SUMMARY FACTSHEET HUMAN EXPERIMENTATION - SFS12.001

Project Category: Metabolic and Physiological Studies

Funding Source(s): AEC/ERDA/DOE

Institution(s) and Principal Investigator:

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Objective(s) of Project: Tracer studies using various radionuclides

Short Description: During the period 1950-1980 many tracer studies were conducted on human subjects for the purposes of studying the physiology and metabolism of labeled substances. Usually only a few subjects are involved in each study. No late effects are expected and in general, there has not been a systematic follow-up. Brief description of the studies are:

(1) Progesterone-4 labeled with carbon-14 was used to study progesterone metabolism in two patients. Doses were 5.27 and 37.81 uCi. A third patient who was 10 weeks pregnant was given 28.3 uCi. A therapeutic abortion 6 days later because of severe sickle cell anemia was performed. Activity in maternal and fetal tissues studied. Storage of the hormone in the fat compartments were found. (1958.)

(2) 450 uCi of DL-glutamic acid-1-C14 were injected in a patient to investigate whether synthesis of Bence-Jones protein is related to that of myeloma globulin. Urinary and expiratory CO-2 were measured. (1958.)

(3) Metabolism of glucose studied with C-14, by CO-2 in expired air samples. (1958.)

(4) Sequential studies were made of the body potassium content of man in various cardiac disease states, in aldosteronism, and in hypertension with suspected hyperaldosteronism. A special study was made of the relationship between plasma potassium shifts and total-body content of potassium in man in various disease states. They are also measuring the effect of magnesium deficiency on levels of sodium, potassium, magnesium, and calcium in plasma, cerebrospinal fluid, brain and skeletal muscle. (1968.)

(5) Retention curve data with Ca-45, Sr-85, and radium were obtained. (1959.)

(6) An arm counter was used to measure activity in blood to determine the clearance of ^{131}I - Rose Bengal in the liver. The curve has two exponential components, interpreted as reflecting hepatic uptake and excretion rates. (1960.)

(7, 8 and 15) (1965.) A study was conducted to measure the long-term retention and localization of technetium in humans following both oral and intravenous administration and to derive mathematical models for excretion, which are very useful in determining the radiation dose to humans from technetium isotopes in the body. They are important from both medical and occupational standpoints.

^{95m}Tc and ^{96}Tc were administered to 8 subjects by physicians at the University of Washington Hospital in Seattle. The subjects were hospitalized at the University of Washington Clinical Research Center for the first week. Whole body counting and excreta measurements were made for 60 days. The University of Washington obtained and reimbursed the subjects for their services. The participation by PNL personnel was limited to providing the equipment, making the whole body counting and excreta measurements and analyzing the data. The PNL participation was funded by AEC but not the University of Washington participation.

(8) A study was conducted to determine the uptake, retention, distribution and excretion of promethium in humans following both oral and intravenous administration and to study the effectiveness of DTPA in removing promethium from the body. These concentrations were relevant to possible exposure of plant personnel. (1967.)

$^{143}PmCl_3$ was administered to 14 volunteers by physicians of the Hanford Environmental Health Foundation (HEHF). Whole body counting and excreta measurements were made by PNL for one year following administration of the ^{143}Pm. Six of the volunteers were also injected with DTPA at various intervals before and after the administration of the ^{143}Pm. Both the HEHF and PNL contributions to the study were funded by AEC.

(9) (1977-1982.)

(9a) To extend the knowledge of tumor metabolism and to define the localization and improve the diagnosis of cancer in animal models and man, studies have been in progress over the seven year period (1977-1984).
The specific aims are as follows: (1) To synthesize from different radiolabeled precursors a large variety of: (a) N-13 and C-11 labeled amino acids using enzymatic procedures. (b) C-11 radiolabeled carboxylic acids. (c) 1-(C-(c) 1-(C-11)-2-deoxy-D-glucose. (2) To employ the synthesized compounds for quantitative assessment of regional perfusion, transport, and metabolism to improve treatment of cancer, cancer diagnosis and the monitoring of treatment response.

(9b) To investigate the alteration in metabolic patterns related to cancer, methionine, technetium-99m and iodine-131 were used. These were used in various compounds for the study of their metabolism in bone, parathyroid tissue, liver, lung, pancreas and brain. Research was directed towards basic metabolic patterns and their alteration by malignant processes and by therapy, and also towards the development of useful diagnostic tests for early malignancy.

