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Absorption, Accretion and Endogenous Faecal Excretion of Calcium by the Newborn Infant

MEASUREMENTS of calcium absorption require the administration of a suitable marker for natural calcium; the most commonly used markers in adults are ^{45}Ca and ^{47}Ca, two radioactive nuclides of calcium which cannot be used experimentally in infants because of the possible risk from radiation. Calcium salts enriched in the non-radioactive nuclides ^{46}Ca and ^{48}Ca are now available and may be used in newborn infants. Non-radioactive nuclides have the advantages that metabolic information can be obtained without exposure of the subject to ionizing radiation and that, if necessary, measurements can be made after prolonged storage of specimens because the marker is not subject to radioactive decay. The absorption, retention and elimination of calcium by the newborn infant are of practical importance[1] and here we provide measurements from which true absorption and endogenous faecal elimination can, for the first time, be inferred.

Four healthy but premature males (ages and weights given in Table 1) were fed from birth and during the tests on a carbohydrate modified cows' milk formula 1610F Ca (ref. 2). A solution containing 2.0 mg of Ca enriched in ^{46}Ca was added to a single normal feed and the intake of milk from this and subsequent feeds throughout the study was measured. Stools, urine and vomitus were collected for a total of 48 h and all specimens, including aliquots of milk, were dried and thermally ashed. The natural calcium content of specimens was measured by atomic absorption spectrophotometry and the ^{46}Ca content was determined from measurements of the radioactive ^{47}Ca produced during neutron irradiation of the specimens. Appropriate corrections were made for naturally occurring ^{46}Ca present in the specimens. Details of this method are given elsewhere[3].

We have assumed that the calcium marker and the natural calcium in the milk are equally available for absorption. Although for infants this has not been proved, for adults, the absorption of ionic and milk calcium is most probably equal when the two are ingested simultaneously[4].

Table 1 Intake, True Absorption, Accretion and Endogenous Faecal Excretion of Calcium by Four Premature Infants

Subject	Post natal age days	Weight kg	Mean daily intake mg	True absorption mg/day	True absorption % of intake	Endogenous faecal excretion mg/day	Accretion mg/day
L. N.	11	2.3	508	171	33.7	103	66
N. B.	10	1.9	435	161	37.0	46	109
M. M.	9	2.4	480	144	30.0	25	118
L. T.	41	1.5	311	107	34.4	0	105
Mean and s.e.	18 (±8)	2.0 (±0.2)	434 (±44)	146 (±14)	33.8 (±1.4)	44 (±22)	100 (±12)

Because exogenous excretion of the marker had virtually ceased within 24 h of administration, values could be obtained for true absorption, endogenous faecal excretion and accretion of calcium by applying the equations of Aubert *et al.*[5] to the measurements of natural and marker calcium. The results demonstrate the relatively small variation between four infants in the daily amounts of calcium absorbed (107–171 mg) and accreted (66–118 mg) from the milk used in these tests. The percentage absorption was constant (mean 33.8 ± 1.4), but the endogenous faecal excretion varied widely, from 0 to 20% of the intake. The difference in endogenous excretion between different infants may prove to be relevant to the aetiology of the calcium deficiency and calcium excess syndromes in the newborn[2].

Full term infants of the same age range but double the weight, fed on breast milk[6], ingested 45–48 mg Ca kg^{-1} day^{-1} on average, markedly less than the 217 mg kg^{-1} day^{-1} for the premature infants fed on the test formula. Retention in the breast-fed infants was 19–23 mg Ca kg^{-1} day^{-1} as compared with 50 mg kg^{-1} day^{-1} for accretion in the premature infants. There is clearly a need for further investigation of the factors, including dietary composition, which affect calcium metabolism in the human infant.

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Selective Synthesis of Liver Nuclear Acidic Proteins following Glucagon Administration *in vivo*

IT is known that the metabolism of the non-histone, acidic proteins associated with DNA in the chromatin of animal cells is influenced by steroid hormones. The effects are often highly specific; for example, the administration of hydrocortisone to adrenalectomized rats leads to a selective stimulation of synthesis of a liver chromosomal protein of molecular weight 41,000[1]. Hydrocortisone also alters the pattern of phosphorylation of chromosomal proteins in the liver, differential effects becoming evident within minutes after injection of the hormone[2,3]. Similar specific alterations in the synthesis or phosphorylation of nuclear proteins have been observed in uterine cells responding to oestrogens[4], in kidney cells following aldosterone administration (C. Liew, personal communication), in prostate cells stimulated by androgens[5], and in insect chromosomes stimulated by ecdysone[6]. In all these cases, the steroid hormone also affects the RNA synthetic capacity of the target cells, presumably as a result of altered template capacity of the modified chromatin.