Original Article

A Comparison of the Effect of Kegel Exercises and Conventional Therapy versus Conventional Therapy Alone in the Treatment of Functional Constipation in Children: A Randomized Clinical Trial

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What's Known

- Functional constipation is a common problem that affects children of all ages, and the Rome IV criteria are used to diagnose it.
- Standard medical care for functional constipation in children is frequently based on clinical experience and mainly involves a behavioral approach and toilet training with the administration of laxatives.

What's New

- Considering the inadequacy of conventional treatments and defecation training in many children, Kegel exercises may be an effective alternative due to their effects impact on the pelvic floor muscles and anal sphincter.
- Kegel exercise is an effective adjunctive treatment for pediatric functional constipation.

Abstract

Background: There have been few studies on the effect of Kegel exercises on the treatment of functional constipation in children. Hence, the present study investigated the add-on role of Kegel exercises in children with functional constipation.

Methods: This clinical trial was conducted on children with functional constipation, according to Rome IV, who were referred to the pediatric department of Imam Reza Clinic (Shiraz, Iran) in 2022. The sample consisted of 64 children who were randomly assigned to either the intervention or the control groups. In the control group, a pediatrician administered conventional therapy, including diet training, defecation training, and polyethylene glycol (PEG) syrup (0.7 g/Kg daily). In the treatment group, in addition to conventional therapy, a pediatrician taught Kegel exercises to the child both verbally and in writing in the presence of their parents. To investigate the effectiveness of the intervention, frequency of defecation, defecation time, assistance used for defecation, incomplete emptying, unsuccessful defecation, abdominal pain, and painful defecation were selected as the outcomes. Independent sample *t* test was used for continuous variables. Categorical variables were reported as frequency and percentages. To examine the difference in categorical outcome variables, Wilcoxon (pre and post), Chi square, and Fisher exact tests were used. Data were analyzed using SPSS software version 21. $P<0.05$ were considered statistically significant.

Results: Twenty-seven (88.4%) patients in the Kegel exercise group reported a defecation time of less than 5 min, while only 12 (37.5%) patients in the control group reached this time, and this difference was statistically significant (P=0.001). Moreover, patients in the treatment group showed significant improvements in terms of incomplete emptying of stool, unsuccessful defecation, abdominal pain, and painless defecation (P=0.001, P=0.001, P=0.001, P=0.037, respectively). After intervention, the use of laxatives, digits, or enemas to assist defecation was not significantly different between the groups (P=0.659).

Conclusion: Kegel exercise was an effective adjunctive treatment for pediatric functional constipation.

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Keywords ● Exercise therapy ● Kegel exercises ● Constipation ● Child

Introduction

Constipation is a common complaint in children, with a general population prevalence ranging from 0.7 to 29.9%. Any definition of constipation is relative and depends on stool consistency, defecation frequency, and defecation difficulty. In most cases (90-95%), constipation is a functional disorder with no organic etiology.[1] Functional constipation accounts for 3-5% of outpatient visits and nearly 25% of all referrals to pediatric gastroenterology clinics.[1]

Several factors contribute to functional constipation, the two most prominent of which are stool retention and delayed colon transit.[2] The child retains the stool to avoid painful bowel movements; with every urge to defecate, the child contracts the anal sphincter by stiffening his/her body, hiding in a corner, shaking back and forth, or fidgeting. Parents frequently misinterpret these retention behaviors with an attempt to develop a bowel movement. Lack of defecation can lead to long-term stool stasis in the colon and fluid reabsorption, making the stool harder, larger, and more unpleasant to pass. Rectal sensation gradually diminishes over time as the rectum stretches to make room for the residual fecal material, and fecal incontinence may develop. This cycle is generally initiated by improper bowel training, changes in routine or diet, stressful events, illness or lack of access to a toilet, or bowel movements delay due to a busy schedule.[3, 4]

To diagnose functional constipation, the Rome IV criteria are used. In the absence of criteria for irritable bowel syndrome or other medical disorders, at least two of the following must be present in a child aged 4 years or older:

(1) Two or fewer bowel movements in the toilet per week;
(2) At least one episode of fecal incontinence per week;
(3) History of fecal retention behaviors or voluntary fecal retention;
(4) History of painful or hard bowel movements;
(5) Presence of a large stool mass in the rectum;
(6) History of large-diameter stools that may obstruct the toilet.

