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Original Article

The role of glucomannan fiber in childhood functional constipation

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Abstract

Background Constipation is a common problem in children, and its most common type is functional constipation. The dietary fiber may be useful in childhood functional constipation management, but unfortunately the role of fiber in functional constipation is still less developed.

Objective To determine the role of glucomannan in treatment of childhood functional constipation.

Methods A crossover randomized controlled trial (RCT) was done from May until July 2012 in a boarding school in Medan, North Sumatera. The subjects were children with functional constipation aged 7 to 12 years. Subjects were randomised into two group receiving glucomannan fiber as polysaccharide gel (group A) and maltodextrin as placebo (group B) with each dose of 100 mg/kg/day (maximum of 5 g/day) diluted in 50 ml water/500 mg for 4 weeks, then after a wash out period we did the crossover of the two groups. Frequency and consistency of stools were recorded into diary sheet for 4 and 8 weeks of treatment. Functional constipation has been diagnosed based on Rome III criteria. Data was analyzed using independent T-test and Chi-square test.

Results A total of 36 subjects were eligible with each group consisting of 18 subjects and mean of weight of 25 kg. We found significant difference in stool frequency, treated on glucomannan with P= 0.002 before and P = 0.0001 after the wash out period. For stool consistency, we found difference while treated on glucomannan 9/18 (P= 0.034) in 4 weeks before and 11/18 (P = 0.008) in 4 weeks after the wash out period.

Conclusion Glucomannan has significant effect to improve functional constipation especially in 4 weeks treatment. **[Paediatr Indones. 2016;56:95-100.]**

Keyword: *fiber, glucomannan, functional constipation, children*

Constipation is a common problem in children, about 10-40% occur in school-aged children and 4% in preschool-aged. Almost 90-95% of functional constipation occurs in children over the age of 1 year, and only 5-10% constipation is caused by organic or pathological abnormalities.[1,2] In the United States, constipation is very common among infants and children. The prevalence of childhood constipation is 22.6% in children aged 4-17 years.[3] A longitudinal study on children aged 9-11 years reported 18% of children experienced constipation.[4] A study in South America found 28% of Brazilian children aged 8-10 years experienced constipation.[5]

The etiology of childhood functional constipation is multifactor. Several factors that have associated include hereditary, less diet of carbohydrates and cellulose, psychological factors, and hormonal disorders [6-8] Solutions for functional constipation include

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increasing water intake, consuming fibrous food, and doing physical activities along with the use of a laxative. A diet with adequate fiber, helping to weaken the stool and normalize the frequency defecation.[9] Glucomannan is a fiber and considered as a bulk-forming laxative. Glucomannan is an effective treatment if used 3-4 grams per day.[10-12] Although the rules of fiber in childhood constipation is still controversial, but studies of glucomannan in children aged 5 years have been done. However, very little information available about how the efficacy glucomannan in the treatment of functional constipation.[12,13]

The purpose of this study was to determine the role of glucomannan for the treatment of functional constipation in children.

Methods

We conducted a double blind, randomized clinical trial, crossover design comparing the fiber supplement glucomannan and maltodextrin as placebo. The subjects were children aged 7 to 12 years who had functional constipation based on ROME III not attributable to organic or a pathological abnormalities causes or intake of medication, and were recruited from Religious School Ar-Raudhatul Hasanah in Medan, North Sumatera, from May 2012 to July 2012. This study was approved by Medical Ethics Committee of the Medical School, University of Sumatera Utara.

After signing an informed consent, subjects were randomized by random table for the double-blind, crossover study. Blinding was done by having the medication labeled with the code kept by the institution until the study was completed and analyzed. Group A received glucomannan first for 4 weeks and after a wash out period, group A received placebo containing maltodextrin for another 4 weeks. Then, initially group B received placebo for 4 weeks and after a wash out period, group B received glucomannan for another 4 weeks. Placebo and glucomannan were given as 100 mg/kg body weight daily (maximal 5 g/day), rounded to the nearest 500 mg, because each capsule contained 500 mg. Each capsule was diluted into 50 mL of water as solution. Then, teacher instructed students to sit on the toilet after meals and keep a stool diary.

