



## Review Article

# Toilet training methods in children with normal neuropsychomotor development: A systematic review



<sup>a</sup>Universidade Federal de Minas Gerais, School of Medicine, Pediatrics Department, Nephrology Unit, Avenida Alfredo Balena 190, sala 267, Santa Efigênia, Belo Horizonte, Minas Gerais, 30130-100, Brazil

<sup>b</sup>Universidade Estadual de Feira de Santana, Urology Department, avenida transnordestina s/n, Feira de Santana, Bahia, 44036-900, Brazil

<sup>c</sup>Universidade Federal de Juiz de Fora, School of Medicine, Urology Department, Av. Eugênio do Nascimento s/n Dom Bosco, Juiz de Fora, MG, 36038-330, Brazil

<sup>d</sup>Faculdade de Ciências Médicas e da Saúde de Juiz de Fora e Maternidade Therezinha de Jesus, Urology Department, R. Dr. Dirceu de Andrade, 33 - São Mateus, Juiz de Fora, MG, 36025-330, Brazil

\* Correspondence to: Flávia Cristina de Carvalho Mrad, Universidade Federal de Minas Gerais, Faculdade de Medicina, Departamento de Pediatria, Unidade de Nefrologia, Pediátrica, Avenida Alfredo Balena, 190, Belo Horizonte, Minas Gerais, Postal Code: 30130-100, Brazil.  
[flaviacarvalhomrad@gmail.com](mailto:flaviacarvalhomrad@gmail.com) (F.C. de Carvalho Mrad)

**Keywords**

Toilet training; Potty training; Children; Approaches; Methods

Received 4 March 2021

Revised 6 May 2021

Accepted 9 May 2021

Available online 13 May 2021

Flávia Cristina de Carvalho Mrad <sup>a,\*</sup>, Maria Eduarda da Silva <sup>a</sup>, Eleonora Moreira Lima <sup>a</sup>, Ana Luiza Bessa <sup>a</sup>, José de Bessa Junior <sup>b</sup>, José Murillo Bastos Netto <sup>c,d</sup>, Mônica Maria de Almeida Vasconcelos <sup>a</sup>

**Summary****Background**

Toilet training (TT) is an important milestone in child development. The purpose of this review is to summarize the different TT methods found in the literature and determine their effectiveness for the TT process.

**Data sources**

Articles about toilet training were collected from databases, including PubMed and Scopus. The Preferred Reporting Items for Systematic Reviews (PRISMA) statement was used to guide the systematic review.

**Results**

Two main classifications were used: a child-oriented approach and a structured behavioral approach.

**Introduction**

Toilet training (TT) is an important milestone in child development, representing a complex process that can be affected by anatomic, physiologic and behavioral conditions. It often represents a great challenge for children, parents, and physicians [1–4]. A child is considered fully trained when he/she is aware of his own need to eliminate urine and stool and initiates the act without being remembered or prepared by parents or caregivers [5].

Several factors can influence the TT process, such as mother's age, parental education level, mother's working status, single parenthood, family's socioeconomic status, race, gender, and prematurity. Late-onset of TT was associated with older mothers [6], a higher level of maternal education [6–8], mother working outside the household [9], single mothers [10] and families with a higher socioeconomic status [7,8]. Preterm children

Most children were trained by the structured behavioral approach, with early onset, but at the age of completion of TT, similar to those who used a child-oriented approach. Success rates, in the few studies that reported, were better with the child-oriented approach. The lowest reported success rate was the daytime humidity alarm approach. There is no consensus on the best method to be used, as it involves a wide variety of parents' preferences and expectations and cultural differences, with studies showing great heterogeneity and methodological flaws that make meta-analysis unfeasible.

**Conclusions**

The approaches have not been directly compared, so it isn't possible to make definitive claims about one method's superiority over the other.

start [11] and complete TT [8,9] later than full-term children. Caucasian parents begin toilet training at a significantly later age compared to African-American parents and those of other ethnicities [10]. Regarding gender, several studies have described that girls achieve almost all TT skills before boys [8,10,12,13], including completing it [8,12]. Girls are physically more mature than boys and have more advanced language skills, which facilitate the TT process [12,14]. It seems that boys may have the additional obstacle of learning to adopt different postures to urinate and evacuate [14]. However, other authors have found no gender differences in relation to the age of the TT process [7,9].

In the past 50 years, the average age at which children with normal neuropsychomotor development start and complete TT has been postponed from 18 to 24–36 months and from 24 to 36–39 months, respectively [7,12,15,16]. This late initiation may be related mainly

to the use of disposable diapers and working parents [12,16]. The duration of the TT physiological process may vary between 6 and 12 months [7,8,16]. However, it is common a very early training of infants that can start at two to three weeks of age and be completed in around 12 months, in some Asian and African countries [2,4,10].

