factors leading to metabolic syndrome in this population. These assumptions, however, need verification through further studies. Our study suffers from a limitation that the results are based on a survey done 7 years ago.

Stroke is relatively common in this rural sample of Bangladesh. Severe residual disabilities are also very common. Stroke prevention in this population should address highly prevalent major risk factors, such as tobacco and salt consumption, and early detection and treatment of hypertension and diabetes. Early rehabilitation should also be integral part of the stroke control program to prevent disability.

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REFERENCES

1. Zaman MM. Non-communicable disease trends. Paper presented at: the National Public Health Conference; January 2013; Dhaka, Bangladesh. Available at: http://www.iedcr.org/pdf/files/NPHC%20WEB/UPLOAD-4/Dr.Zaman.pdf. Accessed: April 18, 2014.
2. Zaman M, Choudhury SR, Ahmed J, et al. Plasma lipids in a rural population of Bangladesh. Eur J Cardiovasc Prev Rehabil 2006;13:444–8.
3. Mohammad QD, Habib M, Hoque A, et al. Prevalence of stroke above forty years. Mymensingh Med J 2011;20:640–4.
4. Prashad K, Vibha D, Meenakshi. Cerebrovascular diseases in South Asia—part I: a burning problem. JRSM Cardiovasc Dis 2012;1(7). http://dx.doi.org/10.1258/cvd.2012.012025.
5. World Health Organization. Report of the Expert Meeting on Population Sodium Reduction Strategies for Prevention and Control of Noncommunicable Diseases in the South-East Asia Region, 11—13 December 2012. New Delhi, India: WHO, 2013. Available at: http://www.searo.who.int/entity/noncommunicable_diseases/documents/sea_ncd_88.pdf. Accessed: April 17, 2014.

Low 25-Hydroxyvitamin D Concentrations May Explain Atherosclerosis in Ancient and Modern Humans

A recent issue of *Global Heart* contained a set of articles on the prevalence of atherosclerosis in ancient and modern people. An article by Thomas et al. [1] suggested that chronic inflammation might be an important contributing factor. It noted that in ancient times, inflammation could be due to microbes and parasites, whereas in modern times, it could be due to chronic systemic inflammatory diseases.

I would like to propose that low 25-hydroxyvitamin D (25(OH)D) concentrations may explain the high prevalence of atherosclerosis in mummies as well as in modern people in countries such as Egypt, and that the mummies as well as modern people likely exhibit additional features that could be used to evaluate this hypothesis. First, low 25(OH)D concentrations are a risk factor for both atherosclerosis and osteoporosis [2]. The classic role of vitamin D is to facilitate absorption of calcium from the intestines and regulate calcium metabolism. When 25(OH)D concentrations are too low, calcium stores are reduced in bones and increased in soft tissues, including the arteries. Evidently osteoporosis was common in Egyptian mummies [3]. It is also likely that other diseases linked to low 25(OH)D concentrations such as dental caries, periodontal disease, rheumatoid arthritis, and tuberculosis could be found in a number of mummies or modern people with atherosclerosis. The evidence for the role of vitamin D in reducing risk of many types of disease is given in a recent review by Pludowski et al. [4]. Although much of the evidence comes from observational studies, similar results are often found in different populations, and the mechanisms whereby vitamin D reduces the risk of many types of disease are well known. Vitamin D has been found to reduce biomarkers of inflammation in a number of randomized controlled trials, especially when baseline 25(OH)D concentrations were below 50 nmol/l [5].

Why might ancient and modern Egyptians have low 25(OH)D concentrations? For modern Egyptians, it is probably that they wear clothing that covers much of the body surface area and do not spend much time in the sun during the summer when it is hot. In some of the Middle Eastern countries, 25(OH)D concentrations are highest in spring rather than summer due to avoiding the sun during the oppressive heat in summer. Those Egyptians who were mummified were mostly from the highest social levels. As such, they would not be working in the fields but would rather be found indoors most of the time. For ancient and modern Egyptians, diet is also a cause of low 25(OH)D concentrations. Ancient Egyptians likely got much of their food from wheat and other grains. Modern Egyptians derive >10% of their energy from animal products according to the Food and Agriculture Organization of the United Nations. A study in the United Kingdom found that vegans have 25(OH)D concentrations 20 nmol/l lower than meat eaters do independent of season [6].