These conditions should be observed at least once a week for at least 1 month.[5]

Laxatives, dietary modifications, increased fluid consumption, and toilet training are among the non-invasive methods of treating functional constipation in children. However, their success is not guaranteed. Some children do not respond adequately even to pharmacologic and invasive treatments, with nearly 30% of patients remaining symptomatic.[2, 6]

Constipated children are recommended to increase their daily physical activity. Pelvic floor muscles help control urine and stool by supporting the pelvic contents, including bladder bladder, urethra, prostate, vagina, uterus, anus, and rectum.[7-9] Various conditions can lead to increased or decreased pelvic floor muscles' tone and loss of pelvic support, which gives rise to constipation.[8, 10, 11] In 1948, Arnold Kegel was the first to explain and recommend Kegel exercises for strengthening pelvic floor muscles. According to the findings of Kegel's study, these exercises could aid in the prevention of cystocele, rectocele, and stress incontinence.[12]

Standard medical care for functional constipation in children is frequently based on clinical experience and mainly involves a behavioral approach and toilet training with the administration of laxatives.[13] Considering the inefficiency of conventional treatments and defecation training in many children, Kegel exercises may be a viable alternative due to their effects on the pelvic floor muscles and anal sphincter. However, there were few studies on this problem among children. Hence, the present study aimed to investigate the effectiveness of Kegel exercises combined with conventional therapy vs. conventional therapy alone in treating functional constipation in children.

Patients and Methods

This interventional randomized clinical trial was conducted from September 2022 to December 2022. The participants were the patients who were referred to the pediatric department of Imam Reza Clinic (Shiraz, Iran), affiliated with shiraz University of Medical Sciences, with a history of more than six consecutive months of constipation. The total sample size was calculated based on Engelenburg and colleagues' study.[14] The sample size of 64 was estimated using the formula of comparing two ratios, considering 10% drop-out, assuming a type I error of 0.05, a test power of 80%, the proportions of 63% (effectiveness in the control group), and 93% (effectiveness in the intervention group).

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 * [p_1(1-p_1) + p_2(1-p_2)]}{(P_1 - P_2)^2}$$

The inclusion criteria were age 8-18 years, functional constipation according to Rome IV criteria, and willingness to participate.

The exclusion criteria were severe delay in motor skills development, endocrine and metabolic disorders such as hypothyroidism, hypercalcemia, diabetes mellitus, diabetes insipidus neurological

and psychiatric disorders, including spina bifida, cerebral palsy, anorexia nervosa, autism, or pervasive developmental disorder-not otherwise specified (PDD-NOS), down syndrome, Hirschsprung's disease, constipation caused by medicine, bowel surgery (except appendectomy). Moreover, patients who could not learn the exercises, children who could not complete the follow-ups, and children with warning symptoms of non-functional constipation were excluded.

The samples were allocated to two groups using a random block sampling method with eight blocks of size eight. The data was placed inside sealed envelopes labeled with random numbers generated by the Allocation Random Software, version 2.0 (Informer Technologies, Inc., USA). An individual who was not involved in the research performed the blocking and allocation sequence of the envelopes for concealment. This study was an open-label research with no blinding (figure 1).

After obtaining written informed consent, each patient was randomly assigned to either the treatment or control group. In the control group, a pediatrician provided conventional therapy including diet training, defecation training, and polyethylene glycol (PEG) syrup (Shiraz School of Pharmacy, Iran) (0.7 g/Kg daily). In the treatment group, in addition to conventional therapy, a pediatrician taught Kegel exercises to the child verbally and in writing in the presence of their parents.

Kegel exercises involved two fast and slow contractions of the pelvic floor muscles. Fast contraction was for 2 sec (1 sec of contraction and 1 sec of relaxation) and slow contraction was for 15 sec (10 sec of contraction and 5 sec of relaxation). Each set of Kegel exercises included 10 fast contractions and 10 slow contractions. The patients were instructed to perform 10 slow contractions immediately after performing 10 fast contractions. The instructions were to do five sets every day in the first week, then 10 sets in the second week, increasing by five sets each week. The patients were instructed to perform Kegel exercises in different positions such as standing, sleeping, and sitting, as well as during daily activities such as watching TV, in the same order specified.[15]

The data was collected twice, once at the beginning of the study and once three months later, using a self-maid checklist containing demographic information and information related to the evaluation of treatment response. To investigate the effectiveness of the intervention, frequency of defecation, defecation time, assistance used for defecation, incomplete emptying, unsuccessful defecation, abdominal pain, and painful defecation were selected as the study outcomes.