Toilet training methods have fluctuated over the last 100 years [16,17]. In the late 19th and early 20th centuries, TT was considered a passive and permissive process determined by parents [14,18]. In 1932, U.S. Government published a book called "Child Care", which recommended that children complete TT at eight months of age. To facilitate the bowel training process, parents were instructed to use the "soap stick" rectal conditioner, called "coercive bowel training", and the need for regularity and programming of bowel movements was emphasized [19]. In the 1940s, pediatric specialists began to reject absolute rules for the TT process, due to a theory that rapid and rigid training could determine a failure to obtain continence and cause behavioral disorders. In addition, at that time, parents began to be instructed to identify their children's readiness for TT before starting this process [1,14,20]. In 1962, Brazelton developed a child-oriented approach, based on TT's readiness signs, from a retrospective review of the medical records from 1170 patients followed up at his pediatric clinic [1,21]. Benjamin Spock addressed toilet training in *Baby and Child Care*, published in 1968. He recommended a child-oriented approach like Brazelton's, being against absolute rules that could result in behavioral problems [22]. Next, Azrin and Fox described a structured behavioral and parent-oriented method [23,24]. Over the past 40 years, studies have shown TT as a fundamental part of child development. Even though there is much discussion on the most appropriate method for achieving continence, little research has been done to define the best method [1,4,14,17]. Therefore, this systematic review aims to describe the different methods used and determine the effectiveness of the TT process.

The various TT methods were grouped in two approaches: Child-oriented and Structured behavioral approaches [4], as described below.

## Child-oriented approach

### Brazelton child-oriented method

Introduced in 1962, the Brazelton child-oriented approach [21] emphasizes that the TT process should only be started when the children present themselves physiologically and behaviorally ready to train (readiness signs) [1,2,4,14,15,17,21]. It comprises three variant pillars of the child's neuropsychomotor development: physiological maturation (as the ability to sit, walk, dress, and stay dry for more than 2 h), external feedback (i.e., understands and responds to instruction), and the development of self-esteem and motivation (desire to imitate and identify with mentors, self-determination, and independence) [1,2,21].

The equipment used in Brazelton child-oriented approach [21] is the potty, considered a device that helps in the evaluation of the readiness signs. Parents must present it as the child's personal object. It can be colored and set in

a helpful area to pull in the child to use it. The child should be taught to observe, touch, and become familiar with the potty, before its use is encouraged. Parents should offer the child the opportunity to utilize it, but they should not force the child to use it or remain on it. When the child begins to show an interest in using the potty chair, the parents should let the child sit on it fully clothed, to avoid initial discomfort. To offer help to the child to conceptualize and understand the method, parents may be instructed to demonstrate the reason for using the potty, for example, by depositing the contents of the dirty diapers on it. The transition to the toilet will start when the child is safe and trained to use the potty. In this approach, there's no negative reinforcement, such as punishments, and positive reinforcement may be carried out with praise and supply of treats [1,2,14,17,21].

In Brazelton's approach, each stage of development is recognized so that parents can anticipate the progress of TT and plan the steps to follow. At 18 months of age, children may present readiness signs; at 24 months, a step-by-step approach should be initiated to instruct what part of it is in the preparation; at 30–36 months, most children will have achieved daytime continence and, finally, between 36 and 48 months, most children will have completed TT with the acquisition of nighttime continence [1,14,17,21]. The readiness signs are described in Fig. 1 [1,17].

### American academy of pediatrics guidelines: child-oriented approach

The American Academy of Pediatrics (AAP) guidelines incorporate many of the components of Brazelton's child-oriented approach [21]. However, the AAP does not recommend the use of treats as a positive reinforcement [1,14,17]. The AAP recommends that training begins at around 24–36 months of age, using a potty, and that parents be instructed to assess readiness signs (Fig. 1) for TT [1,17]. This approach guides gradual TT, in which parents expect the children to show that they are prepared for the next step, without forcing them [2,4,14,15].

## Structured behavioral approach

### Azrin and Foxx method

In 1973, Azrin and Foxx developed the "TT in a day" [23], an intensive, structured, and parent-oriented method, to achieve specialized training, based on the principles of conditioning and imitation [14,17,23,24]. Component skills of this approach include physiological readiness with periods of dryness and physical ability to perform tasks related to TT, and psychological readiness, represented by the ability to understand and follow instructions [14,17,21,23,24]. Initially, it was developed to achieve bladder continence and, later, this method was adapted to also achieve intestinal continence [17,22,23]. In this approach, the TT is carried out in a training area, without any means of distraction, and equipped with the necessary training material (car seat, children's clothes, dolls that the child identifies that can use a wet diaper). It is based on increasing the child's fluid intake, enough to make him feel

1. Imitates parental behavior
2. Seeks to please others
3. Seeks to be autonomous: completes tasks without help and takes pride in new skills.
4. It is able to point out what you want.
5. It is able to pick up small objects
6. Can walk without help
7. It is capable of sitting stable and without help
8. Demonstrates independence and uses the word “no”
9. Can follow simple instructions
10. Is able to pull clothes up and down.
11. It has a simple vocabulary referring to toilet training
12. Uses words, facial expressions, or movements that indicate the need to urinate or evacuate.
13. Follows parent into bathroom and expresses interest in the toilet
14. Awareness of bladder sensations and the need to void
15. Stays dry for two hours at a time or is dry following naps
16. Has regular and predictable bowel movements
17. Reports soiled diapers and wants a clean diaper
18. Asks to use potty-chair
19. Continues playing with the same activity for more than 5 minutes
20. Can stand on the potty-chair or toilet for 3 to 5 minutes.
21. Wants to be clean and is distressed by wet or soiled diapers
22. Wants to wear underwear

**Fig. 1** Main Readiness Signs in children with normal neuropsychomotor development [1,17].

like urinating. Timed intervals are determined, encouraging the child to approach the potty, sit for a few minutes, raise and pull the pants. Besides, parents also check that their pants are dry during regular breaks. Parents should reinforce immediately with praise, hugs, toys and treats when children remain dry or can urinate or evacuate on the potty. Also, they should avoid negative reinforcement and verbal reprimand and omission of positive reinforcement when there is urinary loss [1,14,17,23,24]. This method is less used worldwide, but it is also recognized as effective by the AAP [4,14].