The patients kept diary sheets during the 4th-week and 8th-weeks of treatment. At the 4th-week and 8th-week visits, stool diaries were collected and evaluated. Subjects recorded the frequency of daily defecation and stool consistency. The frequency of defecation every 3 days and hard stools was considered as constipation. The stool consistency was assessed using the Bristol stool chart. The stool consistency was described as type 1: separate hard lumps, like nut; type 2: sausage shaped but lumpy; type 3: like sausage but with cracks on the surface; type 4: like sausage or snake, smooth and soft; type 5: soft blobs with clear-cut edges; type 6: fluffy pieces with ragged edge, a mushy stool; and type 7: watery, no solid pieces. At the 4th week visit, the crossover in medication was performed.

The data was entered, processed and analyzed using *SPSS 15.0.* A P value of <0.05 was considered to be statistically significant. Independent T-test analysis was done to show the stool frequency and Chi-square test was used to analyze the stool consistency.

Results

There were 240 children enrolled in the study. Fifty-two children had functional constipation, 5 were excluded and 11 were rejected from study. At last the 36 children who fulfilled the inclusion criteria were randomized into two groups of 18 children each, one group received glucomannan fiber and the other group received placebo (maltodextrin) (**Figure 1**). Distribution and characteristics of subjects in both groups are shown in **Table 1**.

After all respondents were divided into two groups, group A and group B were given glucomannan and maltodextrin, respectively, for 4 weeks, and at the end of the first 4 week of the treatment, we carried out an assessment of the frequency and consistency of stools. From the observation for 4 weeks in group A who received glucomannan, stool frequency increased significantly ($P = 0.002$) with an increase in stool frequency from 3.6 times/week to 9.7 times/week (**Figure 2**).

From the observation for 4 weeks in group B that received maltodextrin, there was a slight increase in stool frequency. The study result showed a significant increase for the mean stool frequency, from 3.9 times/

Table 1. Baseline characteristics

	Group A (*n* = 18)	Group B (n = 18)
Mean age (SD), years	9.8 (1.52)	9.8 (1.52)
Mean weight (SD), kg	24 (2.13)	28 (2.41)
Mean stool frequency (SD), times/week	3.7 (1.03)	4.1 (0.54)
Stool consistency, n		
Type 1	14/18	6/18
Type 2	3/18	11/18
Type 3	1/18	1/18

