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*ANTI, M. E. LIPPI, M. PAOLUCCI, G. GASBARRINI*

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## Fibers and fluids in chronic idiopathic constipation

ANTI, M. E. LIPPI, M. PAOLUCCI, G. GASBARRINI

*From Internal Medicine Department, Catholic University of Rome, Rome, Italy*

Chronic constipation is very common in the general population, especially in women, in its idiopathic form. Most patients respond to simple therapeutic measures aimed at correcting diet and lifestyle. Others need more aggressive treatment, including laxatives, psychological therapy and biofeedback. Chronic functional constipation is known to depend on numerous factors, including personality type, psychological stress, activity levels, drug use and socio-economic conditions. A high-fiber diet is currently the treatment of choice for chronic functional constipation but, in many cases, the positive effects seem to diminish over time, suggesting that colon, somehow, adapts to the increased fiber load. Low fluid intake is also thought to play an especially important role, and in clinical practice constipated patients are frequently advised to increase their daily intake of liquids, even though only a few controlled studies have been carried out to demonstrate the efficacy of such measures.

**KEY WORDS:** Chronic constipation - Water supplementation - Fiber

The term "constipation" indicates a symptom or a complex of symptoms representing the end result of several disorders with different epidemiology, etiology, pathophysiology, type and severity of clinical presentation, and treatment.<sup>1</sup>

Constipation affects up to 34% of the general population,<sup>2</sup> mainly females of all ages, but its prevalence depends on demographic factors, the definition used and the patients selected.<sup>3,4,5,6</sup>

Despite a lack of consensus, most clinicians agree that the term constipation means infrequent and/or unsatisfactory defecation, but for clinical practice and research purposes, a more standardized definition is needed. In an attempt to standardize the definition, a Working Team Report<sup>7</sup> considered constipation to be the presence of two or more of the following symptoms lasting >3 months, when the patient is not taking

laxatives: a) straining at defecation >25% of the time; b) lumpy and/or hard stools >25% of the time; c) sensation of incomplete evacuation >25% of the time, and two or fewer bowel movements per week.

In the presence of a specific recognizable cause, constipation is considered secondary and classified according to its cause. When no definite cause (diet, drugs, anatomic, biochemical, specific disease) can be demonstrated, as is usually the case, constipation is defined as "idiopathic" or "functional" and classified according to the results of investigations on daily colon movements or clinical patterns.<sup>1</sup> Symptoms of idiopathic constipation might result from abnormal colonic motility, which might or might not delay transit of intestinal contents and/or cause inability to evacuate rectal contents.

*Fibers.* Dietary fibers play a well-known role in the treatment of chronic constipation,<sup>8,9</sup> irritable bowel syndrome and diverticulosis; some Authors believe that they can also take part in colon cancer prevention. Fiber can influence colon function through at least four mechanisms: a) enduring bowel bacterial digestion because of its "lignin" content, fiber is able to retain water and to stimulate bowel motility; b) fiber fermentation products can increase stool bulk; c) the decreased transit time reduces water absorption, promoting stool dampness; d) fibers are fermented with production of gas, particularly H<sub>2</sub>, CH<sub>4</sub> and CO<sub>2</sub>, which remain entrapped inside stool, and short chain fatty acid (SCFA), which increase stool bulk and weight.

All kinds of fiber can increase the output of stool and its components (fats, nitrogen, minerals and trace-elements), but everyone has its own particular action. Differences between fibers are due to their physical and chemical properties, such as solubility, size and chemical composition of fiber; pectin, for instance, which is soluble, can increase stool weight in the order of 1.3 gr of stool per gram of introduced fiber, whereas bran, which is insoluble, can increase stool weight four times as much, 5.7 gr of stool per gram of introduced bran.

