaves, flowers--but most importantly, softer, more digestible animal foods such as bugs without exoskeletons, birds' eggs, small vertebrates, such as frogs, lizards, as well as crabs when available; they also prey occasionally and sadly on the babies of other primates. They also prey occasionally on the babies of other monkeys (Sampaio & Ferrari 2005). (Fragaszy, Visalberghi, & Fedigan pp. 44-45). Perhaps most importantly, many of the seeds they eat are either nuts or something similar to nuts and contain considerable amounts of fat--thus making them one of the few primates, to my knowledge, to receive more of their nutrients as longer chain fatty acids. In some cases their diet ranges from about eighty percent plants to twenty percent animal foods (Spironello 2001)--but sometimes and depending on the species it can amount to as much as forty percent animal foods (Fragaszy, Visalberghi & Fedigan pp.47-48). And otherwise, the proportion of foods they eat from these different categories vary through the seasons. During certain times of year when fruit is scarce, they will fallback on more reliable and stable foods such as nuts and insects (Fragaszy, Visalberghi & Fedigan pp. 43-44). So, as you can see, their diet is quite close to ours: fruit, starchy and fatty seeds and animals and eggs and smattering of leaves, flowers and the like--although we humans typically eat way more starch than fruit.

SENSES

Vision

males: dichromats, red and green color blind

females: some trichromats

males protanopia--cannot distinguish between red and green or blue and green
or just one type of cone, capable of seeing green

but then another study contradicts, based on capuchin performance in test--concluded that see
all across all ranges of colors so bit confusing

In one study- tufted capuchin monkeys (*Sapajus* spp., formerly referred to as *Cebus apella*) had
their DNA analyzed and were characterized as the following: one trichromat female, seven
deuteranope dichromats (six males and one female), and two protanope males, one of which
was identified as an "ML protanope."

Dichromat Studies

Jacobs, Gerald H. "Prospects for Trichromatic Color Vision in Male *Cebus* Monkeys."
Behavioural Brain Research, vol. 101, no. 1, Elsevier BV, May 1999, pp. 109–112. Crossref,
doi:10.1016/s0166-4328(98)00155-7.

Jacobs, Gerald H., and Jess F. Deegan II. "Cone Pigment Variations in Four Genera of New
World Monkeys." *Vision Research*, vol. 43, no. 3, Elsevier BV, Feb. 2003, pp. 227–236.
Crossref, doi:10.1016/s0042-6989(02)00565-5.

Trichromat Studies

Pessoa, Valdir F., et al. "Color Vision Discrimination in the Capuchin Monkey *Cebus Apella*:
Evidence for Trichromaticity." *Behavioural Brain Research*, vol. 89, no. 1–2, Elsevier BV, Dec.
1997, pp. 285–288. Crossref, doi:10.1016/s0166-4328(97)00079-x.

Vision Summary

All of the capuchins, male and female, learned to distinguish colors across the color spectrum
from one another, to distinguish between two different shades of gray, and to distinguish
between gray and colors. They were able to do this 9/10 times after no more than 150 trials,
though one male required substantially more trials than the other male and female to achieve
this (put him on the short bus...)! They would not have been able to do this if they were
dichromats. In other words, since the capuchins were able to distinguish between different
colors across the color spectrum, they are NOT dichromats, they must have trichromatic color
vision. Also, since they could distinguish colors from gray cubes, this suggests they didn't have
protanopia, since protanopes struggle to distinguish some red shades from gray. It is possible
that the capuchins were using shade cues, rather than hue cues, to discriminate between
colors. So future studies are required. Also, the hues tested were somewhat 'far apart' from a
wavelength perspective, so future studies need to compare hues that are even closer together
on the color spectrum.

Overall, this study suggests that capuchins (including males) are likely trichromats, like humans. This finding is consistent with studies in howler monkeys.

LOCOMOTION

Capuchins cover territories in accord with their more refined diet, following the usual pattern, around three square miles and generally travel over one mile per day even though they are so tiny. At the same time, their territories can also vary greatly, to as small as .19 square miles. In contrast, the howlers, though four times as large as them, if you remember, have home ranges about one sixty of the average for capuchins. They also inhabit more marginal terrain that other primates typically ignore.

