PROPOSITION OF DIET IN CONSTIPATION

Abstract

Constipation is a common gastrointestinal condition which is now increasing enormously. Chronic constipation (CC) is characterized to be a common issue caused with a irregular bowel movement or difficulty in feces passage. It is presented by many forms with varied symptoms. Genetic predisposition, Type of diet, socio-economic status, absorption, life style, and colonic motility, pharmaceutical and biological factors are the variables that contribute to the development of the disease. Diagnostic and therapeutic options are crucial in management of CC. Dietary fiber has been recommended as a step in the management of CC since it plays a significant role in this condition.

Keywords: CC, Nutrition, Physical activity, Fiber.

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I. INTRODUCTION

Constipation is characterized by the decrease in frequency of bowel movements or increased difficulty in process of eliminating stool [1,2]**.** CC is a prevalent gastro-intestinal (GI) condition presented to surgeons, subspecialty physicians and primary-care physicians globally [3,4]. Worldwide, the constipation prevalence rate was estimated to be 16% [5]. In India, the Gut Health Survey results imply that 22% adults are complaining of CC [6] and 13% people with severe constipation and 6% suffers from constipation associated with certain co-morbidities [6]. The co-morbidities include GERD (Gastroesophageal reflux disease), IBS (Irritable bowel syndrome), anxiety, depression, dyspepsia, etc. Constipation is often associated with nausea, bloating [7] and abdominal pain (mild to severe) [39], loss of appetite, infrequent bowel movements, hard stools, excessive straining [7]. CC was more prevalent in the elder people i.e., 50-70% [2,78].

Constipation is classified into acute and chronic based on duration of problem [78]. Acute constipation is a type which lasts less than one week. Chronic constipation lasts for more than 4 weeks or more than months (consensus criteria) [8].

1. **Criteria for Diagnosing Constipation:** The CC diagnosis according to Rome III includes- 1. Including ≥ 2 of the criteria: (a) Straining for more than 1/4th of defecations, (b) Having type 1 and type II stools (Lumpy or hard stools) [84] more than 1/4th of defecations, (c) Feeling of an inadequate evacuation for more than 1/4th of defecations, (d) Sensation of anorectal obstruction/ blockage more than 1/4th of defecations, (e) Manual maneuvers to facilitate more than 1/4th of defecations, (f) Having < 3 spontaneous bowel movements/week; 2. Loose stools are rarely present without the use of laxatives; 3. Insufficient criteria for irritable bowel syndrome: Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis [8,9,79,80]

   Primary chronic constipation is a type of CC without unknown cause. Inadequate fibre intake, a sedentary lifestyle, or a disturbance of colonic propulsion or rectal emptying can all contribute to this inappropriate bowel function. [10].

   Treatment for systemic diseases (Parkinson's disease or hypothyroidism), organic diseases (opioids or antihypertensive medications), and local pathology in the colon-related disorders (colon cancer or diverticular structure) might result in secondary persistent constipation. [10]

   There are 3 types of primary chronic constipation- rectal evacuation disorders [outlet delay disorders or dyssynergic defecation], normal transit constipation [functional constipation] and slow transit constipation [colonic inertia or chronic colonic pseudo obstruction]. The rectal evacuation disorders include lack of coordination in pelvic and abdominal muscles to evacuate feces (either by structural and functional defects); slow transit constipation include delayed movement of stool in the colon due to abnormalities in the pelvic and anal sphincter muscles; normal transit constipation due to unidentifiable biochemical or structural cause. This type overlaps irritable-bowel-syndrome (IBS).

   Slow transit constipation responds to dietary changes. Increased intake of water and fiber hydrates the feces that hasten intestinal transit. On the contrary, dietary changes

could not affect the dyssynergic defecation and could only improve stool consistency. The pelvic floor rehabilitation can be an effective therapy [11]. This type was more frequently observed in women [10,12].