### Intensive toilet training method

Intensive TT approach consists of setting the children on potty or taking him/her to the toilet on regular intervals regardless of his/her readiness. Parents should regularly ask the child whether she/he had to go to the potty or toilet. The purpose of this approach is to establish appropriate behavior towards TT. Dryness is rewarded with positive reinforcement through affection, toys or sweets. Accidents can be reinforced negatively, usually through punishment or lack of positive attention [2,7,14,25–27].

### Assisted infant toilet training

Assisted infant toilet training starts between 2 and 3 weeks of age, with an average of 4–6 months of age [18]. Parents need to be trained to recognize and understand the signs of their child’s elimination [14,28]. In this approach, when the baby looks like he is going to urinate or evacuate, he is placed in a special position (in the caregiver’s arms to allow

for easy elimination) and the parents make a noise so that he could associate with the act of eliminating. When the baby urinates or evacuates with the specific noise, he is rewarded, usually, with food or affection [4,14,17,29].

### Elimination communication

This method is started at birth. Parents need to learn to recognize body language, bowel, and bladder noises and rhythms to determine when the infant is about to urinate or evacuate. The infant is then placed on the sink, toilet, or miniature potty and the parents makes a sound similar to running water. The main benefits of this strategy include reduced diaper expenses, reduced pollution of the environment by disposable diapers, improvements in the bonds between parents and children, and greater comfort for the infant [14,17,30].

### Daytime wetting alarm diaper

The daytime wetting alarm system is a device connected to the diaper and rings when wet. This system is an accepted treatment in children with bed wetting but it has seldom been used for toilet training. This approach begins in children 18–36 months of age [31,32]. Parents and guardians must place the child in the toilet or potty when the device rings [2,31,32]. Bladder control can be successfully trained in this age group in days, with a properly explained use of a wetting alarm during the day, good parental attention, and positive reinforcement, and can be performed in daycare centers [31,32].

## Methods

### Source and search strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was used to guide the systematic review [33]. We searched PubMed and Scopus for literature on TT. The following search terms were used: "Toilet training" or "Potty training". We only selected publications dealing participants who had to be 12 years old or younger, with a normal neuropsychomotor development and without history or clinical signs of an organic urologic disease, which could influence the TT process.

### Study selection

Reviews, letters, case reports, recommendations, and comments were also excluded. Moreover, only publications written in English or Portuguese were included. In these publications, we specifically searched the method used in the TT process.

Two reviewers independently examined titles and abstracts to select eligible studies and filter out duplicates. Afterward, they assessed the title of each study and the summary for searching the relevant articles. When disagreement was identified between reviewers, the full text of the article was retrieved; controversies were again considered and discussed until consensus was reached. If controversies had persisted, a third reviewer would have been consulted to determine final inclusion. Two reviewers evaluated the full text of the articles included in the final selection. A data extraction table was used to organize the information. The following data were extracted: (a) Study identification: first author, year and date of publication, study setting, and country or region; (b) Study design; (c) Participants: age, gender, sample size. (d) Variables: TT method type, equipment utilized, time of TT duration, age of initiation and end of the TT, readiness signs, TT success or failure.

### Risk of individual bias

The methodological quality of the eligible studies was independently assessed by both reviewers using Cochrane collaboration tool to evaluate the risk of bias (it classifies types of selection, performance, detection, attrition, and reporting bias, classifying as low risk, high risk, and uncertain risk). Extracted data were analyzed using the non-Cochrane mode in the RevMan 5.3 software [34].

## Results

The search term "Toilet training" or "Potty training" gave 1.253 results in PubMed and 1.309 in Scopus. After de-duplication, 1.493 studies remained, which were screened on title and abstract. Of these 1.493 found articles, 382 articles were excluded because they were reviews,

systematic reviews, meta-analysis, letters, case studies, or essays, 100 papers were excluded because they were not written in English or Portuguese, 895 were excluded because they did not meet criteria mentioned in the Methods section. Also 101 articles fulfilled the inclusion criteria section but were excluded because they did not address the TT methods. Therefore, 15 of these 1493 articles fulfilled the inclusion criteria mentioned in the Methods section and were included in this systematic review. The TT methods discussed in these articles are reviewed in the following section. In accordance with the PRISMA statement [33], the flowchart summarizing the literature search process is shown in Fig. 2.

The summary of risk of bias within studies is presented in Fig. 3. An inadequate description of randomization and allocation concealment, and failure to report attrition were rated as a high risk of bias.

**Definition of TT used in this review:** Age at which toilet training was completed was defined as the age at which a child maintained full bladder and bowel control, without any failure in holding urine or stool during the day and night [7].

**Data-items:** Outcome measures were as follow: 1) patient type (age, gender, and corresponding number of participants), 2) method of TT used, 3) type equipment, 4) average initial and final age, 5) TT duration time, 6) factors associated, 7) success and/or failure (Table 1).

**Study characteristics:** Among the total of 15 eligible studies included 8 cross sectional, 3 longitudinal studies, 1 randomized control trial, 2 prospective studies and 1 case-control. The age of the participants from the included literature ranged between <1 month [35] and 38 months [36]. The number of subjects varied between 34 [23] to 1.467 [7]. Five studies were performed in USA [13,21,23,36,37], four in Europe [26,32,38,39], five in Asia [7,27,35,40,41] and one in Brazil [9].