They move mostly quadrupedally, on all fours and while having prehensile tails, do not use them for locomotion, only about four percent of the time, way less than both howlers and spiders. To move from one tree to another, they either leap or bridge--and use their tails to stabilize them while descending, changing direction and to stabilize themselves when sitting.

Perhaps for this reason, they seem more adaptable than other primates and as such have wider range of habitats than other monkeys in the New World; in fact, they live in fifty percent of the habitats where monkeys are generally found (Fragasazy, Visalberghi & Fedigan p.46 & 29-30). (There is data suggesting that the home range size of the capuchin is between 3.1-3.5 square miles- Spironello 2001. However, this can vary significantly with a given habitat, some have a smaller home range, with the smallest being 0.19 square miles (wisc.edu website). They typically travel about 1.3 miles per day (Robinson & Janson 1986). There are data on their locomotion as well-cited on the wisc.edu website from original research articles.

Apparently, they principally move quadrupedally and do not use their prehensile tail much for movement (only used 3.6% of the time)- in contrast with the spider monkey and howler monkey. They use leaping most often to cross gaps, followed by bridging, but this was only for locomotion but used bridging less often in feeding and foraging (Youlatos 1999.)

Rather, they primarily use their tail during feeding and foraging, and to help them break when they're descending through the trees (61.5% of the time) (Youlatos 1999). Overall, they use their tail about 36% of the time, whereas howlers use their tale 58.3% of the time and spider monkeys 71.3% of the time (Youlatos 1999). They also use their tail to help control risky movements, changing direction, and to stabilize themselves while they're eating in a seated position. It is unusual for them to use suspensory postures and they normally move on branches and twigs (Fleagle & Mittermeier 1980 and Youlatos 1999).

CAPTURE

They mostly use their prehensile tail in the capture of plant foods, mostly fruits, able to hold their bodies, like the spiders, in all sorts of positions to gather their foods, with high degree of manual dexterity as compared to other primates.

Since mostly frugivorous and insectivorous do not deal with as many chemical defenses as other primates--but nonetheless, diversify their diet

hunt by using their incredible agility and speed

Source: "Arkive Closure". Wildscreen, 2020, <https://www.wildscreen.org/arkive-closure/>.

and hunt somewhat cooperatively--chasing rodents around
and focusing on their babies: waiting for parents to leave
and then grabbing the babies

and steal from prey from snakes: videos or rescues but they are stealing them to eat them themselves

Notes: For example, the South American capuchin monkey, *Cebus apella*, has a high degree of manual dexterity and very powerful jaws (They are considered extremely dexterous and manipulative compared to other nonhuman primates- Fragasazy, Visalberghi & Fedigan). These features aid capuchins in cracking open the hard palm nuts that form an important part of their diet, which also includes ripe fruits, insects, and small vertebrates.

There is a plant called the Guadua that grows in thick patches where capuchins live. Many of the Guadua plants have slits in their trunks, likely made by insects or birds. Apparently, frogs and/or grasshoppers spend time in these slits/holes, which often have some water in them (it's not clear whether or not the frogs/grasshoppers stay there most of the time, or stay part of the day and come out at night to feed). Many times, capuchins will put their ear to the slit and tap the surface of the trunk to listen for the presence of a frog. Sometimes they peep into the hole as well. If they hear or see a frog, then they capture it doing the following: 1) Capuchins capture frogs by gnawing the epidermis and cortex of the lower or upper end of a slit and then use their teeth to pull the epidermis and cortex downward or upward, depending on where they gnawed first. So, if they gnawed at the upper end of the slit, they would use their teeth to pull downward. 2) After doing this, they scrape the two parts out with their hands repeatedly, anywhere from 5-14 times. 3) Once they've done that, they reach into the enlarged slit to catch the frog. They always kill the frog immediately upon catching it, either by squeezing the neck or using their teeth. After killing the frog, they rub it against the bark of a branch, which could be to remove the stick tunic that covers the frog's skin, though it's unclear whether or not this is indeed the reason for rubbing the frog against the branch. The capuchins seem to like the thigh meat best, and start eating the legs and thighs first. They also eat the heads and guts, and the meat of the neck and hands. Interestingly, higher ranked capuchins don't steal frogs from lower-ranked capuchins. Some capuchins will drink the water out of the hole as well.

