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How Old Are Your Arteries?

For most Americans over the age of 60, atherosclerosis is a common fact of life, viewed as an inevitable consequence of growing old.

Atherosclerosis is a disease in which plaque, composed of fat, cholesterol, calcium and other substances, builds up inside the arteries. Over time, the plaque hardens and can impede blood flow. When the buildup occurs, plaque can rupture and blood clots (thromboses) form in a coronary artery, leading to a heart attack — or worse.

But as UC Santa Barbara anthropologist Michael Gurven and his team have found, an indigenous population in the Amazon region of Bolivia proves atherosclerosis to be the exception rather than the rule — and a rare exception at that. Among the Tsimane, coronary artery disease is practically nonexistent.

Gurven's study, which appears in The Lancet, was conducted with the Tsimane Health and Life History Project. Gurven co-directs the project with Hillard Kaplan of the University of New Mexico; Ben Trumble, formerly a postdoctoral researcher at UC Santa Barbara and now an assistant professor at the University of Arizona; and Jonathan Stieglitz of the Institute for Advanced Study in Toulouse, France.

Almost No Risk of Atherosclerosis

"The Tsimane have the lowest reported prevalence of atherosclerosis than any population recorded to date," said Gurven, professor of anthropology and chair of the campus's Integrative Anthropological Sciences Unit. In the study, the researchers measured the participants' risk of heart disease using non-invasive

chest CT scans of 705 adults over age 40. They measured the extent of coronary atherosclerosis by computing the coronary artery calcification (CAC) score, which has been shown to be a reliable predictor of heart attacks and other cardiovascular events.

Based on the CAC scores, 85 percent had no risk of heart disease, 13 percent had low risk and only 3 percent had moderate or high risk. Consistent with this low overall risk of coronary atherosclerosis, the researchers report that heart rate, blood pressure, cholesterol and blood glucose also were low.

And these findings extend into old age. Sixty-five percent of 80-year-old Tsimane had almost no risk and only 8 percent had moderate risk. By comparison, the United States-based Multi-Ethnic Study of Atherosclerosis, which included 6,814 people ages 45 to 84, found that only 14 percent of Americans had no risk of heart disease and a whopping 50 percent had a moderate or high risk — a five-fold higher prevalence than in the Tsimane population. Tsimane men and women also showed similar risk, whereas CAC scores in the U.S. and elsewhere are two to four times higher in men than women. Based on the comparison with the U.S. study, an 80-year-old Tsimane has the same arterial age as an American in his or her mid-50s.

But Why?

The million-dollar question, according to Gurven, is, why?

“We already know several risk factors commonly lead to heart disease,” he said. “The Tsimane have minimal smoking, and they have no trans fat and little saturated fat in their diets. They eat a lot of carbs, but they aren’t processed or refined. They’re mostly fiber-rich crops from their fields. They’re also active physically — not vigorously running marathons, but they are rarely sedentary. In combination, these factors put the Tsimane at lower levels of heart disease risk.”

So isn’t this just proof that if Americans lived a more Paleo-friendly lifestyle atherosclerosis would be the exception for us as well?

“Two aspects of Tsimane health are difficult to reconcile with their minimal atherosclerosis,” said Gurven. “Their ‘good cholesterol’ — or HDL — is really low. Low enough to be classified as high-risk for most Tsimane.”

The second point has to do with inflammation, which, according to Gurven, has been implicated in all stages of atherosclerosis. “Tsimane have elevated levels of inflammation, no matter which biomarker of inflammation we examine,” he said. “Chronically elevated levels of low-grade inflammation have been consistently associated with atherosclerosis and its clinical manifestations in most studies.”

That the inflammation experienced by Tsimane is a chronic condition is demonstrated by the fact that the same people have been sampled multiple times throughout their longitudinal Tsimane Health and Life History study. As explained by co-author Benjamin Trumble, “Tsimane do suffer from acute infections, but inflammation is still relatively high even among those without active infections, and levels are consistent over time.”

The Role of Parasites

So why might elevated inflammation not place the Tsimane at higher risk for coronary artery disease? That leads to another area of Gurven’s research — the role of intestinal helminths (worms) in heart disease, which he and colleagues assessed in a review paper published in the journal Evolution, Medicine & Public Health. In that study, Gurven and his team found that among the Tsimane, people with worms have lower cholesterol and higher energy expenditures. “If you’re burning more calories each day, it’s easier to keep your weight down,” he said. “But those are conventional risk factors.”

According to Gurven, worms may also help modulate and regulate immune function. And that, he noted is where opportunities for building new understanding can arise. “There is some novelty here,” he said. “In the poly-infected Tsimane world, most have helminthes, distinct gut microbiota and other infections. The initiation and progression of atherosclerosis, from lesion and atheroma development to plaque rupture, all involve inflammatory immune responses.”

The interesting possibility, Gurven added, is that worms — perhaps in combination with other types of infections — might promote anti-inflammatory activity that protects against inflammation. Or they might help regulate immune function in ways that make inflammation less destructive to Tsimane arteries than it is for us.

Different Kinds of Inflammation

Among Tsimane, the source of elevated inflammation is different than the chronic low-grade inflammation that affects Americans. “Our inflammation isn’t coming from infection, for the most part,” explained Angela Garcia, a doctoral student in anthropology and co-author of the paper. “It’s ‘sterile’ – that is, it comes from smoking and obesity. But that’s not what we’re seeing with the Tsimane.”

Either way you look at it, parasites are part of the story of Tsimane lives, and so should be considered in combination with more conventional risk factors like diet, smoking and activity, Gurven added. Figuring out the relative contributions of the risk factors in isolation, and in combination, is the complicated part. “It’s hard to know whether there are threshold levels,” he said. “Some experts believe, for example, that if your LDL cholesterol is so low [e.g. <70 mg/dL], there’s nothing to oxidize and build up in the arteries, and so it might not matter how sedentary you are. But without taking statins, there is probably no way a sedentary American eating a typical diet will ever get their LDL that low.”

Recommendations concerning “healthy” cholesterol levels and the point at which statins become an appropriate course of action have changed, Gurven noted. “But even the levels typically recommended as being desirable [<100 mg/dL] are still a lot higher than those observed among Tsimane and other subsistence populations.

Unpacking the Risk Factors

“At the beginning of our longitudinal study, the average Tsimane LDL was 72 mg/dL,” Gurven continued, “but now it’s higher — 91 mg/dL — as Tsimane lifestyles have begun to change. Disentangling how the mix of risk factors and exposures now shifting over the life course will impact heart disease risk in the coming years is a critical next step.”

Other research contributors and co-authors of the paper and include the Horus Project led by cardiologist Gregory Thompson, M.D.

About UC Santa Barbara

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