The protocol of this study was reviewed and approved by the Medical Ethics Committee of Shiraz University of Medical Sciences (code: IR.SUMS.MED.REC.1400.484.) and was also registered in the Iranian Registry of Clinical Trials Registration (IRCT20230424057984N1). Furthermore, all aspects of the study were explained to the patient's parents, and written informed consent was obtained from them and submitted to the ethics committee.

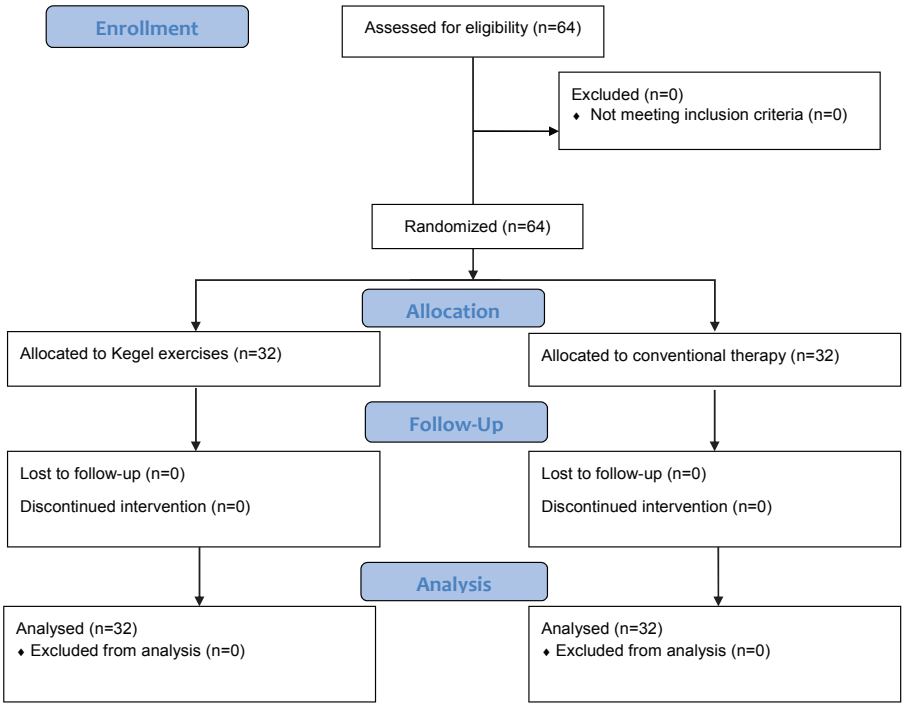

Figure 1: The figure represents the CONSORT flow diagram of the study.

Statistical Analysis

Data analysis was done using SPSS version 21.0 (SPSS, Chicago, IL). In this study, continuous variables were expressed as mean±SD, and categorical variables were reported as frequency and percentages. Independent sample *t* test was used for continuous variables. Wilcoxon (for pre and post), Chi square, and Fisher exact tests were used to examine the difference in the categorical outcome variables. P<0.05 was considered statistically significant.

Results

There were 32 patients in each group. The demographic characteristics of the study population are summarized in table 1. In terms of baseline characteristics, the two groups were well-matched.

The results related to the comparison of the outcome measures between the two groups are presented in table 2. At the beginning of the trial, the statistical tests of the variables revealed no significant difference between the treatment and control groups. In contrast, a significant difference was found between almost all the variables in the intra-group comparisons, except for assistance used for defecation in both the treatment and control groups (P=0.138 and P=0.522, respectively). The significant difference in the Wilcoxon test among the control group was due to receiving conventional treatment by this group.

In fact, none of the studied groups were deprived of conventional therapy. There was no significant difference between the patients in terms of frequency of defecation after the intervention (P=0.855). At baseline, most children in both groups spent 5-10 min in the toilet for defecation (59.4% and 75% in the treatment and control groups, P=0.321). However, after the interventions, 84.4% of children in the treatment group spent less than 5 min in the toilet, which was significantly higher than the corresponding proportion of 37.5% in the control group (P<0.001). Remarkably, neither group used laxatives, digits, or enema to assist defecation at baseline and after the trial, with no significant difference between the groups at either time point. While incomplete emptying was statistically similar between the groups at baseline (P=0.112), the treatment group had significantly less incomplete emptying after the interventions (P=0.001). The same was true regarding the unsuccessful defecations, with the between-group comparison indicating P=0.131 and P=0.001 at baseline and after the interventions, respectively. In addition, Kegel exercises improved abdominal pain and uncomfortable defecation in the patients (P=0.001 and P=0.037, respectively).