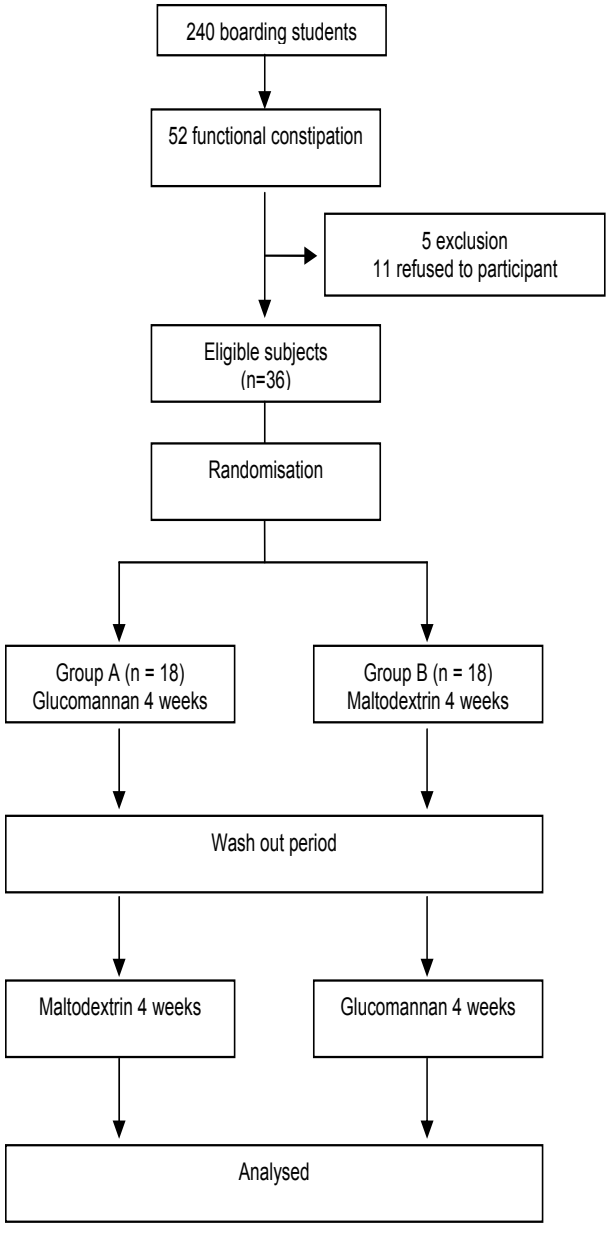

Figure 1. Profile of the study

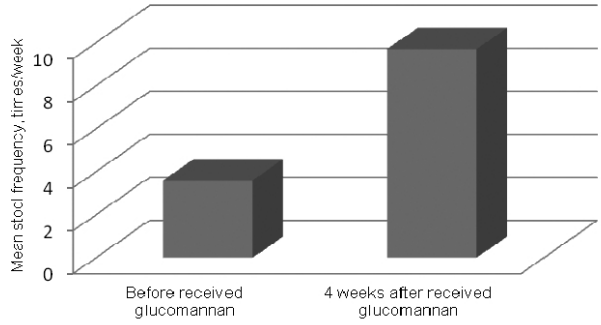

Figure 2. Comparison of stool frequency before and after giving glucomannan.

week to 4.2 times/week (P=0.012) (**Figure 3**).

Stool consistency between 4 weeks before the wash out period is shown in **Table 2**. Nine subjects (9/18) in group A (received glucomannan) with stool type 4 like sausage or snake, smooth and soft but in group B (receive maltodextrin) 8/18 subjects had stool type 2, sausage shaped but lumpy (P = 0.034).

The mean frequency of bowel movement in children who had constipation after maltodextrin in group A after the second 4 weeks of treatment was 4.28

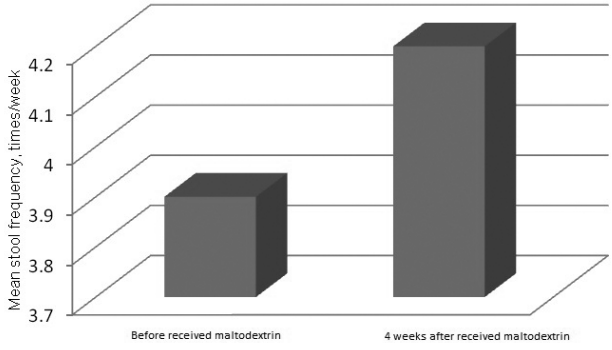

Figure 3. Comparison of stool frequency between before and after giving maltodextrin

Table 2. Stool consistency after the first 4 weeks of the treatment

	Stool Consistency , n		P value
	Group A (*n* = 18)	Group B (n = 18)	
Type 1	2/18	5/18	
Type 2	3/18	8/18	
Type 3	-	-	
Type 4	9/18	5/18	0.034
Type 5	4/18	-	

times/week while in group B who received glucomannan is 7.67 times/week. The study found differences in the mean frequency of bowel significantly between the two study groups (P = 0.0001) (**Figure 4**).

Stool consistency 4 weeks after the 2nd 4 weeks period of study is shown in **Table 3**. In group A (received maltodextrin) found 7/18 subjects had stool consistency type 2 as sausage shaped but lumpy, while in group B (received glucomannan) 11/18 subjects had stool type 4, sausage or snake, smooth and soft (P = 0.008).

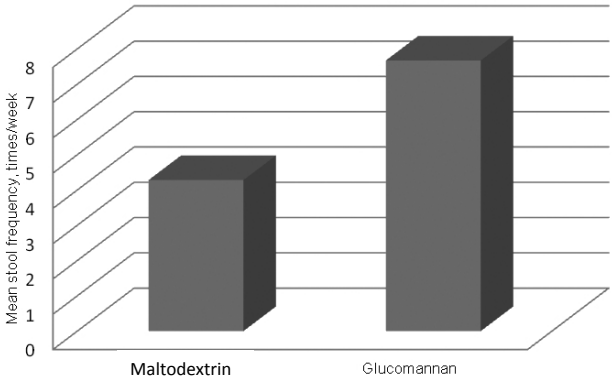

Figure 4. Comparison of stool frequency after the 2nd 4 weeks period of study

Table 3. Stool consistency at the 2nd 4 weeks period of study (after the wash out period)