**The different methods used for toilet training:** Child-oriented approach [9,13,21,27,35–37], and structured behavioral approach: Azrin and Foxx method [9,23], intensive toilet training method [7,27,35,36,38], combined methods [35], elimination communication [41], assisted infant toilet training [40] and daytime wetting-alarm [9,32] and others [7,9,27,39].

**Syntheses of the results:** Two main distinctions between TT can be made: Child-oriented approach and structured behavioral approach.

**Child-oriented approach:** This approach emphasizes that the TT process should only be initiated when children are physiologically and behaviorally ready to train, by analyzing the signs of readiness described in Table 1. The studies samples ranged from 52 [35] to 1.170 [21], with a total of 2.368 children being trained with this approach [9,13,21,27,35–37]. The gender of the trained children ranged from 41% [27] to 58% [21] male, and 42% [21] and 59% [27] female. Half of the studies used a single approach [13,21,37], and other half had more than one group [9,27,35], being part trained by the child-oriented approach and another part undergoing structured behavioral approach. The type of equipment most frequently

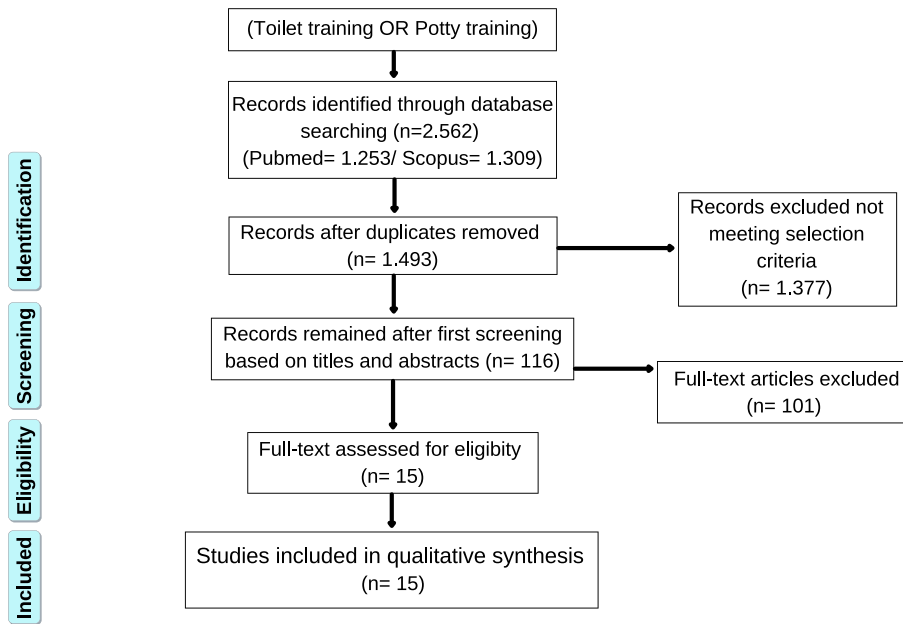


Fig. 2 Preferred reporting items for systematic review (PRISMA) flow diagram of literature search process and result.

reported was the potty-chair (varying from 43.6% to 94.6%) [9,21,37]. The main adverse effects reported were constipation [9,21,35] and stool toileting refusal [9,37]. The success rate varied between 80% [21] and 88.4% [9], but most studies did not describe this data objectively.

**Structured behavioral approach:** Unlike the approach described as child-oriented, the other used methods did not take into account the child’s physiological or psychological development, having its beginning and stages defined by the parents. Different methods were grouped in this

classification, including Azrin and Foxx [9,23], daytime wetting alarm [9,32], assisted infant [40], training elimination communication [41], intensive toilet training method [7,27,35,36,38], and other methods that have been described [7,9,27,39]. The N of the studies’ samples included in this category ranged from 34 [24] to 1.467 [7], with a total of 3.596 children trained using different parent-oriented approaches. The studies came from 8 different countries. The main equipment used was the potty [7,9,21,23,26,32,36–39,41], but also other

| Study                                 | Random sequence generation (selection bias) | Allocation concealment (selection bias) | Blinding of participants and personnel (performance bias) | Blinding of outcome assessment (detection bias) | Incomplete outcome data (attrition bias) | Selective reporting (reporting bias) | Other bias |
|---------------------------------------|---|---|---|---|--|--------------------------------------|------------|
| Bakker et al., 2001                   | +   | +                                       |   |   | +  | +                                    |            |
| Benjasuwanterp & Ruangdaraganon, 2011 | +   | +                                       |   |   | +  | +                                    |            |
| Blum et al. 2003                      | +   | +                                       |   |   | +  | +                                    |            |
| Brazelton T., 1962                    | +   | +                                       |   |   | +  | +                                    |            |
| Duong et al., 2013                    | +   | +                                       |   |   | +  | +                                    |            |
| Fox RM & Azrin NH, 1973               | +   | +                                       |   |   | +  | +                                    |            |
| Hoonan et al., 2013                   | +   | +                                       |   |   | +  | +                                    |            |
| Kaeris et al. 2014                    | +   | +                                       |   |   | +  | +                                    |            |
| Martin et al., 1984                   | +   | +                                       |   |   | +  | +                                    |            |
| Netto et al., 2020                    | +   | +                                       |   |   | +  | +                                    |            |
| Tarhan et al., 2015                   | +   | +                                       |   |   | +  | +                                    |            |
| Taubman B., 1997                      | +   | +                                       |   |   | +  | +                                    |            |
| van Aggelpoel et al., 2018            | +   | +                                       |   |   | +  | +                                    |            |
| Vermandel et al., 2009                | +   | +                                       |   |   | +  | +                                    |            |
| Yang et al., 2011                     | +   | +                                       |   |   | +  | +                                    |            |

Fig. 3 Risk of bias summary: review authors’ judgements about each risk of bias item for each included study..

