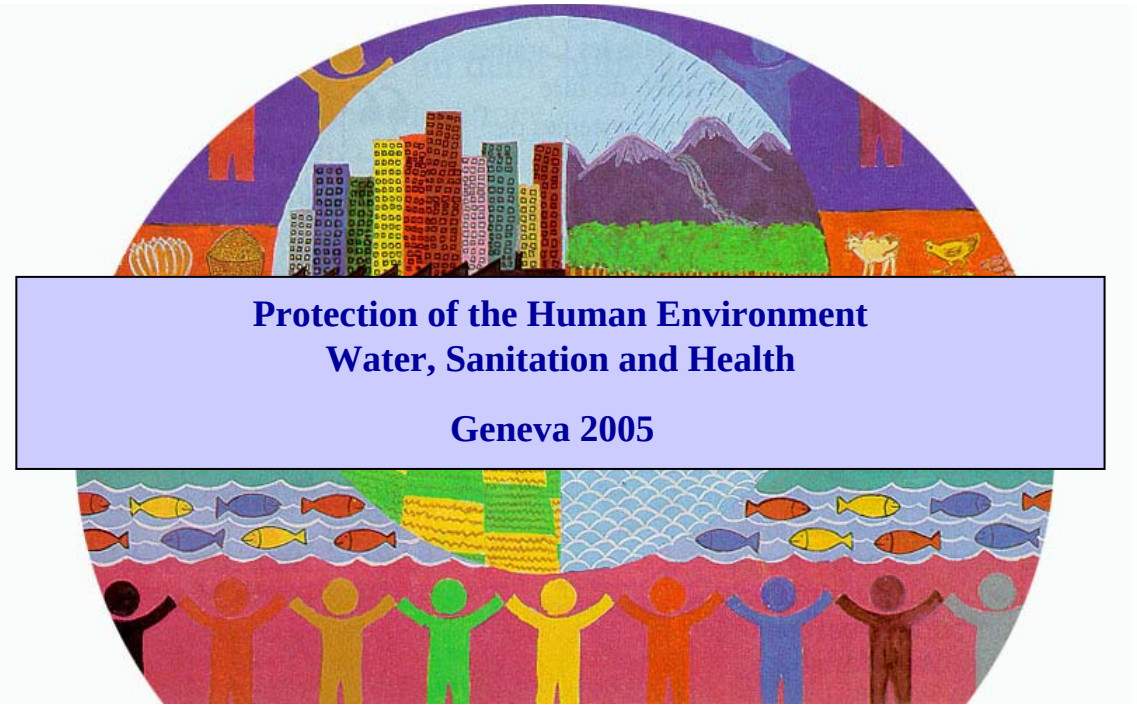
World Health Organization

Nutrients in Drinking Water



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PREFACE

The World Health Organization assembled a diverse group of nutrition, medical and scientific experts in Rome in November 2003, at the WHO European Centre for Environment and Health, to address a number of questions relating to the nutrient composition of drinking water and the possibility that drinking water could in some circumstances contribute to total dietary nutrition. The original impetus of the meeting was as a contribution to development of Guidance on health and environmental aspects of desalination that was initiated by the WHO Eastern Mediterranean Regional Office, and intended ultimately to contribute to the development of the 4th edition of the WHO Guidelines for Drinking Water Quality (GDWQ). There were 18 invited experts from Canada, Chile, Czech Republic, Germany, Ireland, Italy, Moldova, Singapore, Sweden, United Kingdom and United States of America. Additional papers were provided by invitees who could not attend. The task was to examine the potential health consequences of long-term consumption of water that had been 'manufactured' or 'modified' to add or delete minerals. In particular, the meeting originated from the question of the consequences of the long-term consumption of waters that had been produced from demineralization processes like desalination of seawater and brackish water as well as possibly some membrane treated fresh waters, and their optimal reconstitution from the health perspective.

The scope of the review included these questions:

- What is the potential contribution of drinking water to human nutrition?
- What is the typical daily consumption of drinking water for individuals, considering climate, exercise, age and other factors?
- Which substances are found in drinking water that can contribute significantly to health and well-being?
- Under what conditions can drinking water become a significant contribution to the total dietary intake of certain beneficial substances?
- What conclusions can be drawn about the relationship between calcium, magnesium and other trace elements in water and mortality from certain types of cardiovascular disease?
- For which substances, if any, can a case be made from the public health perspective for supplementation of the mineral content of treated drinking water derived from demineralized water?
- What is the role of fluoride in such water with respect to dental benefits, dental fluorosis and skeletal fluorosis?

Drinking water is usually subjected to one or more treatment processes aimed at improving its safety and/or its aesthetic quality. Fresh waters can be treated by one or more processes such as coagulation, sedimentation, granular media filtration, adsorption, ion exchange, membrane filtration, slow sand filtration, and disinfection, and sometimes softening. The conversion of high salinity waters like seawater and brackish waters to potable water by desalination is being increasingly practiced in water-short areas as demand for water increases, and the technology becomes more economically attractive. More than 6 billion gallons of desalinated water are produced daily throughout the world. Remineralization of desalinated water is necessary to control its aggressiveness to piped distribution systems. Since remineralization of desalinated water is required, a logical question is: are there methodologies that could bring with them additional benefits such as by reconstituting certain important minerals?

Natural waters are of widely diverse compositions depending upon their geologic and geographical origin and the treatments that they have undergone. For example, rain waters and some rain water-dominated surface waters have very low salinity and mineralization, whereas some ground waters can become highly, and sometimes excessively mineralized. If

remineralization of processed water is desirable for health reasons, another logical question is whether some natural waters would also be more healthful if they also contained appropriate amounts of beneficial minerals.

The meeting concluded that only a few minerals in natural waters had sufficient concentrations and distribution to expect that their consumption in drinking water might sometimes be a significant supplement to dietary intake in some populations. Magnesium and possibly calcium were the two most likely significant contributors to dietary intake in populations that consumed 'hard' water. Information was provided on about 80 of many epidemiology studies of varying quality over the last 50 years that had addressed the issue of hard water consumption and possibly reduced incidence of ischemic cardiovascular disease in populations. Although the studies were mostly ecological and of varied quality, the meeting concluded that on balance they indicated that the hard water /CVD beneficial hypothesis was probably valid, and that magnesium was the more likely positive contributor to the benefits. This conclusion was supported by several case control studies as well as clinical studies. There were other possible health benefits that had been reported, but there was not sufficient data in hand to address those matters. The meeting also concluded that before making a Guidance determination, WHO should undertake a more detailed assessment of that hypothesis to include an examination of its biological plausibility. A follow-up symposium and meeting is being planned in 2006 to address that recommendation.

In respect to fluoride, the meeting concluded that optimal levels of fluoride intake from water are known to contribute beneficially to dental health. It also noted that higher intake levels can contribute to dental fluorosis, and much higher levels cause skeletal fluorosis. It concluded that a decision to remineralize demineralized water with fluoride would depend upon: the concentration of fluoride in the existing water supply, the volume of water consumed, the prevalence of risk factors for dental caries, oral hygiene practices and the level of public dental health awareness in the community, and the presence of alternative vehicles for dental care and fluoride available to the population.

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