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Delay in toilet training in healthy toddlers: investigating possible influencing factors and implementing a new toilet training method

Dissertation for the degree of doctor in Medical Sciences
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Verlating van de zindelijkheidstraining bij gezonde peuters: onderzoek naar mogelijke beïnvloedende factoren en implementatie van een nieuwe zindelijkheidstrainingsmethode

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Voor Thomas, Imte, Vic en Stan

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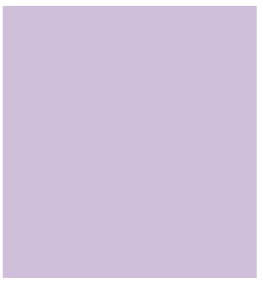

01

GENERAL INTRODUCTION AND OUTLINE OF THE THESIS

1.1 TOILET TRAINING

1.1.1 Normal toilet training acquisition

Toilet training (TT) is one of the first developmental milestones in a child's life and an important phase in acquiring independence[1]. It is an inevitable step to meet the standards of the society and culture in which they grow up[2]. And while the child is exploring and improving much of its physical abilities, the child will also develop self-esteem ("I can do it myself") and gain self-control ("I want to do it by myself")[3].

The ability to use the toilet or potty independently requires the child to go through a stepwise but complex maturation process, learning to recognize and indicate feelings of the urge to urinate or defecate, then walk to the toilet or potty, pull the pants down, sit on it for a certain time and urinate or defecate, then wipe, get up, get dressed again and wash hands[1].

TT refers to gaining independence and control over the bladder and bowel during daytime, not during nighttime.

1.1.2 Normal physiology of micturition and defecation

In order to discuss the topic of TT, we first need to clarify the normal process of micturition and, secondly, defecation.

1.1.2.1 Micturition[4]

The lower urinary tract consists of two functional units, namely the urinary bladder, serving as a reservoir for urine; and an outlet formed by the bladder neck, urethra and the urethral sphincter. The bladder has only two possible mechanisms of action: storage and elimination. The storage and (periodic) elimination of urine depends on the coordinated activity of smooth muscles (for example detrusor) and striated muscles (for example urethral sphincter).

The neural control of the lower-urinary-tract functions as an on–off switching circuit, maintaining a reciprocal relationship between the bladder and the urethral outlet. During the filling phase, the bladder smooth muscle is stimulated to relax and, simultaneously, the urethral smooth muscle is stimulated to contract. This will lead to storage of the urine. This storage reflex is organized primarily in the spinal cord. Voiding on the other hand is moderated by reflex mechanisms organized in the brain. When the bladder smooth muscle (detrusor) is stimulated to contract, the external urethral sphincter will relax, leading to urination.

Neonates and infants will involuntarily urinate, based on primitive reflexes, sited at the spinal micturition center (at the level of S2-3)[5]. These reflexes will progressively

become weaker and eventually a spino-bulbo-spinal reflex will dominate making urination voluntarily. The complex neural pathway that controls this process involves circuits at many levels of the brain, the spinal cord and the peripheral nervous system[6]. In addition, a good integration of autonomic and somatic efferent mechanisms is needed. The cortical micturition center determines when we void, for example at low volumes. The pontine micturition center decides how we void and is essential for complete voiding. The spinal micturition center is controlled from above (higher cortical centers)[7], although recent studies in preterm neonates also point out that voiding during quiet sleep was accompanied by cortical arousal that might have emanated from a lower center[8].

1.1.2.2 Defecation[9]

Defecation is a complex function that demands a good coordination between the gastrointestinal system, the nervous system, and the musculoskeletal system[10]. Colonic mass movements and peristalsis propel the content of the colon distally into the rectum. The gastrocolic reflex is one of the factors that initiates these bowel movements[11]. Filling of the rectum will activate mechanoreceptors in the rectal wall, which will lead to the awareness of the urge to defecate[10].

Two sphincters control the act of defecation. The internal anal sphincter (smooth muscle) is under involuntary control, whereas the external anal sphincter consists of voluntarily-controlled striated muscle cells[12]. The internal anal sphincter will involuntarily relax, causing a small amount of stool to pass through to the anal canal. This recto-anal inhibitory reflex is necessary to determine the consistency of the rectal contents (gaseous, solid or liquid form) and is called anal sampling[10].

If defecation is not socially acceptable or convenient, the rectal wall will relax and the need to defecate decreases for a while. To retain stool, the child unconsciously contracts the striated external anal sphincter and puborectalis muscle to push faeces back into the rectum[10].