**Table 1** Characteristics of the 15 studies that constitute the sample.

| Study ID                                  | Country  | Study type                     | Approach of TT  | Method of TT   | Type Equipment   | Patient type                   |   |        | Age initial TT bladder in months        | Age end TT bladder months                             | Time of duration TT months                 | Factors associated with TT age   | Success (%)       |
|---|----------|--------------------------------|---|--|--|--------------------------------|---|--------|---|---|--|--|-------------------|
|   |          |                                |   |  |  | N                              | Age (Median, Range) months                        | Male   |   |   |  |  |                   |
| Brazelton T., 1962 [21]                   | USA      | Cross sectional; observational | Child-Oriented  | Child-Oriented   | Potty chair  | 1170                           | 18.8% btw 12-18; 20.9% 18-24; 54.7% by 24         | 57.40% | 22.47±3.81*                             | 28.5±4.39*  | -  | gender - no difference   | 80,70%            |
| Fox RM & Azrin NH, 1973 [23]              | USA      | Cross sectional; observational | Structured behavioral approach  | Azrin and Foxx   | Potty chair  | 34                             | 25  | 64.7%  | 25 (20-36)**                            | 25§   | 3.9 hours                                  | -  | 100%              |
| Martin et al., 1984 [13]                  | USA      | Longitudinal study             | Child-Oriented  | Child-Oriented   | Not described  | 71                             | Assessment at the ages 9, 18, 26, and 33          | 49%    | 18-26***                                | 26-33***  | -  | Girls x early TT   | -                 |
| Taubman B., 1997 [37]                     | USA      | Prospective study              | Child-Oriented  | Child-Oriented   | Potty chair  | 482                            | 18 a 30   | 52,9%  | 22.98 ± 4.29*                           | (30) 22% (36) 60% (42) 88% ‡                          | -  | Girls x early TT - stool toilet refusal x late TT mother's working- no difference            | 88% by 42m        |
| Bakker et al., 2001 [39]                  | Belgium  | Case-control                   | Structured behavioral approach  | Alternated between the intensive (34% - 22) and the oriented-children method (34%). In the symptom group, parents used 3 or 4 different methods at a time (the methods not specified).   | Potty chair  | 140                            | 138   | 47%    | <18 (23.6%) ‡ 18-30 (67.1%)             | -   | -  | -  | -                 |
| Blum et al. 2003 [36]                     | USA      | Prospective study              | Structured behavioral approach<br>Child-oriented  | Intensive TT method 79%<br>Child-oriented 21%  | Potty chair  | 378                            | 17 to 19  | 52%    | 20.9 ± 2.6*                             | 36.8 ± 6.1* Male: 38.0 ± 5.6 Female: 35.8 ± 6.6       | -  | Girls x early TT   | -                 |
| Vermandel et al., 2009 [32]               | Belgium  | Randomized control trial       | Structured behavioral approach  | Daytime Wetting Alarm  | Potty chair  | 39                             | 24.8 ± 9.0  | 51%    | 24.8§                                   | 26.7 ± 1.5*   | 14 days                                    | gender - no difference   | 52%               |
| Yang et al., 2011 [35]                    | Taiwan   | Cross-sectional                | Child-Oriented<br>Structured behavioral approach<br>Structured behavioral approach<br>- | Child-Oriented: 15.2- 23.5%<br>Structured behavioral approach (Urination at fixed times) 35.2- 56.1%<br>Combined methods: 25.4 - 29.6%.<br>Unknown or do not remember 4.6- 12.7%   | Not described  | 235                            | 57,6±10.8   | 45%    | 24.4±8.4*<br>Male: 25.7<br>Female: 23.3 | -   | <1: 19%<br>1-6: 62%<br>7-12: 7%<br>>12: 3% | Girls x early TT   | -                 |
| Benjasuwantep & Ruangdaragonon, 2011 [40] | Thailand | Longitudinal study             | Structured behavioral approach  | Assisted infant  | Not described  | 50                             | The infants were followed at 1, 2, 4, 6, 9 and 12 | 56%    | 4-12 (80.9%) ‡                          | 12 (61%)  | 1.54                                       | -  | 96%               |
| Duong et al., 2013 [41]                   | Vietnam  | Longitudinal study             | Structured behavioral approach  | Training Elimination Communication   | Potty chair  | 47                             | 0 to 24   | 55%    | 9§                                      | 12- 24***   | -  | -  | -                 |
| Hooman et al., 2013 [27]                  | Iran     | Cross-sectional                | Child-Oriented<br>Structured behavioral approach<br>-                                   | Child-Oriented: 44,4%<br>Intensive Method 52,1%<br>Unknown or do not remember 3,4%   | Not described  | 556 - 349 described methods TT | 67,2 ± 36   | 41%    | 12 -24***                               | 12-24 (47%) ‡ >24 (49%)<br>Male: 33.5<br>Female: 28.8 | -  | Girls x early TT   | -                 |
| Kaerts et al. 2014 [26]                   | Belgium  | Cross-sectional                | Structured behavioral approach  | Put the child on the potty in regular time points 104(65%); Regularly ask child whether she/he had to go to the potty 105(60.7%); Remove the diaper 96(55.5%); Reward the child 87 (50.3%); Imitation use the toilet 54(31.2%); Read book to the child on the use of the toilet and TT process 46 (26.6%); Other method: not insist, put the potty in sight, making sounds when the child is on the potty 18 (10.4%); Letting to child press 11(6.4%); Give the child a lot to drink 6(3.5%); Punish the child 2(1.2%) | Potty chair  | 221                            | 15-35   | 50%    | 19-35***                                | 26.2§   | -  | -  | -                 |
| Tarhan et al. 2015 [7]                    | Turkey   | Cross-sectional                | Structured behavioral approach<br>Structured behavioral approach                        | Rewards model 93%<br>Modeling an older sibling or parents (not described model) 7%   | Potty chair: 7% - Regular toilet: 46.8% - Turkey style: 44.4%  | 1467                           | 80.4 ± 26.2                                       | 50%    | -                                       | 22.32±6.57*   | 6.60 ± 2.20                                | gender or mother's working -no difference higher mother's education & income level x late TT | 100%              |
| van Aggelpoel et al., 2018 [38]           | Belgium  | Cross-sectional                | Structured behavioral approach  | The methods used most often when toilet trained were to leave the nappy off (71%, n=588), to seat the child onto the potty on a regular basis (69%, n=563), to ask the child whether he or she has an urge to urinate (63%, n=516) and to give a reward (57%, n=470).  | Potty chair: 71%   | 832                            | 18-72   | 50%    | -                                       | 27.8 ± 5.2* Male: 28.6 Female: 26.6                   | 4.9  | Girls x early TT   | 83% by 30 months. |
| Netto et al., 2021 [9]                    | Brazil   | Cross-sectional                | Child-Oriented<br>Structured behavioral approach<br>-                                   | Child-Oriented: 93%<br>Structured behavioral approach 0.8% (Azrin- Foxx, Daytime Wetting Alarm)<br>Others - 6,2%   | Potty chair: 43,6% - Toilet with reducer: 18,9% - Toilet with feet support: 8,7% - Regular toilet: 28,6% | 372                            | 45  | 47%    | <18 (12.9%) 18- 36 (42.2%) ‡            | 31.6±9.3*   | -  | gender -no difference; mother's working x late TT  | 88,45%            |