DIGESTION

As expected, capucins have the usual three chambers as part of their gut with the acidic stomach, small intestine and colon. Overall, given their smaller size and more refined diets, they have guts that are small compared to their overall size, with specifically smaller stomachs, longer intestines for the absorption of macronutrients and smaller colons and smaller caceums for limited fermentation. Of all the primates, their digestive system is most similar to our own in relative sizes and functioning--all of which raises on the most interesting questions in primate evolution. As noted before, smaller primates, with higher metabolisms, eat more refined diets and thus have smaller stomachs--as you see with the capuchins. But we humans broke that pattern completely and utterly: we are the second largest primate on earth--but yet we eat the most refined diet of any animal on earth and accordingly have guts the size of the tiny capuchin. In the pages ahead, we will describe how this happened--and in turn, drove the evolution of our spectacular encephalization.

Of all the primates studied, the Capuchin is most similar to humans in the function and relative size of its digestive system; its diet, too, is quite similar to our own as well (Fragaszy, Visalberghi, & Fedigan p.101).

With their more refined diet, their whole digestive system, relative to their bodies, is smaller and their small intestines are longer to allow for more absorption of sugar and fatty and amino acids and their colon is especially smaller because they need to get less of their energy from the ferments (Fragaszy, Visalberghi, & Fedigan p. 205). Note: Fragaszy, Visalberghi & Fedigan also specifically note that the capuchins' diet consists of high-quality, protein- and energy-rich foods, which helps explain their short caecum (similar to that of humans) because they eat highly digestible foods- as you mention in reference to their more refined diet (p.105).

Transit Time: 3 to 8 hours

Reference: Collinson, Paul, and Helen M. Macbeth. Food in zones of conflict : cross-disciplinary perspectives. New York: Berghahn Books, 2014. Print.

METABOLISM

For their brain, they consume plenty of fruit. For their muscles, they are likely one of the only primates to consume considerable amounts of dietary fats, in the form of long chain saturated monounsaturates and polyunsaturates from nuts, as well as from other animals. Additionally, they still nonetheless consume enormous amounts of fiber, with caecums in their colon--and thus produce considerable amounts of short chain fatty acids for muscle catabolism. For anabolism, they eat other animals, thus supplying complete and collagenous proteins, as well as a mixture of fatty acids, including longer chain polyunsaturates for their brain and nerves.

Because their diet is so refined, while also possessing all of the macronutrients in more optimum ratios to each other, capuchins ostensibly perform little nutrient synthesis, compared to

both the howler and spider, under normal circumstances. However, given their diet heavy in fruit, they synthesize lots of fructose into glucose.

Encephalization

According to the measurement of simple brain to mass (but not adjusted), capuchins are the most encephalized of all primates, except for humans. But if you recall, smaller primates and smaller animals in general have the largest brain to mass ratio--due to other factors unrelated necessarily to the performance of higher functions of the brain--so that measurement alone does not necessarily convey much about "higher" functions of the brain. However, their encephalization quotient is also high as they rank with the great apes; and they also have other indications of higher functions in the brain, including complex folds on the surface of their brain. They additionally spend more time developing their brains after birth as compared to most other primates. Finally, they score high in observed intelligence-.

Note: Capuchins have the largest brain-to-body ratio of any nonhuman primate, complex folds on the surface of their brains, and their encephalization quotient is among the highest of all non-human primates along with chimps, wooly monkeys, and talapoins. Finally, they have proportionally as much extra brain volume for their body size as apes. Finally, they are also unique in that they experience more postnatal development and brain growth than other primates- "the period during which the brain grows at its fastest rate, as it does just before birth, is extended longer after birth compared to other primate genera with proportionally smaller brains (Fragaszy, Visalberghi & Fedigan pp.92-94 & p.111).