When in an acceptable place to defecate, the puborectalis muscle needs to relax so the anorectal angle increases. At the same time, the external anal sphincter relaxes and intra-abdominal pressure increases by a Valsalva manoeuvre and abdominal muscle contraction[10]. Rectal afferent nerves are responsible for the sensation of rectal filling and defecation urge. Sacral nerves S2-S4 innervate the muscles involved in defecation through the pudendal nerve[10].

1.1.3 Definition of toilet training

Secondly, we need to clarify the meaning of the concept of TT and define what exactly is meant by the term ‘being toilet trained’. It is used to describe the process in which

the child is actively trained with the aim of achieving dryness[13]. In scientific literature, different requirements are stipulated and each author emphasizes one or more aspects of being toilet trained, for example the number of accidents; independence of the child; wearing underwear or being able to postpone the urge to go.
Blum, Taubman and Nemeth[14] proposed a successful end of the TT process from the moment the child can wear undergarments during the day and go to the potty independently, with a maximum of 4 urine leakages per week and 2 or fewer episodes of fecal loss per month.

Mota and Barros[1] and Doleys et al.[15] considered a child to be toilet trained when no help nor supervision is needed when using the potty or toilet, the child stays dry during the day and the child can indicate the urge to urinate or defecate, without a reminder from parents.

Vermandel et al.[16] defined a child completely toilet trained during the day when wearing undergarments and when the child itself expresses the need to use the potty or instantly goes to the potty and subsequently urinates or defecates. The child can go independently without a reminder from parents or educators and has a maximum of one urine leakage per day.

Wu et al.[17] stated that TT refers to the ability of the child to recognize the sensation of an urge and can inhibit this urge until the child reaches a socially acceptable moment and place. Also, the child needs to use the toileting facilities independently.

It seems necessary to emphasize that TT is not only a physical fact, but it is also influenced by the social context. So determining whether a child is toilet trained or not, strongly depends on the definition that is being applied.

This diversity of definitions makes comparisons between different studies difficult and an all-encompassing definition of 'being toilet trained' is lacking. Most authors identified independent functioning or independent toilet use as the responsibility of the child. Also, volitional control is marked as the endpoint.

In this research, we used the definition by Vermandel et al.[16]. The moment when a child is introduced to the potty for the first time and some aspects of TT are discussed with the child, is marked as the start of the TT[14].

1.1.4 Readiness for TT

The right time to initiate TT is an important but confusing issue. Bladder control is a maturation process that depends on both physical and psychological skills[18]. Researchers emphasize the importance of starting TT at the moment the child is ready and shows certain developmental skills and characteristics (*readiness signs (RS)*),

instead of just using the age of the child as a single criterion to decide when to start [18]. Assessment of these skills for TT readiness can be conducted using a checklist of 19 RS[19] (see Table 1). Although we need to remark that in children who wear good quality diapers, the discomfort of wetting is reduced, and these signs may present only at a later age[20].

RS1 Child can imitate behavior
RS2 Child is capable of sitting stably and without help
RS3 Child can walk without help
RS4 Child is able to pick up small objects
RS5 Child can say NO as sign of independence
RS6 Child understands and can respond to directions, questions or explanations and can follow simple commands
RS7 Child expresses a need to evacuate and shows awareness of the need to void or to have a bowel movement
RS8 Child puts things in containers spontaneously
RS9 Child evacuates on the potty when he/she has the urge to pee or to have a bowel movement
RS10 Child understands potty-related words
RS11 Child has a broader vocabulary
RS12 Child wants to participate in and cooperate with toilet training, and shows interest in toilet training
RS13 Child is dry after the midday nap
RS14 Child insists on completing tasks without help and is proud of new skills
RS15 Child wants to be clean and is distressed by wet or soiled diapers. Child indicates most of the time by himself/herself that he/she has wet/dirty pants
RS16 Child can pull clothes up and down in a toilet training-related context
RS17 Child begins to put things where they belong
RS18 Child can sit still on the potty for some time without being forced to do this
RS19 Child stays bowel movement-free overnight

Table 1: Readiness signs [19]

1.1.5 Methods of TT

The ways in which parents have carried out TT has fluctuated over the past decades and centuries. In the beginning of the 20th century the approach was more parent-oriented: mothers initiated training when they felt their child was ready to begin. This was a period of behavioral strictness in all schedules (like feeding, sleeping) and so TT became a very rigid and structured training where children were expected to be toilet trained before 18 months[21, 22]. But parents faced great problems in their attempt to TT their infants and this gave rise to a new, more liberal, approach.