Genetic predisposition plays a major role in functional constipation with positive family history of constipation [13]. Constipation is generally functional in origin and rarely a cause of organic aetiologies in >95% cases. Organic aetiologies include metabolic and endocrine factors, anorectal factors, neuropathic factors, and intestinal factors. Psychological disorders, lifestyle factors and genetic factors are the prevalent pathophysiological factors [13,14]. The age positively correlates with the onset of CC [15]. The CC is most commonly observed in women compared to men [15-17], whilst this correlation is not observed in children [19] and elders [10,18].

II. NUTRITION

The alimentary and functional CC can be treated by diet therapy. Besides these, the diet therapy also treats CC with organic origin [20]. The diet and fluid intake play an important role in improving functional constipation. High water intake and high fiber are affirmed to reduce risk of constipation ≤ 65 years, but was not significant > 65 years [2]. Poor dietary intake and mal-absorption of nutrients cause gastrointestinal disorders [78].

1. **Minerals:** The micro minerals like selenium and magnesium were considered essential to reduce chronic constipation (especially in children) [21]. Magnesium is 4th most abundant cation in humans that acts as cofactor for more than 600 enzymes [24]. Selenium is a nutritionally important trace element that is present in many organic foods.

   Selenium provides numerous physiological benefits, such as anti-inflammatory properties, antioxidant protection and the recommended intake is 55μg/day for a normal adult and 60-70 μg/day for pregnant women [22,23]. Magnesium salts like magnesium-sulfate are employed as laxatives in the treatment of constipation for their osmotic effects due to GI tract incomplete absorption [25,26]. This effect has decreased the prevalence in a quartile of men [27,28]. Stool frequency was also inversely associated with constipation with the intake of magnesium. The magnesium sulfate enriched natural mineral water increased the frequency and regularity of bowel movements in individuals with functional constipation. [29,30]. Magnesium oxide also effectively treats constipation [31]. Magnesium acts as a mild laxative in the form of sulfates or citrate salts. These help in fluid retention and motility in digestive tract. Mg/Zn also play a major role in relieving constipation [42,43].

2. **Fiber:** Men >51 years must have 31 grams, whilst women must eat 21 grams of protein per day. Men between 19 to 50 years must eat 38 grams whilst women with 25 grams of protein per day. For ages 1 to 3 years, 19 grams/day is advised, and for ages 4 to 8 years, 25 grams/day. According to DRI guidelines, for ages 9 to 13 years and 14 to 18, the boys should consume 31 and 38 grams/day respectively and girls of ages 9 to 18 should consume 26 grams/day [32,33]. Low fiber diet paves a pathway for the onset of constipation [39].

Dietary fiber is of two types- soluble and insoluble fiber. Pectins, gums, and certain hemicelluloses make up soluble fibres, which can be found in foods like oats, apples, bananas, barley, beans, and barley [8]. Bulk is added to stools by soluble fibre [44]. Cellulose, lignin, and certain hemicelluloses are the main components of insoluble fibres, which do not dissolve in water. Foods including wheat bran, all fruits and vegetables, and entire grains contain it. It is sometimes referred to as roughage or bulk because it maintains regular digestion, lowers the risk of colon cancer, and helps relieve constipation and haemorrhoids [39,40]. Insoluble fiber facilitates easier movement of food through the digestive system and helps prevent constipation. [44]. Stimulating the gut mucosa mechanically results in gastric secretion, peristalsis, and a significant laxative effect. It raises the fecal bulk and colonic transit rate [8]. The majority of fiber-rich meals contain roughly a third soluble and a second-third insoluble fibre [45,46].

The type of stools passed by patients was established using the Bristol stool scale, which divides stools into 7 groups. Difficult to pass hard lumps such as nuts was categorized as Type I, while sausage shaped with bumpy appearance and sausage shaped with surface cracks were categorized as Type II and Type III respectively. Smooth and soft with snake like appearance and easily passed soft blobs with sharp edges were categorized as Type 4 and Type 5 respectively. Stool made of squishy sections with rough edges was categorized as Type 6. 100% watery with no firm pieces was categorized as Type 7 [84].