Curiously enough, experiments have been done with the Capuchins where they were shown their reflection in a mirror: the females responded as you might expect; they gazed into their own eyes and smacked their lips and swayed back and forth as though trying to impress themselves with their beauty. On the other hand, the males, forced to the contemplation of their own singular existence, reacted with confusion and distress, squealing, curling on the floor and trying to escape from the test room--like any good, old male in an existential crisis (Waal 2005). You could even say they acted like Hamlet. However, the scientists did not necessarily conclude that the capuchins were aware that they were looking at themselves in the mirror. (Another interesting finding from this study was that the alpha males, who first competed to get into the chamber first, were reluctant to enter the chamber after they underwent the mirror condition. Both for males and females; however, the observers didn't see any behavior that indicated they recognized that it was themselves in the mirror. Also as an FYI, human children recognize themselves in a mirror around 20-24 months of age, though some do so even earlier. This is considered evidence of self-awareness.)

CULTURE

Capuchins congregate in groups that can vary from six to thirty, but usually averages around eighteen; when groups become larger than twenty, they tend to divide and spread into newer territories. Each group, too, has more females than males. They are typically smaller, in the teens or lower twenties. Izawa 1994- Says that, when the troop size approaches 20 individuals, the chances for fission increase, which thus limits overall group size-from wisc.edu website. According to Fragasazy et al. the average group size is 18 members, and the range is 12-27 p.75. Mothers care for their young for as long as three years, keeping them close to their bodies at the same time. However, unlike most other primates, male capuchins also take care of their young--even though that young may not necessarily be their own. They rescue infants from danger and carry them--and the alphas, who are usually the father of the babies, allows them and their mothers access to their food (Calle 1990). (There is some data to suggest that male capuchins perform important infant care behaviors. For example, *C. capucinus* rescue infants from danger and carry the infants, and *C. apella* alpha males allow immature infants and their mothers more access to nuts, an important food source, than they would others. Mothers are still the primary caregivers; however, capuchins are unique among primates for the high level of alloparental care, particularly with regard to how often group members other than the mother carry the infants (Fragasazy, Visalberghi & Fedigan pp. 214-215)).

It's not clear whether they are matri or patrilocal but it's likely the males that leave their group of origin because the females in the group are more bonded and also outnumber the males substantially. However, since there is substantial sexual dimorphism in the group, with the males weighing about eight pounds and the females about five pounds, the group is male dominated, by one one alpha-male who allows other males to stay in the group to help defend against other groups. While the alpha is primarily responsible for keeping the troupe safe, mostly from other capuchins, and organized, receives several advantages in return: first access to food and sex. However, alpha males are almost always under threat from the betas who attack him once they think they are strong enough. Interestingly, once groups fall apart, the females stay together because of their stronger bonds while all the males disperse. (Fragasazy, Visalberghi, & Fedigan p.216-218).

(Note: Fragasazy et al. state that the alpha male allows other males to remain in the group to help protect the troop against invasion by foreign males. They also state that female capuchins form long-term bonds that create close knit groups. Also, data from Izawa suggests that capuchins could be matrilineal because the matrilineal lines remain together after group fission, but as you mention above, it's still unclear whether or not they are indeed matrilineal (Izawa 1994).

At night they all sleep in the same, well-protected tree (Zhang 1995) and then break into smaller groups during the day to search for food, marking their territory with their urine, spending nearly all their time looking for food and breaking for naps in the afternoons. When finding food, they notify each other through various vocalizations--although scientists thus far have not studied those vocalizations in detail. Although as mentioned, alphas feed first, followed by the betas, some betas nonetheless use deception to access food: they make calls, signifying predators, so the alphas run away and then they come and eat the food.

However, tactical deception has been observed in capuchins as a way for low ranking monkeys to get a meal if there is not enough to go round. Subordinate individuals will give an alarm call so the dominant monkeys will make an escape, leaving food behind for those waiting (Wheeler, 2009).

Male capuchins protect their territory from other males from different groups, usually with vocalizations--and protect even more so when food is scarce. However, they also live peacefully with other primates that do not compete for their same food. Due to their smaller size, they tend to have many predators, especially predatory birds such as eagles as well as felines, coyotes, snakes and crocodiles. (Harpy eagles in particular (Rettig 1978; Terborgh 1983; van Schaik & van Noordwijk 1989- all from wisc.edu). Other predators include jaguars, pumas, jaguarundis, coyotes, tayras, snakes and crocodiles (Fragaszy et al. 2004)).