In the middle of the 20th century, TT became more child-oriented: a more flexible training method considering the child's natural habits and patterns to eliminate[21]. Parents were advised to postpone TT until after the age of 18 months, considering the physiological maturation of the child. In the 1960's, the American Academy of Pediatrics (AAP) outlined the child's readiness for TT, based on Dr. Brazelton's child-oriented TT principles[3]. He emphasized the child's psychological and physiological readiness to start TT and the involvement of the parents in this training[23].

In 1971, Azrin and Foxx published their 'rapid TT', a parent-oriented method of TT that was more structured, but also referred to the child's physical and psychological readiness [24]. An increase in fluid intake, timed voiding and positive reinforcements were the ingredients for this TT method in less than a day.

deVries et al. published a remarkably different and unique approach to TT, called the 'diaper free method ' as applied by the Digo people in East Africa[25]. TT is initiated already during the first weeks of life in newborns and is successfully ended in most children by the age of 4 to 6 months. One could ask themselves whether initiating TT in the first weeks of life in newborns is practical, considering the soft neck in newborns and vision and hearing still adapting.

A new method called the wetting alarm diaper training (WAD-T), adding a daytime wetting alarm to TT, was introduced by Vermandel et al.[26]. WAD-T combines elements of different methods previously described. They concluded the alarm to be a child friendly and highly effective method of TT.

Most parents probably look for a method of TT that is child friendly, not complicated, needs a limited time to apply, has a good success rate and induces no conflicts while avoiding unnecessary and fruitless work[16].

1.1.6 Toilet training facilitation techniques

The recommended TT methods have been using a variety of facilitation techniques and several have been proven to facilitate the TT process, like increasing the amount of fluid intake, putting time into the training, imitating a doll or parents, no punishment, praise and reward, attention for elimination signals, training without a diaper or wearing undergarments[16, 23-25, 27, 28]. The AAP guidelines recommend toilet training to be positive, nonthreatening and natural[29].

1.1.7 Delay in toilet training

Not only have the methods of TT changed throughout the past century. A trend is also seen towards a later initiation of TT and along with it an increasing age of acquiring full bladder control. The mean starting age used to be 18 months; nowadays this has

shifted to 21-36 months[13, 14, 16, 19, 26, 30-37]. In the fifties, most children completed TT by the age of 36 months, but the last decades only 40 to 60% of children will be toilet trained by that age[14, 30, 34, 36]. So the question arises: what is the reason for this delay?

1.1.7.1 Causes of later initiation and completion of TT

It is very unlikely that child characteristics have changed during the past half century[14]. On the contrary, a number of sociocultural (traditions, education, place of residence etc.) and care-giving environmental factors (like the availability and cost of diapers, weather, access to water,…) could be of influence in the distinct shift in the age of TT [1, 20, 38-40].

The use of washable, cotton diapers has decreased, although they have financial and ecological benefits[20, 30, 38, 41]. Disposable diapers are easy to use and, as a result, parents take advantage of the opportunity to initiate TT at later ages that disposable diapers offer. Only postponing TT means a longer use of hyper absorbing disposable diapers, although they will limit the tactile feedback of wetting and children will not be aware of the unpleasant feeling of a wet diaper[20].

In many families both parents are working and there is an increasing trend in the use of daycare: up to 63% of all toddlers in Flanders (Belgium) are attaining daycare, meaning child daycare centers have a growing role in the TT process[32, 33]. Kaerts et al. stated that 80% of the parents think daycare has an equal role in the TT process. Nevertheless, 40% of them has no idea whether their way of training is comparable[32].

Also, 30% of parents remain insecure about the proper timing and method of TT and confusing or misleading information will only make it harder to initiate TT[33].

1.1.7.2 Consequences of postponing TT

Delay in TT has several disadvantageous consequences, both for the child and for their environment[33, 42]. The later a child is toilet trained, the longer he/she uses disposable diapers, which has financial and ecological disadvantages. In Flanders, the total domestic waste consists of 12% hygienic waste, like diapers and incontinence materials, meaning a total of 84 million kg hygienic waste per year (excluding the professional waste of day care or other healthcare facilities, who also have a considerable amount of diaper waste)[43].