Table 1: Baseline demographic characteristics of the control and Kegel exercise groups

Characteristics		Treatment group N=32	Control N=32	P value
Age (years)		11.84±2.38	11.00±2.38	0.16
Sex	Male	18 (56.3)	18 (56.3)	>0.99
	Female	14 (43.7%)	14 (43.7%)	>0.99
Weight (Kg)		40.50±9.62	40.94±10.01	0.85
Height (cm)		145.94±19.09	142.91±13.50	0.46
Body mass index (BMI, Kg/m^2)		18.93±2.50	19.79±2.88	0.20
Constipation time>1 year		9 (28.1)	9 (28.1)	>0.99

Data were expressed as mean±SD or n (%). Independent samples *t* test was used for continuous variables, and the Chi square test was used to examine the difference between categorical outcome variables. P<0.05 was considered statistically significant.

Table 2: Comparison of outcome measures between the control and Kegel exercise groups

Variable			Treatment N=32 n (%)	Control N=32 n (%)	P value
Frequency of defecation	Pre	1-2 times per 1-2 days	0 (0)	0 (0)	0.103
		2 times per week	5 (15.6)	6 (18.8)	
		Once per week	8 (25)	15 (46.9)	
		Less than once per week	13 (40.6)	10 (31.3)	
		Less than once per month	6 (18.8)	1 (3.1)	
	Post	1-2 times per 1-2 days	12 (37.5)	10 (31.3)	0.866
		2 times per week	16 (50)	19 (59.4)	
		Once per week	3 (9.4)	3 (9.4)	
		Less than once per week	1 (3.1)	0 (0)	
		Less than once per month	0 (0)	0 (0)	

Variable			Treatment N=32 n (%)	Control N=32 n (%)	P value
P value within the group			<0.001	<0.001	
Defecation time	Pre	Less than 5 min	6 (18.8)	5 (15.6)	0.321
		5-10 min	19 (59.4)	24 (75)	
		10-20 min	7 (21.9)	3 (9.4)	
	Post	Less than 5 min	27 (84.4)	12 (37.5)	<0.001
		5-10 min	5 (15.6)	20 (62.5)	
		10-20 min	0 (0)	0 (0)	
P value within the group			<0.001	0.002	
Assistance used for defecation	Pre	NO assistance	21 (65.6)	25 (78.1)	0.478
		Simulative laxatives	7 (21.9)	3 (9.4)	
		Digital assistance or enema	4 (12.5)	4 (12.5)	
	Post	NO assistance	27 (84.4)	24 (75)	0.659
		Simulative laxatives	2 (6.3)	2 (6.3)	
		Digital assistance or enema	3 (9.4)	6 (18.8)	
P value within the group			0.138	0.522	
Incomplete emptying	Pre	Never	3 (9.4)	1 (3.1)	0.112
		Rarely	16 (50)	17 (53.1)	
		Sometimes	9 (28.1)	14 (43.8)	
		Usually	4 (12.5)	0 (0)	
	Post	Never	16 (50)	5 (15.6)	0.001
		Rarely	16 (50)	21(65.6)	
		Sometimes	0 (0)	6 (18.8)	
		Usually	0 (0)	0 (0)	
P value within the group			<0.001	0.001	
Unsuccessful defecation	Pre	Never	1 (3.1)	0 (0)	0.131
		1-3 times	16 (50)	22 (68.8)	
		3-6 times	12 (37.5)	10 (31.3)	
		6-9 times	3 (9.4)	0 (0)	
	Post	Never	11 (34.4)	1 (3.1)	0.001
		1-3 times	21 (65.6)	28 (87.5)	
		3-6 times	0 (0)	3 (9.4)	
		6-9 times	0 (0)	0 (0)	
P value within the group			<0.001	0.005	
Abdominal pain	Pre	Never	2 (6.3)	0 (0)	0.512
		Rarely	9 (28.1)	8 (25)	
		Sometimes	22 (68.7)	24 (75)	
		Usually	0 (0)	0 (0)	
	Post	Never	14 (43.8)	2 (6.3)	0.001
		Rarely	17 (53.1)	25 (78.1)	
		Sometimes	1 (3.1)	5 (15.6)	
		Usually	0 (0)	0 (0)	
P value within the group			<0.001	<0.001	
Painful defecation	Pre	Never	8 (25)	2 (6.3)	0.083
		Rarely	10 (31.3)	16 (50)	
		Sometimes	14 (43.7)	14 (43.8)	
		Usually	0 (0)	0 (0)	
	Post	Never	20 (62.5)	10 (31.3)	0.037
		Rarely	9 (28.1)	18 (56.3)	
		Sometimes	3 (9.4)	4 (12.5)	
		Usually	0 (0)	0 (0)	
P value within the group			<0.001	<0.001	

Data were expressed as n (%). The Chi square test was used to examine the difference between categorical outcome variables, and the Wilcoxon test was used to examine within the groups (before and after). P<0.05 was considered statistically significant.