Other information about territoriality: The capuchins seem to be xenophobic (afraid of foreigners) rather than territorial, which is why they are aggressive to other troops whenever they meet them in their core territory. However, they also live in sympatry with other primate species. So, their xenophobia is towards other groups of capuchins, not towards other primate species.

Their xenophobia also depends on the given habitat and food availability, distribution and abundance. This obviously makes sense, as we would expect them to be more aggressive towards others in a situation where food supplies are more limited (Fragaszy, Visalberghi & Fedigan pp.37-39).

Adult males are also more aggressive towards non-group males and, as you previously mentioned, they use vocalization to indicate when they see non-group males nearby. They're described as being 'belligerent' towards non-group males, and their overall vigilance is considered a potential reason for why there are few successful predatory attacks on capuchins

Also, the higher-ranking females receive more grooming and perform more grooming than lower ranking females. High ranking females are also more likely to be groomed by or to groom males than lower ranking females (Linn et al. 1995; Parr et al. 1997.).

DIVISION OF LABOR

In their division of labor based upon sex, capuchins are more complex. As we have seen, the howlers and spiders differ in their labor in these ways: the females raise the young and then either males or females dominate the rest of the group, dependent upon sexuallocality as well as sexual dimorphism.

Capuchins clearly have all these divisions, but then more, due to their greater encephalization as well as sexual dimorphism: as already seen, males show some interests in offspring, whether, perhaps, that offspring is their own or others. Females forage more and spend more time in palm trees, perhaps to collect nuts; and when hunting, only hunt small prey like roaches, beetles, grubs and small frogs. Males, however, spend more total time hunting while pursuing larger prey closer to the ground; they also protect their territory from foreign capuchins--all due in part to their greater sexual dimorphism, as their larger size makes them more suitable for these chores.

Females, in contrast, typically forage a few meters above the ground and are more likely to stay in an area they know produces small animals for food-like roaches, beetles, grubs and small frogs. Females also spend a ton of time in palm trees, whereas males rarely do. Researchers suggest that these sex differences in foraging and diet are likely best explained by the sexual dimorphism in capuchins (Fragaszy, Visalberghi & Fedigan pp.48-49).

SOCIAL BONDING

Capuchins groom down on the hierarchy, with alphas grooming the betas, and the betas grooming those lower than them: and the lowest then grooming those of equal standing or up the line. Alpha females both receive and give more grooming than beta females--while also giving and receiving more grooming from males.

As part of bonding, capuchins frequently invent various forms of bonding unique to their specific group that are somewhat odd, such as showing their fingers into each other's eyes, sniffing hands, sucking on tails, fingers and ears--and bite tufts of hair and then pass it around so that other members can chew upon that hair. Females also throw rock at males, and then run away from them, to show their affection--not too dissimilar from some forms of human female behavior.

Susan Perry of UCLA has been studying white-faced capuchins in the jungles of Costa Rica for 25 years. It's grueling work, she says; "I'm always wet, chewed on, or stung." But her hard work has paid off. She and her team have observed some amazing monkey business.

Capuchins often invent new behaviors—Dr. Perry calls them traditions—that spread through the group. One of them is, well, shoving your finger in someone else's eye. Other traditions include sniffing each other's hands and sucking on tails, fingers, and ears. Capuchins even bite a tuft of hair from another's face and pass it around with their mouths. This might all be about reinforcing social bonds [PDF]. Just don't try it with your coworkers.

Source: "11 Mischievous Facts About Capuchin Monkeys." *Mental Floss*, 5 Sept. 2016, mentalfloss.com/article/85646/11-mischievous-facts-about-capuchin-monkeys Professor.

Females throw rocks at males to initiate sex and then run--seem kind of shy

Source: "Love Hurts - If You're a Male Capuchin Monkey." *Yahoo! News*, Yahoo!, 17 Jan. 2014, news.yahoo.com/video/love-hurts-39-male-capuchin-141247491.html.