Delay in completing the TT process could psychosocially reflect on the individual as well as on the family and cause contemporary problems like bullying and child abuse[14, 18].

Another consequence of delaying TT is an increasing number of children not yet toilet trained in kindergarten. Kindergarten teachers emphasize the negative implications on the quality and quantity of their pedagogic tasks, due to the increased attention for diaper dependent children[2].

Literature also reports several medical consequences for the child when TT is being postponed, like an increase in the prevalence of enuresis and LUTS later in older children or stool problems during TT[44-46]. Children with persistent daytime and night-time incontinence had begun TT at an older age (greater than 18-24 months)[17]. Training too severely or too late can be associated with several bowel problems such as stool toileting refusal (STR), functional constipation (FC) and encopresis[47-51]. Initiating TT only after the age of 42 months was associated with a higher chance of FC[14]. The prevalence of FC varries in studies between 5-27% of infants and toddlers[52, 53], with a median age of onset of 2.3 years [54]. These children will present with hard and/or painful bowel movements and sometimes episodes of fecal incontinence. Young children up to 4 years of age are diagnosed with FC when meeting the Rome IV-criteria (see Table 2)[55].

Must include 1 month of at least 2 of the following in infants up to 4 years of age:
1. 2 or fewer defecations per week
2. History of excessive stool retention
3. History of painful or hard bowel movements
4. History of large-diameter stools
5. Presence of a large fecal mass in the rectum
In toilet-trained children, the following additional criteria may be used:
6. At least 1 episode/week of incontinence after the acquisition of toileting skills
7. History of large-diameter stools that may obstruct the toilet

Table 2: Diagnostic criteria for FC - Rome IV-criteria [55]

Although the pathophysiology of FC is most likely multifactorial, withholding the stool is one of the key factors in developing and maintaining FC. Negative experiences with defecation can evolve into a vicious circle of retaining stool, leading to larger and harder masses of feces in the rectum and more difficulties or even pain in evacuating the stool[55-57]. Hiding while defecating is a behavior that is commonly seen around the age of 22 months and is remarkably more frequent in toddlers after TT had been initiated and could complicate the TT process even more[58, 59].

Literature reports that starting to toilet train earlier does not change the duration of training, so children will be dry sooner. Blum et al. found that a very early start, before the age of 18 months, might lead to a longer training duration[60], although Koc et al. suggested that the earlier TT was initiated, the earlier the child completed the TT process, even in families who started training before 18 months [35]. Yang et al found that early TT for urine was associated with early attainment of both daytime and nighttime continence, and there seemed to be no association with bladder dysfunctions and concluded that age under 2 years is no contraindication for TT[37]. There is no association found between starting early and bladder dysfunctions[34] nor stool problems [14].

1.2 AIMS AND OUTLINE OF THE THESIS

1.2.1 Aims

TT has changed several times over the past centuries, with different methods that had a more parent- or child-oriented approach. To date, there is too little evidence to state which is the most suitable training method or which elements a proper TT method should incorporate. We do know that suboptimal TT could lead to dysfunctions of the bladder and bowel system.

As a pelvic floor physiotherapist, we meet in clinical practice children who are not toilet trained as well as young children and their parents dealing with bladder and/or bowel problems and often referring to the TT period as the time of onset of these problems. We see a social phenomenon that parents are afraid that early training can be harmful. But in fact, there is no scientific evidence that an early TT is associated with the developmental or emotional disorders[23]. Early TT got a bad reputation because it was once associated with negative coercive methods, but early timing of TT does not seem to cause problems[14, 36, 37].

We also come across kindergarten teachers dealing with diaper dependent toddlers in their classroom. From the evidence based literature, we know that there is a remarkable postponement in the age of initiating and completing TT and as a result, about 20% of children are not toilet trained by the time they attend nursery school[2, 32].

Following these observations, the question arose which factors related to the TT process could lead to the delay of it and therefore influence the development of childhood bladder and bowel dysfunctions. For example, what is the influence of a variety of modeling, environmental and stimulus modification strategies currently used to toilet train children? Do parents lack good information on how and when to train their infants? Do we need to adapt TT to the increasing number of children attending day care? Do parents still have enough time and motivation to initiate TT themselves?

The main objectives of this thesis were to search for possible factors during TT that could be of influence in the postponement of TT and to present a new method which could facilitate TT in our Western society and thus influencing the possible consequences of the general delay in TT in a positive way.