\* Mean ± SD (standard deviation); \*\* Mean (range); \*\*\* range; § mean; ‡ range (percentage)

equipment was mentioned as a toilet with reducer and footrest [9], regular toilet [9] and turkey style [7]. The success rate varied between 52% [32] and 100% [23].

## Discussion

TT is a complex process that can be affected by anatomical, physiological and behavioral conditions. There is no consensus on the best method to be used, as it involves a wide variety of parental preferences and expectations as well as cultural differences [2,3]. The literature shows scarce research on the topic, which limits conclusive recommendations [42]. Thus, this review aimed to describe the TT methods, comparing the frequency among them. For this, the methods were categorized into two groups, a child-oriented approach and structured behavioral approach [4]: Azrin and Foxx method, intensive toilet training method, elimination communication, assisted infant toilet training and Daytime Wetting-Alarm).

The structured behavioral approach was the most studied, according to the literature in this review, with 3.456 children receiving this type of training. Only 2.338 children were trained following a child-oriented approach. Only one study described the use of the combined methods [35]. The difference between the value of groups trained using different approaches may be due to the following explanation: While the child-oriented approach encompasses only the method defined by Brazelton and/or recommended by the AAP [9,13,21,27,35–37], the structured behavioral approach covers at least five different methods [7,9,23,27,35,36,38,40,41]. Although different approaches have been discussed for quite 60 years, there are few comparative studies seeking to find out the most effective [9,27], and the evaluation of the success rate in the available studies is still scarce. The choice of which method to use is mainly culturally defined by information from family members and the community. Evidence-based and physician-guided recommendations, which are rarely consulted in the process of TT, play a less important role [3,9,26,27].

The structured behavioral approach showed that TT started earlier [7,9,23,27,35,36,38,40,41] with ages ranging from 4 [40] to 25 months [23]. The child-oriented approach values the child's natural development, allowing appropriate time for the child to achieve dominance on its own [9,13,21,27,35–37]. The studies that used this approach mainly come from the USA [13,21,37] and Brazil [9]. Another two studies from Taiwan [35] and Iran [27] also used the child-oriented approach, however most of the samples used a structured behavioral approach. U.S. children achieve most toileting readiness skills between 18 and 26 months of age [13,21,27]. Several studies of this revision showed that the TT skills develop earlier in girls than in boys [13,27,35–38]. It seems that girls' physical and language skills mature sooner than boys [12]. As many aspects in TT, this finding is also controversial as others studies showed similar age by the end of the TT between boys and girls [7,9,21,32].