Discussion

According to the findings of the study, Kegel exercises were found to be an effective add-on treatment for functional constipation in children. Compared with the control group, patients in the treatment group showed significant improvements in terms of time spent in the toilet, complete emptying of stool, effort to defecate, abdominal pain, and comfortable defecation. Although a greater number of children in the treatment group no longer required stimulant laxatives and enemas to facilitate defecation, when comparing the two groups, this parameter was not statistically significant.

Constipation is frequently caused by the spasms of the pelvic floor muscles. Regular Kegel exercises might help relax the muscles. When the muscles are relaxed, defecation is easier. Kegel exercises can also help with bladder and bowel control and prevent pelvic floor muscle weakness.[16-18]

The previous studies evaluated the relationship between physical activity and functional constipation and reported controversial results. Farahmand and colleagues reported that 90% of patients had a general improvement in functional constipation symptoms after performing pelvic floor exercises for eight weeks. They concluded that these exercises were an effective non-pharmacological treatment for functional constipation in children. The improvement in stool frequency, diameter, and consistency was statistically significant. However, there was no statistically significant difference in stool withholding, fecal impaction, fecal incontinence, and painful defecation.[2] Moreover, a double-blind, single-center randomized clinical trial study on children aged 5-13 years in Tehran showed that the pelvic floor muscle exercises reduced the average constipation score.[19]

Silva and colleagues conducted a study on children aged 4-18 years and reported that physiotherapy could be a beneficial treatment for functional constipation. After 6 weeks, the combination of isometric abdominal muscle exercises, breathing exercises, and abdominal massage increased defecation frequency. However, the rate of fecal incontinence remained unchanged.[20] Another randomized trial showed that physiotherapy should be considered as a treatment option for functional constipation in children aged 5-16 years, as the success of physiotherapy and pharmacological treatment was greater than pharmacological treatment alone, with significantly more children in the physiotherapy group no longer required laxatives.[14]

A cohort study on the association between physical activity and functional constipation on 347 preschool children in Rotterdam found that two-year-old children with physical activity were at a lower risk of developing functional constipation by the age of four. Consequently, physical activity was associated with a lower risk of functional constipation in preschool children and suggested a time-dependent effect.[21] Furthermore, another study in Hong Kong demonstrated a link between insufficient physical activity and an increased risk of constipation, as well as that increased physical activity could reduce constipation symptoms in patients. However, Jennings and colleagues investigated the prevalence of constipation symptoms and evaluated the level of activity and fluid and fiber intake in children aged 7-10 and found that the level of physical activity was significantly higher in children with functional constipation.[22] This discrepancy could be attributed to the fact that the studies discussed above used different diagnostic criteria.

The strengths of the present study were the excellent sampling and randomization, with the two groups being well-matched in terms of baseline demographic characteristics. The main limitation of this study was its single-center design. Therefore, larger multi-center trials are recommended. Further studies are required to determine whether Kegel exercises can aid all children with constipation of any severity or only specific subgroups with functional constipation.

Conclusion

This study found that children with functional constipation who received both Kegel exercises and conventional therapy had significantly fewer symptoms than those who only received conventional therapy. Moreover, Kegel exercises might be a valuable add-on treatment for functional constipation in children.

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Authors' Contribution

N.Ach: Study design, data gathering, drafting; M.D: Study design and reviewing the manuscript; H.R: Data gathering and drafting; Mob.H:

Study design, data analysis, and reviewing the manuscript; N.H: Study design, and reviewing the manuscript; N.A: Study design, data gathering, drafting; Mah.H: Study design, and reviewing the manuscript; SM.D: Study design, and reviewing the manuscript, I.Sh: Study design, and reviewing the manuscript, M.A: Study design, and reviewing the manuscript; S.S: Study design, and reviewing the manuscript, F.Z: Data gathering and drafting, MH.I: Study design and reviewing the manuscript. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved.

Conflict of Interest

Mohammad Hadi Imanieh and Naeimehossadat Asmarian, as the Editorial Board Members, were not involved in any stage of handling this manuscript. A team of independent experts was formed by the Editorial Board to review the article without their knowledge.

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