1.2.2 Outline

The outline of this research is based on four possible factors of influence on the delay in TT. Chapter one describes the current evidence based knowledge about TT and the problems that arise today when training healthy children.

Chapters two to five address four factors contributing to the postponement of TT. Chapter two highlights the perceptions of parents in the contemporary society on how to toilet train their children. Chapter three reflects on the confusing and misleading information on TT that exists and tries to suggest how parents want and need to be informed about the proper timing and method to initiate and perform TT. In chapter four we focus on the aspects of achieving bowel control and stool problems that occur during TT and search for a way to facilitate stool TT. In chapter five, a new method of group TT in day care settings is introduced to meet the current issue of 'precious time' and to encounter TT difficulties that arise today in our Western society, like an increasing number of parents using child daycare.

In what follows, the different research questions are outlined in detail.

1.2.3 Influencing factors

Parent's perception

The first research intended to investigate parents' perceptions of TT and their beliefs and views on how to toilet train their children.

A questionnaire was developed by a group of experts in the field of TT with the intention of answering the following research questions:

- At what age do parents start to toilet train their child today in our Flemish society?
- What are the main reasons to start and what method do they use?
- What is the influence of intrinsic and environmental factors, such as the use of disposable nappies, day care, family situation, and stool problems?
- Do the perceptions and beliefs of parents match with what is known about TT in the scientific literature?

Diverse information

Because of the confusing information on TT that is available nowadays, parents are insecure and postpone the start of TT, so a uniform strategy to guide parents during the TT process is indispensable[1, 14]. It is important to advise them correctly about when to initiate TT, how long TT takes and which obstacles they might encounter[17]. Apart from that, more efforts are needed to provide parents with this necessary information[61, 62].

The final purpose of the study is to formulate an answer to the following questions:

- What are the experiences of parents concerning TT?
- What sources of information are currently used?
- How do parents want to be informed about TT and which sources would they like to use in the future?

Stool problems

In our daily practice, we meet more and more parents of young children who refuse to use the potty to defecate and ask for a diaper. Phenomena like stool toileting refusal and hiding while defecating are related to a delayed toilet training[50].

We advise parents to take off the diaper and put their child on the potty several times a day, shortly after meals, right at the moment when mass movements in the bowel could be initiated (due to the gastrocolic reflex) and bowel movements are facilitated. We were very eager to obtain more information about this postprandial response of the colon, however very little research on the clinical use of it has been conducted so far.

A prospective, observational study was performed to explore the occurrence of postprandial defecation in toddlers, in which we tried to answer the following questions:

- How many of the participants defecate shortly after a meal?
- How long after the start of the meal does this occur?

Time

To define the right moment to start TT, age is not the only indicator. A number of other abilities that will influence the start of TT are described, such as the level of physical and psychological maturity[63]. These so called readiness signals can be helpful for parents to decide whether or not their child is ready to initiate TT[18, 19, 32, 33, 36, 63].

For this last study, we set up a prospective clustered randomized controlled trial (CRCT) in different daycare centers. We wanted to address the problems of the growing population of children in daycare that needed to be toilet trained and parents that are insecure about the right time and manner or lack initiative to start TT. We wondered if we could optimize TT in the current daycare setting by training in group, based on the readiness signals present in the child.

We focused on the following research questions:

- Is it possible to toilet train healthy toddlers in a group, in association with the child daycare, to improve the TT process?
- How effective is our group TT?

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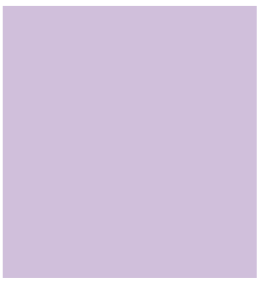

02

PARENTS' PERCEPTIONS

Parents' views on toilet training: a cross-sectional study in Flanders

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Abstract

Aims The goals of this research were to investigate parents' perceptions of toilet training and their beliefs and views on how to toilet train children.

Methods Questionnaires were provided to parents of healthy children, aged 18-72 months, who were or had just finished toilet training. There were 928 questionnaires returned (38% response rate). After correcting for age compliance with the range stated in the study, 832 parents remained.

Results The data confirm a postponement of the age at which children start to potty train and the age at which they are toilet training. Fifty per cent (n=401) of the parents start because the child will soon be attending nursery school and only 27% (n=226) start toilet training because their child shows certain readiness signs. The latter group will significantly end toilet training sooner. Constipation is common and varies considerably in its severity, the complaint should not be ignored. No significant relationship between toilet training and the general family situation – parental status, working status or educational level – was found, suggesting that these factors do not have a significant impact.