	Stool Consistency , *n*		P value
	Group A (*n* = 18)	Group B (n = 18)	
Type 1	5/18	1/18	
Type 2	7/18	1/18	
Type 3	-	-	
Type 4	4/18	11/18	0.008
Type 5	2/18	5/18	

In this study, after 24 hour-wash out period, no significant effects carry over between two sequence of treatments. Therefore, data from the first period can be used to estimate the effectiveness of the drug, and long periods of wash out depends on pharmacokinetics of the drug. Glucomannan had a wash out period of 24 hours.

Discussion

In this study, we found that fiber was beneficial in children with constipation. A previous study showed that glucomannan doses of 2.52 g/day given for 4 weeks, resulted in 72 (90%) of children with functional constipation had normal stool. Regarding the form of feces, they had the same form of feces on the second and fourth week. Stool frequency was only increased by the third week (P = 0.007). There were no differences observed in the stool frequency on any study conducted.[14] Based on a meta-analysis of 1322 articles, fiber showed significant difference compared to placebo in stool frequency (OR = 1.19; 95% CI: 0.58-1.80, P < 0.05). Five randomized control trials evaluated that stool frequency had significant difference between the treatment and the control groups. In addition of four other studies who conducted to evaluate of the stool consistency, there was only one study presented the results of hard feces, but the other three studies found normal stools.[15] In our study, we found stool frequency and consistency increased before and after the wash out period. This difference was not affected by the carry over effect. Therefore glucomannan is beneficial when administered during 4 weeks.

Glucomannan is a water-soluble fiber. The solubility fiber is associated with fermentation microbes, and improvement of fermentation will affect the consistency of stool. An increase amount of water and the proliferation of bacteria are important for two mechanisms in which fiber affect gastrointestinal transit time and the movement of the intestines causing the stool to be more tender and increased stool frequency.[13]

Fiber has been recommended to be given in children with functional constipation. This article is inappropriate with *American Academy of Pediatric Committee on Nutrition* that dietary fiber of 0.5 g/kg/

day is recommended in children. According to *The American Health Foundation*, children over two years should receive dietary fiber with formula minimal dose is equivalent to age plus 5 g/day and maximum dose is age + 10 g/day.[16] There are few studies using glucomannan as a treatment of functional constipation in children.[13] Another study on 10 constipated children with nervous disorders such as primary sensory disorders caused by abnormalities of the spinal cord and secondary sensory disorders caused by mega rectum which cause chronic fecal retention. After giving glucomannan 100 mg/kg twice a day for 12 weeks, this study found improvements in the stool frequency and found no meaningful side effect after the therapy.[17] In this study, we found no nervous disorders. The subjects were given glucomannan with a dose of 100 mg/kg/day during 4 weeks, with average weight 25 kg, so each subjects have 2.5 grams glucomannan per day.

A study on the effects of a fiber such as glucomannan has been evaluated in children with functional constipation based on parent reports. The study found improvement in stool consistency (62%) in glucomannan group than in those given placebo (23%), and few children who have less bowel movements and abdominal pain in group children receiving glucomannan. Another study concluded that the proportion of improved constipation was higher in children who received treatment with fiber (42 vs 13%).[13] In this study, monitoring has been carried out for eight weeks, and no significant side effects from the administration of glucomannan. Glucomannan can thus be used as an alternative to complement of fiber in children with functional constipation

The aims of fiber treatment are to produce normal shape stool based on Bristol Stool Chart, no pain during defecation, and prevent accumulation of feces in the colon. Constipation treatment success depends on a combination of education, behavior modification, drug stool softeners, and diet modification.[18]

We conclude that glucomannan is proven beneficial in the treatment of functional constipation when given for 4 weeks. But in terms of pharmacoeconomics, glucomannan turns unfavorable, considering the price is too expensive and limited availability of drugs.

Conflict of interest

None declared.

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