A Study of Digestive Absorption in Four Cases of Down’s Syndrome. Down’s Syndrome, Malnutrition, Malabsorption, and Alzheimer’s Disease

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Abstract — Many data suggest that patients with Down’s syndrome (DS) suffer from digestive malabsorption. A fecal test of absorption (search for undigested meat fibers following the ingestion of a measured diet) was conducted in 4 patients with DS. The results point to malabsorption in these patients and support the hypothesis of malabsorption in DS. The etiology of probable malabsorption in DS is discussed. Data are presented suggesting that chronic malnutrition caused by malabsorption could be the cause of the neuropathologic signs of Alzheimer’s disease occurring at or slightly before the fourth decade in all patients with DS.

Introduction

The hypothesis that patients with Down’s Syndrome (DS) suffer from digestive malabsorption was proposed by Matin et al. (1) to explain blood values for vitamin B1, nicotinic acid, and ascorbic acid in the deficient range, despite a dietary intake previously assessed as adequate and containing a daily 50 mg supplement of ascorbic acid. This hypothesis is supported by the description in DS of impaired digestive absorption of vitamin A (2, 3), low blood levels of vitamin B1 despite adequate dietary intake and vitamin B1 supplements (4, 5), and xylose excretion below normal after oral administration of a xylose load (6). This hypothesis could also explain the other signs of malnutrition (7) observed in DS: red-cell folate values in the deficient range (8), unusual susceptibility to infections (9, 10), depressed reactivity to skin tests antigens (11), impaired neutrophil bactericidal capacity (12), decreased responsiveness of lymphocytes to mitogens (9, 13, 14), and decreased capability of peripheral blood T lymphocytes to form rosettes with sheep red blood cells (9, 13). It could also possibly explain why patients with DS have low calcium and copper hair concentrations (15) and low platelet calcium levels (16).
We report here the results of a simple and reliable fecal malabsorption test in 4 cases of DS. Data are presented suggesting a possible link between malnutrition and malabsorption in DS and the development of the neuropathologic signs of Alzheimer's disease (AD) in all patients with DS (17).

**Patients and methods**

We studied the 4 patients with DS who were in our psychiatric hospital. Sex and age of patients were respectively 2 males (29 and 39) and 2 females (both 46). In all cases, the diagnosis of Trisomy 21 had been confirmed by chromosome analysis.

The digestive malabsorption test used was the microscopic examination of stools for undigested meat fibers after a measured diet. Patients were fed according to the method of Moore et al. (18) modified slightly: minced meat was used to avoid the appearance in the stools of undigested meat fibers owing to the insufficient dental mastication of such patients. Each patient was fed for seven days (days 1 to 7 included) a daily diet containing 100 g of fat and at least two meat meals (250 to 300 g of meat). After the equilibration period (days 1 to 3 included) the patients received on day 4 a carmine marker with lunch. Four days later, a second carmine marker was given at lunch.

Every stool was collected from the appearance of the first marker and up to, but not including, the appearance of the second marker. These patients being incontinent, the stools were collected in diapers. Care was taken not to collect urine.

The stools were kept at +4°C in a plastic container, and sent each morning to the laboratory where microscopic examination was performed within the six hours following their arrival. Patient identification was unknown to the tester. The stools of each container were homogenized and a small piece of the stools (approximately 5 mm x 3 mm) was taken at random from each container. This small piece was then mixed thoroughly with a 0.8% saline solution in order to obtain a satisfactory thin smear covering the entire area under the coverslip. The entire coverslip was examined and only rectangular meat fibers with clearly evident cross-striations (undigested meat fibers) were counted. Their number per coverslip (18) and per 5 minute search under high magnification (x400) (19) was counted.

**Results**

The number of undigested meat fibers was over 150 per coverslip and over 50 per 5 minute search in all the patients.

**Discussion**

More than 10 undigested meat fibers per coverslip or per 5 minute search under high magnification (x400) indicate a malabsorption syndrome (18, 19, 20, 21, 22, 23). Our results indicate digestive malabsorption in our four patients with DS.

The malabsorption test we used is often neglected. It was chosen because it is safe and reliable (18). The quantitative fecal fat determination which is often recommended was not used because the fecal incontinence did not allow an absolutely complete collection of stools and because false negatives have been reported with the latter test (24, 25). It was impossible to perform other tests such as the secretin test, breath tests, etc. This was due to the mental state of the patients and for ethical reasons.

Our results strongly support the hypothesis (1) that patients with DS have a malabsorption syndrome. The malabsorption test used does not make it possible to determine whether malabsorption is the consequence of pancreatic insufficiency, of reduced intestinal absorptive capacity, or of another cause (18, 19, 20, 21, 22). Malabsorption in DS could be caused by cystic fibrosis and/or celiac disease: abnormally high sweat osmolality and cases of cystic fibrosis (26, 27, 28) as well as cases of celiac disease (29, 30, 31, 32) have been reported in DS. The description in DS of a case of cystic fibrosis in a neonate (27), of cases of cystic fibrosis and of celiac disease in babies and children (26, 28, 30, 32), of impaired vitamin A absorption in children (2, 3), and of nutritional deficiencies in babies and children (4, 8, 13), all suggest that malabsorption and nutritional deficiencies are early events in the life of patients with DS. Malabsorption could be genetic in origin.

Data suggest that chronic malnutrition caused by malabsorption could be the cause (33) of neuropathologic signs of AD in all patients with DS at or slightly before their fourth decade (17):
the Parkinsonism-dementia complex on Guam Island which is characterized neuropathologically by two (neurofibrillary degeneration and granulovacuolar degeneration) of the three main cerebral lesions of AD (34) is probably caused by chronic nutritional deficiency in calcium and magnesium (35, 36); neurofibrillary degeneration is the consequence of malnutrition (review of the literature prior to 1925 by Jackson) (37), of cholera, intestinal tuberculosis and bacillary dysentery (38); dementia is a consequence of malabsorption syndromes (39), and dementia, memory disorders, and intellectual deterioration are the consequences of chronic malnutrition (40, 41, 42, 43, 44).

**Conclusion**

This work strongly supports the hypothesis of malabsorption in DS. It suggests further studies in DS to confirm our findings, and to determine the cause(s) of this probable malabsorption. It also suggests work examining the possible relationship between chronic malnutrition due to malabsorption in DS and the development of the neuropathologic signs of AD in DS. Such studies would greatly contribute to the knowledge of such a devastating illness as AD.

**Acknowledgments**

We thank Drs Demay-Laulan, Damon, Azera and Lemasson for allowing us to study patients under their care, the nurses of the units "Broca" and "Les Tulipes" for their help, and Raymond Cooke for friendly linguistic help.

**References**