Conclusion Proper education of parents in toilet training and readiness signs could reduce the uncertainties that exist. In that way, toilet training could be carried out more efficiently and at the right time for the child.

Keywords: Child Health . Continence . Toddlers . Toilet Training

Implications for practice

- Parents initiate toilet training at a later age than previously
- Children finish the toilet training process at a later age
- Parents need to search for signs in their child that reflect the child's readiness to start toilet training
- Parents and caregivers need to communicate about the method
- they use when toilet training children
- Parents need to be informed about the signs of functional constipation

Introduction

Different studies from past decades report a tendency towards a later age of starting toilet training as well as a later age of completion of toilet training in the western world (Rugolotto et al 2008a, Vermandel et al 2008, Kaerts et al 2012a). In 1940 people began toilet training at a mean age of 18 months, whereas

nowadays the mean age has increased to 21-36 months (Schum et al 2002, Blum et al 2003). In the 1950s 97% of children had completed toilet training by the age of 36 months (Berk and Friman 1990). More recent data show that 40-60% of children are toilet trained by 36 months (Blum et al 2004, Rugolotto et al 2008a, 2008b).

Several factors could be addressed to explain the delay. First, it is unlikely that during the past 30-50 years a significant change occurred in the biological development of children but the social and professional life of parents and relatives of children, as well as the methods of toilet training have changed, which might explain the delay in completion of toilet training (Blum et al 2004). It is unclear from scientific studies or from self-declared 'expert opinions' what the best starting age or method is for toilet training (Schuster et al 2000).

This may lead to confusion and uncertainty among parents even before they have started toilet training (Blum et al 2003, Vermandel et al 2008).

The use of disposable nappies and a more liberal, child-oriented approach could explain the postponement of toilet training (Koc et al 2008, Vermandel et al 2008). Moreover,the dual-earner model, where both parents contribute to the financial support of their household, causes time constrictions for parents to attempt toilet training, which could lead to pressure on parents and toilet training is often left to nurseries (Kaerts et al 2012b). Thirty nine per cent of parents are not aware of toilet training methods used in nurseries (Kaerts et al 2012b). The toilet training expectations of parents are not always aligned with those of the nurseries' and could lead to confusion and stress in the child (Kaerts et al 2014).

The motivation of parents to start toilet training seems to have changed. Nowadays, parents appear to start when they have time, because their child has reached a certain age or their child needs to be toilet trained in time for nursery school (Jansson et al 2005). But these are all extrinsic factors that do not take into account the physical and psychological maturity of children.

Previous research has shown that the uncertainties in parents and postponement of toilet training could have negative consequences for the child, the parents and society (Simon and Thompson 2006, Kaerts et al 2012a). These include, stress and frustrations among parents, abuse of the child by a parent (Schmitt 1987, Jessee and Reiger 1996), a higher prevalence of children in nursery classes who are not yet toilet trained, which limits the nursery teachers' time for pedagogic tasks, impact on the environment and economy including increased use of disposable nappies (Kaerts et al 2012b). Also, a later age of initiation of toilet training, stool toileting refusal and constipation are three factors that could explain the later age of completion of toilet training (Blum et al 2004). For the purpose of this study the authors hypothesise that the current generation of western parents of toddlers seems to have developed different views and a different perception on how to toilet train their child when comparing to previous generations or other cultures.

Aims

The main goals of this study were to investigate the parents' perceptions of toilet training and their beliefs and views on how to toilet train their child. The method used, the age of onset and completion of toilet training were focused on, but other contributing factors were included. The intention was to answer the following questions:

» At what age do parents start to toilet train their child?

» What are the main reasons to start and what method do they use?

» What is the influence of intrinsic and environmental factors, such as the use of disposable nappies, day care, family situation, and stool problems?

» Do the perceptions and beliefs of parents match what is known about toilet training in the scientific literature?

The authors consider a child to be fully toilet trained during daytime if he or she wears undergarments, is aware of the need to void, initiates toileting without prompts or reminders from the parents, and has a maximum of one leakage accident per day. Being dry during the night was not included in this study, instead it was decided to focus only on daytime toilet training, because becoming dry during the day is a process that is influenced by the training that parents and caregivers initiate in the child. The authors believe that becoming dry during the night is the result of the maturation of the bladder. To avoid excluding participants, no distinction was made between parents who had used direct toilet training or who used a potty seat to initiate toilet training.