(10) Various hematological studies included: (1959.)
a) in 35 patients iron kinetics with Fe-59 and cell volume with P-32
b) survival of red cells, white cells and platelets with P-32 diisopropylfluoro-phosphonate.
c) intermediary metabolism of glucose and uric acid with C-14 glucose and C-14 uric acid.
d) heart function with I-131 albumin.
e) Co-60 vitamin B-12 absorption.

(11) The metabolic turnover of zinc-65 was studied, using a total body counter. (1966.)

(12) a) I-131 Hippuran was compared with other renogram agents and found to have the higher renal excretion efficiency.
b) I-131 cholegrafin was used in 35 patients to measure plasma volume as a substitute for human serum albumin.
c) I-131 Rose Bengal was used to study hepatic blood flow compared with the colloidal gold-198 disappearance rate.
d) Sr-85 was used as a tracer for calcium metabolism. This is safer than Sr-90 and more available than Ca-47. (1959.)

(13) A radioisotope technique for measuring regional blood flow was utilized to measure the effect of ionizing radiation on the bowel in experimental animals. In humans the effect of ionizing radiation on the colon was studied in women receiving radiation therapy for carcinoma of the cervix. They were studied before radiation, immediately after radiation and 6-12 weeks after radiation when healing had occurred. In addition, other diseases of the colon such as ulcerative colitis and diverticulitis were investigated to find out if there were detectable disturbances in regional circulation. (1963-1968.)

(14) To evaluate the mechanisms controlling pulmonary circulation, studies were carried out in normal and pathologic subjects, in basal conditions and under various stimulations. The data confirmed the relationships previously found between pulmonary blood volume, stroke volume and total blood volume and provided new material for an integrated evaluation of mechanisms controlling the pulmonary circulation. (1960-1965.)

(15) See item (7).

SUMMARY FACTSHEET HUMAN EXPERIMENTATION - SFS12.002

Project Category: Metabolic and Physiological Studies

Funding Source(s): AEC

Institution(s): INEL

Principal Investigator(s): C. A. Hawley

Objective(s) of Project: To obtain quantitative information on the kinetics of radioiodine transport from the point of release to the atmosphere through the entire air-vegetation-cow-milk sequence in the human food chain.

Short Description: The preliminary experiment was conducted during May and June of 1963. The experiment was conducted near the southern boundary of the INEL (formerly the NRTS). Approximately one curie of Iodine-131 was released atmospherically, and deposited on pasture area downwind from the release point. Six dairy cows were placed on the contaminated pasture and seven human volunteers consumed portions of the resulting contaminated milk over an 18-day period.

During September 1964, approximately the same quantity and chemical form of Iodine-131 was atmospherically released to an area designated the Experimental Dairy Farm located on the INEL (approximately seven miles northeast of the Idaho Chemical Processing Plant). Three human volunteers were on the test area during the time of cloud passage and were later subjected to inhalation thyroid dose measurements.

During November 1965, the 1964 experiment was repeated using similar quantities and forms of Iodine-131 in the same area. Seven volunteers were seated in the test area next to high volume air samplers to correlate inhalation uptake with the amounts of iodine present in the air.

Follow-up Data: Due to the relatively short half-life of Iodine-131 (eight days) and the low thyroid doses received by the human volunteers (ingestion dose, range 230 to 630 mrad; inhalation dose, range 6.1 to 15 mrad) no follow-up data acquisition was considered necessary.

SUMMARY FACTSHEET HUMAN EXPERIMENTATION - SFS12.003

Project Category: Metabolic and Physiological Studies

Funding Source(s): AEC

Institution(s): INEL

Principal Investigator(s): C. W. Still

Objective(s) of Project: The determination of the metabolic fate of radionuclides ingested or inhaled by humans in good health, and calibration of both static and rotational scanning instruments for the direct in-vivo measurement at internally deposited radionuclides.

Short Description: Eight human volunteers were involved with the human studies endeavor, which consisted of thirteen individual experiments conducted during the period May 1965 to January 1972. All of the eight persons involved were employed by the ID-AEC, and all were associated with the Analytical Chemistry Branch of the Health and Safety Division. Four of the experiments involved inhalation of Argon-41 (a noble gas with a half life of 1.8 hours) and nine experiments resulted in the volunteers swallowing insoluble polyethylene capsules containing microcurie amounts of radioactivity.

Follow-up Data: The short half life of Argon-41 and its small residence time in the body resulted in very small radiation doses to the volunteers. The insoluble capsules required about 24 hours to pass through the body and produced very small doses due to the quantities of radioisotopes involved. As a consequence, no follow-up data acquisition was considered necessary.