Also the size of bran particles influences the results of treatment: large particles induce a greater increase in stool

Address reprint requests to: M. Anti MD, Department of Internal Medicine, Catholic University of Rome, Largo F. Vito 1, 00168 Rome, Italy. Fax: +39-6-305 1343 e-mail: iclcm@rm.unicatt.it

TABLE I. "Acqua Oliveto"

Component	Percentage
Calcium	10.0
Magnesium	10.0
Sulfate	10.0
Chloride	10.0
Sodium	10.0
Potassium	10.0
Iron	10.0
Zinc	10.0
Copper	10.0
Manganese	10.0
Fluoride	10.0
Other	10.0

output. Large particles are slowly destroyed and usually run throughout a very long part of colon, taking part in the constitution of stool bulk and offering a wide surface for bacterial adhesion. Even chemical composition is thought to play an important function and particularly the percentage of pentose composition in fiber polysaccharides.

Williams and Holsted,<sup>10</sup> in 1936, were the first authors who recognized the importance of fiber fragmentation and digestion. They hypothesized that the most important products of these two biological events, SCFA, were responsible in increasing stool bulk and in stimulating colon motility. The increased wet-stool weight is closely related with a decrease of transit time and with the frequency of defecation. Numerous studies demonstrated that transit time rapidly decreases when stool weight reaches 160-200 gr per day, but there are irrelevant variations in transit time when stool weight is already over 200 gr per day. A stool weight of 200 gr a day seems to assume the physiological value of "critical weight": a Scandinavian Epidemiological Study demonstrated a lower incidence of colon cancer in a population with a stool weight of about 200 gr per day, when compared with a population having a stool weight of about 150 gr per day. In order to reach a fecal weight of 200 gr per day, human diet has to be supplemented with 35-45 gr of insoluble fiber, such as bran. It is difficult to define exactly how many soluble fibers must be introduced, but we may reasonably conclude that 30-40% of the total fiber supplementation has to be represented by insoluble fibers. SCFA are prevalently produced in the cecum, but also in the other parts of the colon. It is difficult to define the influence of diet composition in SCFA production in human bowel. High fiber diet triplicates SCFA secretion in respect to a low-fiber diet; even the type of fiber can influence the percentage of each particular SCFA. In animal models, "Propionate" and "Butyrate" decrease colonic segmental contractions and promote the ab-oral progression of bowel content; a SCFA lack may represent one of the pathogenic mechanisms of constipation, which could be treated, in this particular case, with soluble fibers, that are able to normalize stool output without increasing stool bulk. On the other hand, the effect on motility by SCFA might explain the favourable effects of soluble fibers in rectal constipation, where fiber supplementation should result not useful or noxious. However, in many cases, positive effects of fiber seem to diminish over time, suggesting that the colon somehow adapts to the increased fiber load.<sup>11</sup>

A dietetic treatment for chronic constipation aims to enrich feeding with alimentary vegetable fibers. In order to achieve this goal, we recommend the following: a) ensure a varied diet, with slag-wealthy foods - raw or cooked fruits and greens contain different types of alimentary fibers, especially pectin and cellulose; they must be eaten at least twice daily; cereals and their whole and unrefined products include certain amounts of fibers in the form of bran together with starch; dry fruit and legumes represent other sources of starch and fibers; b) evaluate the chance to employ fiber integration - this choice may be a "first step" treatment in all patients with chronic idiopathic constipation, in order to increase stool bulk and induce decreased stool consistency. Keep in mind that at least 15-25 gr of bran daily must be consumed to gain benefits. Beyond the quantity, other factors can determine treatment results: fiber size increases and hot exposure of food decreases the results on stool bulk. Ispaghula (Psyllium)<sup>16</sup> is another very important vegetable fiber used against constipation: it can also be used to decrease cholesterol plasmatic levels and to hold the after-dinner hyper-glycemic peak. Diet alone can rarely be sufficient to reach acceptable fiber intake; this is the reason why a fiber supplementation is so necessary. The best strategy consists in progressively increasing fiber intake (in order to let the bacterial flora adapt itself and to avoid critical side-effects, such as abdominal bloating) and then maintenance for a prolonged period of time.

