Copper, Manganese, Zinc, and Cadmium in Tissues from New Zealanders

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Abstract

Concentrations of Cu, Mn, Zn, and Cd were measured in 13 different tissues collected at autopsy from 55 New Zealanders, aged 1 week to 74 years. All analyses were done by atomic absorption spectrophotometry. In general, concentrations of Mn and Zn were similar to those reported elsewhere, but Cu levels were slightly lower. Concentrations of Cd were low in all tissues except kidney. Median values were in accordance with those reported for other "unexposed" populations. A significant trend of increasing concentrations with age was found for Cu in cartilage, Zn in kidney cortex and medulla, and Cd in all tissues except bone, fat, and hair. Declines with age were observed for Cu in liver, aorta, and skeletal muscle, for Mn in heart, aorta, and cartilage and for Zn in lung and muscle. There were no obvious relationships between tissue trace element levels and cause of death assigned according to three groups: sudden accidental, cardiovascular, or respiratory.

Index Entries: Trace elements, levels in human tissues; copper, in human tissues; manganese, in human tissues; zinc, in human tissues; cadmium, in human tissues; atomic absorption spectrophotometry, of trace elements in human tissues; human tissues, trace elements in; New Zealand, trace elements in human tissues in.

Introduction

Investigations of the role of trace elements in health and disease are inhibited to a large extent by the lack of suitable indices of status in the living organism. How-
ever, analysis of tissues from healthy persons dying suddenly, (i.e., those without a disease or cause of death that may be expected significantly to alter trace element metabolism), may allow some assessment of the nutritional status of such elements on a population basis. Iron status, for example, can be readily assessed in the living population and the incidence of anemia thus determined agrees well with the incidence determined from analysis of storage Fe in the liver of accident victims (1). Such a correlation is not possible at present for most other elements; nonetheless, autopsy data is being used with increasing frequency to examine the metabolism of trace elements that have nutritional importance (2, 3) or that are of environmental concern (4, 5).

New Zealand has an interesting history with respect to trace elements. Deficiencies of a number of essential minerals, including copper and selenium, have caused major problems in agriculture (6). The Se status of the human population is low compared with other countries (7). Less is known of the status of other trace elements of interest in human health and nutrition. The study reported here examined copper, manganese, zinc, and cadmium in various tissues obtained at autopsy from a group of New Zealanders. It was devised to provide information on the expected normal range of values for these elements in the New Zealand population. Such information may be used to examine differences within the population arising from nutritional, environmental, or disease factors, and to identify differences in nutritional status by comparison with values for populations in other countries.

Materials and Methods

Tissue samples were obtained at autopsy from a total of 55 subjects who had died in Dunedin Hospital or were subject to a Coroner’s Inquiry. At time of death, all except for neonates (obtained from Auckland) had been living in or near Dunedin. (Dunedin is a city of 113,000, situated in the south of the South Island of New Zealand. It has little heavy industry and the bulk of the food supply is produced locally.) No cancer-related deaths were included and none of the subjects was known to have had an occupational exposure to heavy metals. The age range varied from 1 week to 74 years and the age and sex distributions of subjects are given in Table 1. Table 1 also gives the age distribution of the adult subjects grouped according to the principal cause of death (COD). The groups included:

A. Sudden accidental death: 16 subjects, mean age 33 years.
B. Cardiovascular: 22 subjects, 57 years (includes heart failure, myocardial infarction, aneurysm and cerebral accident).
C. Respiratory: 6 subjects, 58 years (includes pneumonia and chronic obstructive respiratory disease).

Material was collected by the pathologist during the normal course of the postmortem, which was performed within 24 h of death. The pathologist wore disposable rubber gloves and used stainless steel scissors, forceps, and scalpel blades. Except for avoiding rinsing tissues in tap water, no other precautions could readily