B.E.C. NORDIN

SELECTED PUBLICATIONS 1952 - 1992

The attached selected papers have been grouped in the same categories as the research themes in the curriculum vitae.

Where BECN appears as the sole author, no explanation of the attribution is required.

Where he appears as the first author, it can be assumed that he initiated the work, closely directed it, performed the statistical analyses, and wrote the manuscript.

For the remaining papers, an account of BECN's contribution is given at the beginning of each section.
SECTION 1  DIAGNOSTIC AND TECHNICAL PROCEDURES

Reference

D18  EB was a radiological colleague who collected the Xrays on which we jointly carried out the measurements suggested by BECN.

D19  JSB was the pathologist who collected samples from the postmortem room at BECN's suggestion. Data analysis performed jointly.

D59  The idea of combining the exponential and power functions was conceived by BECN who reached the graphical solution. The mathematical equations required the assistance of physicists colleagues. The authors appear in alphabetical order.

D60  The idea was conceived by BECN but the mathematical equations were written by DHM.

D107 Idea generated by BECN. Paper largely written by DHM.

D157 Project planned, supervised and written up by BECN but practical and data collection by DBC.
MEASUREMENT AND MEANING OF CALCIUM ABSORPTION

The distribution of calcium in foodstuffs is uneven, some being very rich in this mineral but most containing very little. For all practical purposes, the main source of calcium in human diets is milk, the average consumption of which in the United States is about 1 pint per person per day, containing some 300 mg of calcium. All other sources bring the dietary calcium up to about 800 to 1000 mg per day.

The dietary calcium mixes in the gastrointestinal tract with about 200 mg of calcium secreted in the digestive juices of the stomach and intestines and absorption then takes place from this relatively homogenous mixture. There may be a very small amount of digestive juice calcium which cannot be absorbed (estimated at 27 mg per day), but it is generally assumed that dietary and digestive juice calcium cannot be distinguished by the nurses and that the same proportion of each is absorbed. The suggestion that biliary calcium (amounting to some 100 mg daily) is preferentially absorbed is not considered any further since it cannot be allowed for in any conventional calculations.

Expressed on a body weight basis, the mean dietary calcium in the United States is about 15 mg per kg per day, of which about 11 mg appear in the feces (fig. 1). This difference between the dietary and fecal calcium is termed "net absorption" and is measured by conventional balance techniques. In 53 balances on normal subjects at intakes below 45 mg per kg we have found that fecal calcium (y) is related to dietary calcium (x) as follows:

\[ y = 0.742 x + 0.45 \text{ mg per kg} \]

Net absorption calculated from this equation rises with the dietary calcium in the manner shown in figure 2. At zero or very low intakes, fecal calcium exceeds dietary intake and net absorption is zero or negative, but as the intake is increased net absorption approaches a maximum value of about 12.5 mg per kg at a dietary calcium of 45 mg per kg. There are very few data at higher intakes than this, but we find that net absorption seldom exceeds 10 to 15 mg per kg and this should perhaps be regarded as the maximum absorption capacity for calcium of normal subjects.

Net absorption is shown as a fraction of the intake in figure 3. This rises to a maximum value of almost 0.3 and falls again as the intake exceeds 45 mg per kg.

The total amount of calcium absorbed from the gastrointestinal tract is termed true absorption and is measured by administering radioactive calcium intravenously to a subject on calcium balance and determining the activity that appears in the urine and feces. Fecal activity represents that part of the digestive juice calcium which is not reabsorbed and is termed "endogenous fecal calcium" (e). It is determined from the formula:

\[ a = f \times \frac{u}{u^0} \]

where \( f^0 \) and \( u^0 \) denote fecal and urinary activity and \( u \) denotes urinary calcium. Endogenous fecal calcium (e) is deducted from total fecal calcium to yield non-absorbed dietary calcium and the latter in turn deducted from dietary calcium (f) to yield absorbed dietary calcium (a). Thus:

\[ a = f - e \]

Since the fraction of dietary calcium
Fig. 1. Diagrammatic representation of calcium turnover in the body with approximate normal values. Note the recycling of calcium between the calcium pool and the gut.

Fig. 2. The relation between calcium intake and total calcium absorption (true and net) based on the approximate mean values in normal subjects. Note that there is probably a maximum absorptive capacity.

absorbed is assumed to be the same as the fraction of digestive juice calcium (d) that is reabsorbed, and since the endogenous fecal calcium represents the unabsorbed digestive juice calcium, d can be determined as follows:

\[ d = \frac{e_i}{f - e} \]