**Fluids.** A low fluid intake is currently believed to play a role in the genesis of chronic, non-organic constipation and in clinical practice frequently constipated patients are advised to increase their daily intake of liquids.<sup>12,13</sup> However, a small number of studies have been conducted so far to show that such measures are actually beneficial. In a study conducted by general practitioners in Germany, there was no evidence that an increased fluid intake alone had any therapeutic effect in cases of chronic constipation.<sup>14</sup> Contrarily, a study conducted on healthy, non-constipated individuals showed that daily fluid intake had a significant influence on both bowel movement frequency and fecal mass. In this latter study of non-constipated volunteers, Klauser et al<sup>15</sup> also noted a correlation between fluid intake and stool frequency. In these individuals, whose dietary fiber was not modified during the study, simple fluid restriction significantly reduced the weekly frequency of bowel movements compared to the rate noted during a control period where fluid intake was  $\geq 2500$  ml/day. These investigators concluded that low fluid intake might be a contributing factor in some cases of idiopathic constipation, but it is not easy to establish a reliable cut-off between adequate and inadequate fluid intake.

An essential aim in every case of chronic constipation is to obtain a convenient hydration: this result may be obtained by introducing at least 1.5 lt of fluids a day, possibly away from meals, as shown in a recent study carried out at the Sacred Heart Catholic University in Rome.<sup>17</sup> In this study, the effects of water supplementation with high contents of calcium and magnesium (bottled mineral water "Acqua Oliveto", Oliveto Terme, Pisa) and a high-residue diet in a group of adults with chronic functional constipation have been evaluated.

In the constipated patients enrolled into the study (117 individuals) a significant increase in dietary fiber intake (from a baseline average of 12 gr/day to a mean of 24 gr/day) for a period of two months led to a significant improvement in the frequency of bowel movements and fecal mass. It also demonstrated that the results achieved with dietary fiber can be significantly enhanced by a daily intake of 1.5 lt of mineral water. It is difficult to identify the mechanism underlying the clinical effects noted in this study. An increase in the intestinal water content generally occurs when the water load exceeds the absorptive capacity. At any rate, it is difficult to determine whether the quantity of water consumed by each patient could have produced any significant increase in intestinal water content.

The mineral water used for supplementation contains 30.5 mg of magnesium and 206.1 mg of calcium per liter, and it is theoretically possible that these minerals contributed to the laxative effect of fluid supplementation. Magnesium in particular, might form sulphate or citrate salts that would promote fluid retention in the digestive tract and indirectly alter motility.

It was hypothesized that the increased bowel movement frequency produced by water supplementation is, in part, mediated by hormones, such as arginine-vasopressin or ADH. These hormones are involved in the regulation of extracellular osmolarity and intravascular volume, and they also seem to influence colonic absorption and motility.<sup>18</sup> Hard data to support this hypothesis are currently lacking, and the effect of vasopressin on colonic motility is particularly controversial. In a recent study, continuous subcutaneous infusion of arginine-vasopressin had no effect on stool output or gastrointestinal transit time in healthy volunteers. Similar results have been noted with IV infusion of physiological doses of ADH.<sup>19</sup>

Another possibility is that even a mild increase in fluid intake over a prolonged period of time provides a more intense stimulus for the gastro-colic response.<sup>20,21</sup>

In conclusion, only if fiber integration and water supplementation fail, more aggressive interventions can be evaluated and applied. They are based on the use of osmotic, such as "lactulose" or "mannitole", saline (Magnesium, Sodium and Potassium salts) and stimulant laxatives (bisacodile, senna, rhubarb, cascara, aloe). The use of these substances induces more negative side-effects than fiber does; for this reason, they must be used only in specific and strictly selected situations.

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