It drew attention in this review that the age of the complete TT was the same, regardless of the type of approach used, including the elimination communication

approach, with an average of 24–36 months. This determined only a longer time in the formative process, which could generate stress and discomfort for children and families and was not reported in any article selected in this review. There is no evidence that a structured approach, even with the intensive method, before 27 months, is associated with complications such as stool retention, constipation, refusal to go to the bathroom, hiding to defecate, lower urinary tract dysfunction or enuresis [4,37]. The factors that are associated with late TT are not clear [7,9]. In this revision, some studies described factors that can influence the TT [7,9,13,27,37]. Netto et al. have reported that mother working status is related to an increasing age for completing the TT [9] in disagreement with others studies [7,37]. A high mother's education and a better family income level were associated also with late TT [7]. Another factor that can difficult the TT, increasing the final process age, is stool toileting refusal, this behavior could lead to stool withholding and severe constipation [37]. The one article that described complete TT at a very early age (12 months) was conducted in Thailand, using assisted infant TT approach [40].

Regarding efficiency of methods, rates of 80–88.4% [9,21] and 52% [32] to 100% [23] were reported for child-oriented and structured behavioral approaches, respectively. Noteworthy the assisted infant approach used by Benjasuwantep & Ruangdaraganon [40] reported 96% efficiency, with all children being trained before 12 months. Azrin and Foxx [23] in the original study that developed their method had 100% success, with the shortest training time reported (between 1 and 10 h, with an average of 3.9 h). However, parents who tried to replicate this method without the assistance of a professional did not obtain similar rates, showing high application's complexity. Studies have suggested that an intensive procedure without continuous professional supervision is not effective and creates many emotional effects for a child [14]. It is emphasized that the daytime wetting alarm approach, one of the structural behavioral techniques, was more effective than placebo. However, it was the least efficient of all the methods studied, with a success rate of 52%. In this study the main limitation was that the training process was carried out only at the daycare center, without home evaluation [32]. Vermandel et al. [31] reports that the daytime alarm approach has some advantages over other TT methods, highlighting that the child and parents are warned when micturition has started. Therefore, it would be essential to assess the effectiveness of this approach through its application at home.

The limitations of this systematic review are the following. First, research on toilet training has been hampered by heterogeneity and methodological flaws, including bias, lack of standardization of TT terminologies, including cultural definitions, successes, failures and factors that may affect TT and the lack of statistical analysis. Yet, given the heterogeneity of the studies, we were unable to apply a meta-analysis. The research sought to locate all the relevant literature on the topic, but we recognize some studies may have been lost. We believe that the excluded studies were carried out for consistent and adequate reasons.

## Conclusion

TT methods were categorized into two groups: a child-oriented and a structured behavioral approach. Most children were trained by the structured behavioral approach, with early onset. The age of completion of TT was similar to both. Success rates, reported by few studies, were better with the child-oriented approach. The lowest reported success rate was the daytime humidity alarm approach. The approaches have not been directly compared, so it isn't possible to make definitive claims about one method's superiority over the other. Large prospective cohort studies and randomized clinical trials will be needed for this purpose and also to assess long-term maintenance of continence.

## Funding source

No funding.

## Ethical approval

Not needed.

## Conflict of interest statement

No financial or nonfinancial benefits have been received or will be received from any party related directly or indirectly to the subject of this article.

## Acknowledgement

Research supported by Pro-Reitoria de Pesquisa-UFMG Grant PRPQ-UFMG 26048\*104.