Fibre includes lignins and polymers of three or more monomeric units called glucans that are neither digested nor absorbed in the small intestine [62]. Fibre consists of a variety of molecules with different solubilities, viscosities, and fermentabilities [63]. Both viscous and non-viscous fibres are effective at bulking up stools because they both reach the lower gut in an undamaged state [64]. The luminal sac is further dilated and peristalsis is induced by an increase in stool bulk [65]. Fermentable fibres boost short-chain fatty acid (SCFA) [39] synthesis and gut bacteria diversity, which increases faecal biomass. The subsequent increase in colonic osmotic load raises the water content of the faeces, making the stools softer [66].

Additional categories of fibre include soluble, viscous, unfermentable (HPMC—Hydroxypropyl methylcellulose, Psyllium [79]); soluble, viscous, fermentable (Guar gum) [44]; Soluble, non-viscous, unfermentable (Partially Hydrolyzed Guar Gum); Soluble, non-viscous, fermentable (Inulin [44], FOS, GOS, Pectin); Insoluble and unfermentable (Cellulose, Lignin); Insoluble and slowly fermentable (Wheat bran [44], Resistant starch, Whole grains)

In order to normalise stool consistency in constipation, soluble viscous fiber exhibits rapid gel forming capability. This is conserved all through large bowel and undergoes minimal fermentation. Because it has a softening impact on the stool, stool water content has a strong correlation with stool consistency. Through mechanical stimulation of the gut mucosa, insoluble fibre increases the faecal bulk and colonic transit rate while having a laxative effect [45].

The Dietary Guidelines for Americans strongly advise eating foods high in nutrients, like whole grains. In order to boost dietary fibre, ensure appropriate GI function

that prevents chronic diseases in both children and adults, at least half of all grains are consumed. 30g of whole grain is equal to five whole-grain crackers, one-half cup of cooked whole-grain pasta, rice, or oatmeal, one slice of whole-wheat bread, and three cups of popped popcorn [33].

Wheatbran [44, 47], glucomannan (nonabsorbable fiber) [44], psyllium, or ispaghula (bulk-forming fiber) with water holding abilities [47,48,79], polydextrose, inulin, galactooligosaccharides [49], cellulose, guar gum were commonly used for the treatment of constipation [44,47]. A high-fiber diet can lengthen colon transit time and increase stool weight, whereas a low-fiber diet promotes constipation [50]. Young women who consumed more rice and coffee had lower rates of constipation [51]. Combining clarified butter and jiggery can also help with constipation [69].

- **Fatty Acids:** Constipation was directly linked to dietary intake of high saturated fat, but the relationship between dietary unsaturated fat and constipation was the opposite [2]. Among participants who were physically active, dietary fibre intake was linked to constipation related to stool consistency but not significantly to stool frequency [33,34]. In order to delay the development of constipation, the WHO advises consuming 25 to 40 grams of high dietary fibre per day [35]. High levels of lignans, linoleic acid, and alpha-linolenic acid can be found in flaxseed (Linum usitatissimum). It is a good reserve of soluble and insoluble fiber, which is useful for treating constipation [36]. The bacterial diversity in gastrointestinal system was raised by consuming 9 g of omega-3 type of PUFA (polyunsaturated fatty acids) daily from perilla oil for 8 weeks [37]. Constipation was relieved as a result of the favourable correlation between gut bacterial diversity and blood levels of omega-3 unsaturated fatty acids [38,39].

- **Mushrooms:** The fibrillar and matrix parts of mushroom cell walls contain polysaccharides such as (13)-D-glucans and mannans, respectively, as well as chitin, a straight-chain (14)-linked polymer of N-acetyl-glucosamine [40]. Beta-glucan, the fibre present in mushrooms, is comparable to the major fibre in goods made from oats. Beta-glucans relieve constipation and intestinal peristalsis. It is also advantageous for controlling blood sugar and cholesterol levels. In addition, mushrooms offer extra nutrients such selenium, copper, and potassium as well as the B vitamins pantothenic acid, riboflavin, and niacin [40, 41].