COMMUNICATION

Tools

While howlers do not use tools at all, and spiders only in limited ways such as throwing sticks, capucins use them in more developed ways. They bomb predators with debris, rocks and sticks. But they also use sticks to extend their reach

(Fragaszy, Visalberghi & Fedigan p.61). They also mob predators and bomb them with dead boughs and other debris-scary!) As one of the most intelligent monkeys they are also known for their tool use, using sticks to extend their reach and rocks to break into hard shelled nuts (Ottoni & Izar, 2008).

They gather nuts from one area and stones from miles away then use those stones, which sometimes weigh as much as themselves, to smash the nuts open (Mannu & Ottoni p.242), with this practice not being instinctive but learned--and thus an example of cultural evolution discussed in prior sections. They smash fruits against trees and with sticks to crack their shell to get to the pith on the inside (Fragasazi, Visalberghi, & Fedigan p. 47-see note above about their 'combinatorial behavior'). They also smear millipedes across their fur which acts as repellent against mosquitoes (Fragasazi, Visalberghi, & Fedigan pp.102-104). And they have even shown some tendency to use money as a resource in exchange for goods. They also rub themselves with various insect repellants, including ants, millipedes and urine.

Monkey Medicine: In the wild, capuchins will rub themselves with a variety of substances which have a strong smell; this behaviour is called 'fur rubbing'. They will crush acidic ants or millipedes and rub them all over their bodies along with urine to protect themselves against biting insects, such as mosquitoes and ticks. Rubbing urine on themselves is also thought to control temperature and is even good for general hygiene (Paukner & Suomi, 2008).

(Note: wisc.edu website specifically states that *Cebus apella* cannot open nuts and other inaccessible fruits with its teeth or jaws; rather, they smash them on tree surfaces or use 'baton-like' branch pieces to open the fruit. Apparently, their approach to breaking open food items is known as 'combinatorial' because it combines an object (like a nut) with a substrate (like a tree) (Fragasazy, Visalberghi, & Fedigan.))

Sources:

"Capuchin Fact Sheet." *World Animal Foundation*, 2020, www.worldanimalfoundation.net/f/Capuchin.pdf.

"Primate Info Net." *WNPRC*, primate.wisc.edu/primate-info-net/.

SUMMARY

More total nutrition (refined diets)
equals
sensing (about the same)
locomotion (enhanced, perhaps, greater territories)
digestion (reduced)
metabolism (enhanced)
storage (the same)
synthesis (reduced)
encephalization (enhanced)
leading to much greater intelligence, culture, communication and tools,
including more human like behaviors:
cultural evolution
tools
communication
rigid hierarchies
group hunting
and shared child rearing.....

All of which helps them find their more refined diet, even amidst competition from many other monkeys, including spiders and howlers

Given their more refined diets, brain to body ratio and many other conditions suitable to encephalization that surpass that, say, of chimps, orangutans and bonobos, we might assume that capuchines are perhaps the most encephalized of all the primates; and they just about are. But not quite: they are limited by two factors: the shortness of their lifespans, fifteen to twenty five years, caused by their smaller bodies that lead to higher metabolisms as well as greater potential for predation.

They are also limited by greater amounts of grey area, relative to their overall size, being used for basic functions, such as voluntary and involuntary muscle control.

As applied to humans:

--capuchins separated from us because new world monkeys, by millions of years, but nonetheless followed many of the same pathways of evolution of ourselves--that is, towards more refined diets including all three classes of macronutrients and all macronutrients within those classes, smaller guts, greater locomotion, reduced digestion, reduced synthesis--which in turn, allowed them the extra nutrition needed to support their larger brains. In some senses, they are the humans of the new world and express the most human of traits: more organized societies, greater care of the young, greater intelligence, tool use and more complex communication--as well as cultural evolution--that is, learned behaviors handed down from one generation to another.

Perhaps they could have eventually evolved into the new world equivalent of the human, perhaps even smarter, sexier than ourselves, except they were limited by their smaller bodies

and its concomitant, biological attributes: shorter lifespans--thereby reducing the biology and expression of "encephalization."

and perhaps, if they were larger, with longer life, they may have evolved into another but different form of human.