DIETARY EVALUATION OF TOXIC ELEMENTS THROUGH INTEGRATED DIET

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(Received December 13, 1991)

Several potentially toxic trace elements, namely, Hg, Pb, Cd, As, Sb, Br and Se have been measured by INAA in combination with AAS techniques in the integrated diet representative of the inhabitants of Gujranwala, a highly industrialized city of Pakistan. The dietary intake values for these elements have been estimated from the prevailing concentration level in the summer and winter season diets, which reveals that present intake data are well within the reported WHO values and can be considered to be safe. Possible sources of food contamination by the toxic elements and their adverse impacts on human health are briefly discussed.

Introduction

Rapid establishment of diversified industries to provide various amenities of life are responsible for global indiscriminate pollution of biosphere and subsequent contamination of human food chain resources with harmful chemicals and toxic heavy metals. Being biologically undegradable and incompatible even at trace level with normal biochemical functions in human body, exposure of vital organs such as brain, nervous system, kidneys, liver, intestinal tract, lungs, etc., to these metals are likely to induce physiological disorder in a number of ways.1,3 In order to get minimal adverse impact, it is important to measure and continuously monitor their levels in various environmental samples with particular emphasis on various food items. Food due to the introduction of mechanized farming, ever increasing use of chemicals, sprays, preservatives, food processing, canning etc., are likely to be further contaminated with the trace toxic elements. Gravity of this situation has attracted attention of national institutes in many countries and international organizations towards adopting measures for their effective control. Prior to any attempt on their control, it is necessary to define the safe levels in individual as well as integrated human foods and to estimate the dietary intake values. These objectives can be achieved by analyzing the trace elements in individual food items or determining them in an integrated diet prepared from basic food items. This approach though time consuming, is helpful in identifying the extent of toxic elemental
contamination in individual food samples. However, later approach is suitable for obtaining necessary trace element data in the shortest possible time. Consequently, a study was undertaken to prepare integrated diets of various cities of Pakistan and to determine the dietary status of toxic trace elements. Previously, an integrated diet representative of a non-industrialized city, Islamabad was reported. Similar IAEA co-sponsored studies were undertaken to determine the levels of nutrients and other trace elements in the total diets of USA, Canada, Sweden, Spain, Italy, Turkey, Iran, China, Thailand and Sudan. This work describes the concentration level of such elements in the integrated diet of a highly industrialized city of Pakistan, Gujranwala.

**Experimental**

**Preparation of the integrated diet**

A comprehensive survey was conducted to assess general dietary pattern of the residents of Gujranwala in summer and winter seasons which revealed that the basic food items of daily use comprise mainly rice, wheat, pulses, vegetables, fruits, mutton, beef, poultry, dairy products, etc. (Table 1). Appropriate quantities of these items were collected from various farms and groceries across the city. The samples were washed with normal water, packed in polyethylene bags and brought for further processing to NAA laboratory at PINSTECH. In order to avoid chances of contamination from exposure of food sample to laboratory environment, all the food items were handled in a laminar flow box (Kotterman R. model 8580). Samples with high water content such as fruits, vegetables, dairy products, meat etc., were sequentially freeze-dried (BETA-A Christ) for 48 to 72 hours. All the samples were pulverized separately in a grinder with PTFE coated blades to minimize Fe, Cr and Ni contamination.

Based on the market basket survey and taking into consideration, as far as possible, nutritional habits, appeal and weekly requirements, four parallel average integrated diets (Table 2) representative of Gujranwala residents were prepared by blending 37 dried basic food items presented in Table 1. The prepared diets were filled in precleaned screw capped polyethylene bottles and placed in a freezer unless and until used for analysis.

**Preparation of standard**

Utilization of presently available wide range of reference materials as standard is limited. Therefore, a multi-element comparison basis and calibration solutions were prepared for NAA and AAS, respectively. The comparison basis was prepared by dissolving optimum quantity of spcure elemental salts in appropriate purified aqueous acids. 100 µl of the aliquot was dried on filter paper and used as standard after accounting...