  Mushrooms have been used for treating constipation [55]. A. auricula (black ear mushroom) has good water absorption, good water holding capacity and also exhibit good antioxidant activity [52,53]. The phenolic compounds present in mushrooms will minimise the risks of free radicals [40]. The cloud ear mushrooms (Auricularia polytricha) significantly improve constipation related symptoms [54,55,81]. The mushrooms like Boletus edulis, *Flammulina velutipes* [57] have increased the rate of propulsion in small intestine [56]

- **Fruits:** Most of the fruits are good sources of dietary fibre in varied forms (fresh/dry/juice). Fruits with high fibre content are good for the GI tract [49]. A prune (dry plum) boosts peristaltic and gastrointestinal motility [58, 59]. It does not affect faecal water, only faecal bulk [61]. In adult clinical research, fruits including the

polyphenol-rich mango, papaya, and green kiwifruit dramatically increase faeces frequency, volume, softness, and comfort. A natural laxative called Ficus carica (fig) increases the frequency of faeces [49].

The regularity of the stools and the intensity of the symptoms serve as indicators of intestinal health. It was discovered that the mango fruit supplementation was more successful at modifying these parameters [60]. Both fibre and sorbitol are abundant in apricots. Increased faecal weight, lipid content, and relative abundances of Bacteroides and Clostridium cluster IV are all provided. Gut transit time was sped up by trifoliate orange extract powder, fig paste, and kiwifruit in addition to apple fibre isolation. The only fruit that has been shown to raise human faecal weight and small bowel water content is the kiwifruit. Raisins, prunes, and apple fibre isolate all increased faecal weight [61].

The primary components of fruits and fruit products which mediate the effects of fruits on gut bacteria, motility and function of gut [61] and consequently affect CC are fibre, sorbitol, and polyphenols (Figure 1). Fruits, vegetables, cereals, tea, coffee, and wine are just a few examples of the many plant-based meals and beverages that include sorbitol (sugar alcohol) and polyphenols [67,68,79].

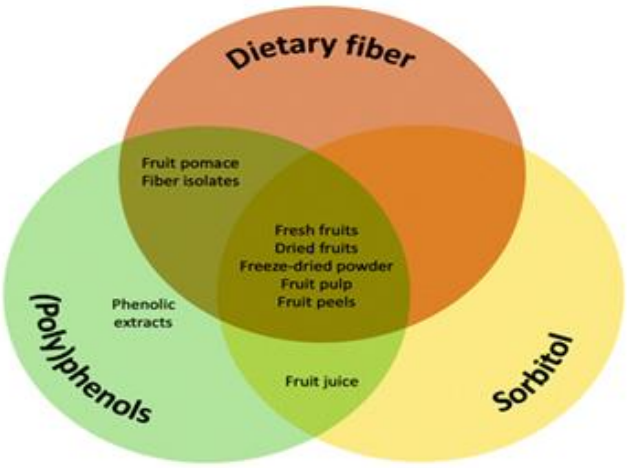

Figure 1: Main constituents in Fruits and fruit products

- **Probiotics:** CC patients showed improved defecation with the use of probiotics and fermented milk [36, 49], feces frequency, increased responsiveness to treatment, integrative symptoms and severity of incomplete evacuation. The *B. coagulans* Unique IS2 showed improvement in abdominal pain and defecation pain. In the similar fashion, *B. lactis* showed improvement in stool frequency [39]. Probiotics can be an excellent substitute for those who experience side effects from traditional therapy options like fibre and laxatives. The probiotics would relieve constipation[70].

In animal model studies, Treatment with yoghurt dramatically reduced constipation-related symptoms and altered the microbiome. Additionally, yoghurt

helped mice with antibiotic-induced constipation feel better and somewhat repaired their gut microbiota [71].