## References

- [1] Stadtler AC, Gorski PA, Brazelton TB. Toilet training methods, clinical interventions, and recommendations. *American Academy of Pediatrics. Pediatrics.* 1999;103:1359–68.
- [2] Kiddoo DA. Toilet training children: when to start and how to train. *CMAJ (Can Med Assoc J)* 2012;184:511–2.
- [3] Howell DM, Wysocki K, Steiner MJ. Toilet training. *Pediatr Rev* 2010;31:262–3.
- [4] Baird DC, Bybel M, Kowalski AW. Toilet training: questions and answers. *Am Fam Physician* 2019;100:468–74.
- [5] Mota DM, Barros AJ. Toilet training: methods, parental expectations and associated dysfunctions. *J Pediatr* 2008;84:9–17.
- [6] Joinson C, Heron J, Von Gontard A, Butler U, Emond A, Golding J. A prospective study of age at initiation of toilet training and subsequent daytime bladder control in school-age children. *J Dev Behav Pediatr* 2009;30:385–93.
- [7] Tarhan H, Cakmak O, Akarken I, Ekin RG, Un S, Uzelli D, et al. Toilet training age influencing factors: a multicenter study. *Turk J Pediatr* 2015;57:172–6.
- [8] Mota DM, Barros AJ, Matijasevich A, Santos IS. Longitudinal study of sphincter control in a cohort of Brazilian children. *J Pediatr* 2010;86:429–34.
- [9] Netto JMB, De Paula JC, Bastos CR, Soares GD, De Castro KKV, Do Carmo AV, et al. Personal and familial factors associated with toilet training. *Int Braz J Urol* 2021;47:169–77.
- [10] Schum TR, McAuliffe TL, Simms MD, Walter JA, Lewis M, Pupp R. Factors associated with toilet training in the 1990s. *Ambul Pediatr* 2001;1:79–86.
- [11] Yildiz D, Suluhan D, Eren Fidanci B, Mert M, Tunc T, Altunkaynak B. The differences between preterm and term birth affecting initiation and completion of toilet training among children. A Retrospective Case-Control Study *Urol J.* 2019;16:180–5.
- [12] Schum TR, Kolb TM, McAuliffe TL, Simms MD, Underhill RL, Lewis M. Sequential acquisition of toilet-training skills: a descriptive study of gender and age differences in normal children. *Pediatrics* 2002;109:E48.
- [13] Martin JA, King DR, Maccoby EE, Jacklin CN. Secular trends and individual differences in toilet-training progress. *J Pediatr Psychol* 1984;9:457–67.
- [14] Klassen TP, Kiddoo D, Lang ME, Carol Friesen, Kelly Russel, Carol Spooner, et al. The effectiveness of different methods of toilet training for bowel and bladder control. *Evid Rep Technol Assess* 2006;147:1–57.
- [15] Colaco M, Johnson K, Scheneider D, Barone J. Toilet training method is not related to dysfunctional voiding. *Clin Pediatr* 2013;52:49–53.
- [16] Van Nunen K, Kaerts N, Wyndaele JJ, Vermandel A, Hal GV. Parent's views on toilet training (TT): a quantitative study to identify the beliefs and attitudes of parents concerning TT. *Child Health Care* 2015;19:265–74.
- [17] Choby B, George S. Toilet training. *Am Fam Physician* 2008;78:1059–64.
- [18] eVries MW, deVries MR. Cultural relativity of toilet training readiness: a perspective from East Africa. *Pediatrics* 1977;60:170–7.
- [19] US Dept of Labor, Children's Bureau. *Infant Care (report), vol. 8.* Publication; 1932.
- [20] Lieberman L. The changing ideology of socialization: toilet training, mass media, and society. *J Contemp Sociol* 1972;9:188–99.
- [21] Brazelton TB. A child-oriented approach to toilet training. *Pediatrics* 1962;29:121–8.
- [22] Spock B. *Baby and child Care.* New York (NY): Meredith Press; 1968.
- [23] Foxx RM, Azrin NH. Dry pants: a rapid method of toilet training children. *Behav Res Ther* 1973;11(4):435–42.
- [24] Azrin N, Foxx R. *Toilet training in less than a day.* New York, NY: Simon & Schuster; 1974.
- [25] Staddon JE, Cerutti DT. Operant conditioning. *Annu Rev Psychol* 2003;54:115–44.
- [26] Kaerts N, Vermandel A, Van Hal G, Wyndaele JJ. Toilet training in healthy children: results of a questionnaire study involving parents who make use of day-care at least once a week. *Neurourol Urodyn* 2014 Mar;33:316–23.
- [27] Hooman N, Safaai A, Valavi E, Amini-Alavijeh Z. Toilet training in Iranian children: a cross-sectional study. *Iran J Pediatr* 2013;23:154–8.
- [28] Smeets PM, Lancioni GE, Ball TS, et al. Shaping self-initiated toileting in infants. *J Appl Behav Anal* 1985;18:303–8.
- [29] Sun M, Rugolotto S. Assisted infant toilet in a Western family setting. *J Dev Behav Pediatr* 2004;25:99–101.
- [30] Bender JM, She RC. Elimination communication: diaper-free in America. *Pediatrics* 2017;140:e20170398.
- [31] Vermandel A, Weyler J, De Wachter S, Wyndaele JJ. Toilet training of healthy young toddlers: a randomized trial between a daytime wetting alarm and timed potty training. *J Dev Behav Pediatr* 2008;29(3):191–6.
- [32] Vermandel A, Van Kampen M, De Wachter S, Weyler J, Wyndaele JJ. The efficacy of a wetting alarm diaper for toilet training of Young healthy children in a day-care center: a randomized control trial. *Neurourol Urodyn* 2009;28:305–8.



- [33] Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;4:1.
- [34] Higgins JPT, Green S (editors) *Cochrane handbook for systematic reviews of interventions*, 5.1.0 edn. [www.cochrane-handbook.org](http://www.cochrane-handbook.org).
- [35] Yang SS, Zhao LL, Chang SJ. Early initiation of toilet training for urine was associated with early urinary continence and does not appear to be associated with bladder dysfunction. *Neurourol Urodyn* 2011;30:1253–7.
- [36] Blum NJ, Taubman B, Nemeth N. Relationship between age at initiation of toilet training and duration of training: a prospective study. *Pediatrics* 2003;111:810–4.
- [37] Taubman B. Toilet training and toileting refusal for stool only: a prospective study. *Pediatrics* 1997;99:54–8.
- [38] Van Aggelpoel T, De Wachter S, Van Hal G, Van der Cruyssen K, Neels H, Vermandel A. Parents' views on toilet training: a cross-sectional study in Flanders. *Nurs Child Young People* 2018;30:30–5.
- [39] Bakker E, Van Gool J, Wyndaele JJ. Results of a questionnaire evaluating different aspects of personal and familial situation, and the methods of potty-training in two groups of children with a different outcome of bladder control. *Scand J Urol Nephrol* 2001;35:370–6.
- [40] Benjasuwantep B, Ruangdaraganon N. Infant toilet training in Thailand: starting and completion age and factors determining them. *J Med Assoc Thai* 2011;94:1441–6.
- [41] Duong TH, Jansson UB, Hellström AL. Vietnamese mothers' experiences with potty training procedure for children from birth to 2 years of age. *J Pediatr Urol* 2013;9:808–14.
- [42] Russell K. Among healthy children, what toilet training strategy is most effective and prevents fewer adverse events (stool withholding and dysfunctional voiding)? Part A. Evidence-based answer and summary. *Paediatr Child Health* 2008;13:2001–2.