Thus, the low 25(OH)D concentration hypothesis could be evaluated by looking at the computed tomography scans of ancient mummies for evidence of any diseases or pathologies related to low 25(OH)D concentrations and correlating the findings with the extent of vascular calcification. Confirming this hypothesis could have important implications for modern humans.

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REFERENCES

1. Thomas GS, Wann LS, Allam AH, et al. Why did ancient people have atherosclerosis? Glob Heart 2014;9:229–37.
2. Stojanovic OI, Lazovic M, Lazovic M, Vuceljic M. Association between atherosclerosis and osteoporosis, the role of vitamin D. Arch Med Sci 2011;7:179–88.
3. Stride PJ, Patel N, Kingston D. The history of osteoporosis: why do Egyptian mummies have porotic bones? J R Coll Physicians Edinb 2013; 43:254–61.
4. Pludowski P, Holick MF, Pilz S, et al. Vitamin D effects on musculoskeletal health, immunity, autoimmunity, cardiovascular disease, cancer, fertility, pregnancy, dementia and mortality: a review of recent evidence. Autoimmun Rev 2013;12:976–89.
5. Cannell JJ, Grant WB, Holick MF. Vitamin D and inflammation. Dermatoendocrinol 2015. In press.
6. Crowe FL, Steur M, Allen NE, Appleby PN, Travis RC, Key TJ. Plasma concentrations of 25-hydroxyvitamin D in meat eaters, fish eaters, vegetarians and vegans: results from the EPIC-Oxford study. Public Health Nutr 2011;14:340–6.

The Authors' Reply

We thank Dr. Grant for his interest in our contribution [1]. While vitamin D deficiency has been proposed as a cause of atherosclerosis, definitive data are lacking [2]. Regardless, we suggest that it is unlikely that the Egyptians or the several other populations we studied were vitamin D deficient. Grant posits that Egyptians who were mummified may have worn clothing over most of their body and lived predominately indoors. However, a robust supply of murals and statues created during the millennia in which mummification occurred suggest that clothing covered relatively little of the body. Archaeologic findings of the housing of ancient Egyptians commonly demonstrated generous courtyards and outdoor space. This and their use of walking as the predominant form of transportation suggest that much time was spent out of doors. While modern-day Egyptians wear more clothing and likely spend less time outdoors, Mahmoud and Ali [3] found vitamin D deficiency to be very uncommon in a cohort of healthy modern-day Egyptians.

Another population in which we found that atherosclerosis was common were ancient Peruvians [4]. Iconography of the time (900 BCE to 1500 CE) also demonstrated the use of only light clothing. Modern-day Peruvians also experience only infrequent vitamin D deficiency, which is consistent with the country's tropical location. Similarly, vitamin D deficiency would be unexpected among the ancestral Puebloans who also experienced atherosclerosis while living with little protection from the sun on the Colorado Plateau 1500 BCE to 1500 CE years ago.

As Dr. Grant suggests, we too continue to search for causes of the prevalence of atherosclerosis in ancient times.

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REFERENCES

1. Thomas GS, Wann LS, Allam AH, et al. Why did ancient people have atherosclerosis? From autopsies to computed tomography to potential causes. Global Heart 2014;9:229–37.
2. Shapses SA, Manson JE. Vitamin D and prevention of cardiovascular disease and diabetes: why the evidence falls short. JAMA 2011;305: 2565–6.
3. Thompson RC, Allam AH, Lombardi GP, et al. Atherosclerosis across 4000 years of human history: the Horus study of four ancient populations. Lancet 2013;381:1211–22.
4. Mahmoud AA, Ali AHK. Vitamin D receptor gene polymorphism and 25 hydroxy vitamin D levels in Egyptian patients with pulmonary tuberculosis. Egypt J Chest Dis Tuberc 2014;63:651–5.