

No dose–no poison

Paul Froom

Published online: 4 February 2012
© The Japanese Society for Hygiene 2012

Environmental scientists attempt to find a causal connection between pollutants and disease, especially cancer. For most environmental exposures, however, the dose is too low to detect an effect. Only exposure to high doses of chemical substances can be shown to increase the risk for cancer, as is evident by examining the list of definite human carcinogens (IARC group 1). These substances are characterized by a history of very high human exposures, mostly in the workplace (around 50%), but also from chemotherapy/drugs (around 20%) or infections (around 15%). Alcoholism and smoking are two additional examples of cancer being caused by high doses of chemicals. In fact, animal studies have demonstrated that at high enough doses, nearly 50% of tested substances will increase the risk for cancer, including approved drugs and natural pesticides for vegetables [1]. Therefore, it is probable that many more substances would be defined as definite carcinogens if humans were to be exposed to higher doses. Coffee, for example, is an animal carcinogen, and if a large human population drank enough coffee, perhaps 30 cups per day, then it could likely be demonstrated that coffee would increase the risk of bladder cancer in humans as well as animals.

Attempts to demonstrate that low environmental exposures to known carcinogens are increasing the risk for cancer in the general population are problematic because even real small increased risks are unstable in epidemiological ecological studies. Such studies are generally

confounded by more important risk factors and occasionally, such as in the case of an arsenic study, report protective effects [2] that are equally unsubstantiated.

It would seem more prudent to invest financial resources in the primary prevention of true risk factors for cancer, such as obesity, lack of exercise, a diet poor in vegetables/fruits and fish and rich in red meats and smoking, rather than in futile attempts to demonstrate small increases in the risks of cancer from exposure to environmental chemical pollutants. Any association between significant environmental exposures and high doses will be obvious, and the effort to identify subtle influences of the environment on the risk of developing cancer are futile, unnecessary and a waste of valuable resources. Even studies showing a positive association will be suspect because of the low increase in risks observed, which even if due to the exposure rather than confounders will be difficult—if not impossible—to find consistently. Similar advice in the past [1] has generally been ignored.

References

1. Ames BN, Gold LS. The causes and prevention of cancer: gaining perspective. *Environ Health Perspect.* 1997;105[Suppl 4]:865–73.
2. Bastrup R, Sorensen M, Balstrom T, Frederiksen K, Larsen CL, Tyonneland A, et al. Arsenic in drinking-water and risk for cancer in Denmark. *Environ Health Perspect.* 2008;116:231–7.

P. Froom (✉)
Epidemiology and Preventive Medicine,
Sackler School of Medicine,
Tel Aviv University, Tel Aviv, Israel
e-mail: froomp@gmail.com