Table 1: List of Various foods with available dietary fiber content

Food	Type	Fiber/100g	Reference
Wheat bran	Grain	42.8 g	47
Oat Meal	Grain	10.6 g	82
Rye flour	Grain	12.9	82
Psyllium, or ispaghula	Seed	70g	48
Guar gum	Seed	90g	49
Flaxseed (Linum usitatissimum)	Seed	26.6g	36
Prune	Fruit	6.1g	58
Apple	Fruit	16.7	84
Banana	Fruit	10.1	
Cherries	Fruit	8.7	
Grapefruit	Fruit	14.5	
Orange	Fruit	18g	
Peach	Fruit	16.1	
Pineapple	Fruit	13.6	
Strawberry	Fruit	31.6	
Watermelon	Fruit	6.4	
Pear	Fruit	21.2	
Mango	Fruit	9.4g	49, 60
Papaya	Fruit	1.7g	49
Green kiwifruit	Fruit	3g	49
Fig (Ficus carica)	Fruit	2.9g	49
Shiitake mushroom	Mushroom	4.6	83
Pleurotus sajor-caju	Mushroom	48.60	
Pleurotus ostreatus	Mushroom	8.70	
Agaricus bisporus	Mushroom	20.90	
Auricularia auricula	Mushroom	19.80	
Calocybe indica	Mushroom	3.40	
Lentinula edodes	Mushroom	28.80	
Flammulina velutipes	Mushroom	3.70	
Volvariella volvacea	Mushroom	54.80	
Dried kidney bean	Seed	19.6	82
Dried cowpea	Seed	18.4	
Dried azuki bean	Seed	15.3	
Dried pea	Seed	17.4	
Dried soybean	Seed	17.9	
Beet root	Vegetable	26.7	84
Broccoli	Vegetable	34	
Cabbage	Vegetable	30	
Carrot	Vegetable	34.2	

XCelery	Vegetable	29.4	
Cucumber	Vegetable	15.8	
Lettuce	Vegetable	33.3	
Sweet corn	Vegetable	22	
Tomato	Vegetable	20.7	

3. **Fluids:** Adequate intake i.e for about one and a half litre to two litres of water per day is proposed as the first line treatment in chronic constipation [49]. Daily intake of at least 1.5 to 2 liters of fluid and daily exercise is significant [9]. Insufficient drinking of water causes constipation [72]. Water intake and hydration has decreased constipation [14] in adults and also in children [74]. The water intake and decreased constipation was questionable in older persons and secondary constipation [73]. Functional constipation group were observed to have a considerable low water intake (1200ml) than the non-functional constipation group (1500ml) [42]. Adequate hydration is important for maintaining intestinal motility [39,42].

4. **Physical Activity:** Physical inactivity is considered as treat for onset of CC [39,75,76]. Light to moderate exercise were coupled to propulsive mass movements in colon. This suggests that physical activity facilitates defecation and total colonic transit time. It also improves BMI, constipation complaints, quality of life in women [77]. In comparision with the normal people, malnourishment persons have higher risk of functional constipation [42, 43].

III. CONCLUSION

Constipation can be prevented or treated by maintaining balanced diet that contain vegetables, fruits, wholegrain cereals, water intake along with slight moderate physical activity. Eatwell Guide provides the size and recommended type of various foods to consume a wholesome, balanced diet. According to PHE, 2016, it suggests having vegetables and fruits for atleast 5 portions or 400g daily. This contributes to 1/3rd of the food per day which would reduce the non-communicable diseases risk including constipation. This is robustly encouraged by the WHO (2015).

The daily fibre intake for slow-transit constipation patients must be boosted to 20 to 25 g either by altering diet or by using packaged fibre diets. Osmotic laxatives should be used by patients who do not respond to fibre therapy. Until the stool softens, the osmotic laxative dosage should be adjusted, along with dietary adjustments. Surgery is not always required. Biofeedback could be used to retrain the evacuation process in patients with defecatory problems. Patients with severe defecatory disorders must use oral laxatives often at high doses that might result in watery diarrhea and other adverse effects. Patients with enough fibre consumption and the laxatives usage encourages regular bowel movements, additional bouts of faecal impaction should be avoided.

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