Methods

Design

A questionnaire was developed by a group of experts, based on their experience, scientific literature and previous questionnaires used by the research group (Kaerts et al 2014).

It contained 70 multiple choice and open questions. It was divided into seven parts concerning: the child; the environment of the child; toilet training; stool problems; toilet culture – for example, how parents handle leakage or loss of urine or stool; data of the interrogated person; and general remarks. In this way, aspects of toilet training methods were obtained and different environmental factors that could attribute to start and completion of toilet training and to the existence of stool problems were evaluated.

Setting

Participants were recruited from kindergartens, school care and nurseries in Belgium, based on demographic data, from January to June 2013, to investigate methods of toilet training. Permission to participate in the study was asked at the managing board of these centres, who distributed the questionnaires to the parents.

Sample

Parents of children, aged 18 to 72 months, who were at or just finished toilet training were considered eligible for the study. A letter was given to all participating parents to inform them about the aim of the study and to request their consent on the use of the anonymous data. A total of 2,419 parents received a self- administered questionnaire to be completed. Teachers and nurses were asked to remind the parents to hand in the questionnaires after one week. Questionnaires were returned in a closed envelope to ensure anonymity.

Data

All data collected were encoded using a codebook that was based on the questionnaire. Data-cleansing was performed after input to correct for possible errors. Statistical analyses (frequencies, descriptive statistics, logistic regression and Kaplan Meier) were made in the software Statistical Package for the Social Sciences (SPSS) version 20.

Because not all children were already toilet trained, statistical analysis was performed on that part of the study population who had already finished toilet training (*n*=634, 74%).

Ethical considerations

Approval of the ethical committee of the University Hospital Antwerp was obtained (registration number: B300201317927). All procedures performed in studies involving human participants were in accordance

with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Results

A total of 928 completed questionnaires were sent back which is a response rate of 38%. Not all parents answered all the questions so totals differ between different questions.

General data of the participants

Ninety six per cent (n=832) had a Belgian nationality. Ninety two per cent (*n*=802) of the parents were married or cohabiting, 8% (*n*=71) were single parents. Most families had one child (62%, *n*=541), 26% (*n*=228) had two children and 12% (*n*=91) had three children or more.

The majority of the participants were mothers (93%, *n*=805) with a mean age of 33 years. Seventy one per cent (*n*=631) had a higher education diploma, 26% (*n*=216) a grade school diploma. Almost half of the mothers had a full-time job (47%, *n*=404) and 40% (*n*=332) worked part time. Only a small proportion were fathers (6%, *n*=55) with a mean age of 35 years. A total of 56% (*n*=473) had a higher education diploma, 39% (*n*=336) had a grade school diploma and 81% (*n*=686) had a full-time job.

The parents reported that 74% (*n*=634) of the children were already toilet trained, of them 50% (*n*=318) were male and 50% (*n*=310) female toddlers. Eleven per cent (*n*=103) had not yet started toilet training,

14% (*n*=125) had initiated toilet training but were not completely toilet trained and 1% (*n*=7) had started but stopped.

Toilet training: age, methods and reason to tart

The start of toilet training is marked as the moment where parents introduce the toilet or a smaller potty for the first time. The average age was 23.1 months. Twenty five per cent (*n*=110) of parents started before their child was 20 months old, and by the age of two 64% (*n*=270) still needed to begin. Thirty four per cent (*n*=145) of the parents started at 24 months and 2% (*n*=20) had not yet started by the age of 30 months.

The mean age at which toilet training was completed was 27.8 months (95% confidence interval (CI) 22.6-32.9 months). Although most children went to kindergarten for the first time at the age of 30 months, 17% (*n*=109) of this study's population was not toilet trained at that time (Figure 1). Strikingly, 63% (*n*=404) were toilet trained at 29 months and this total increased to 83% (*n*=531) at 30 months.

Girls finished toilet training at a mean age of 26.6 months (CI: 21.9-31.3 months), which is significantly earlier compared to boys who finished at a mean age of 28.6 months (CI: 23.8-33.4 months) (*P*=0.000).

The mean duration of the toilet training was 4.9 months. After seven months of training, 80% were toilet trained.

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).

Almost half of the respondents (49%, *n*=430) started toilet training because their child needed to be ready for nursery school.

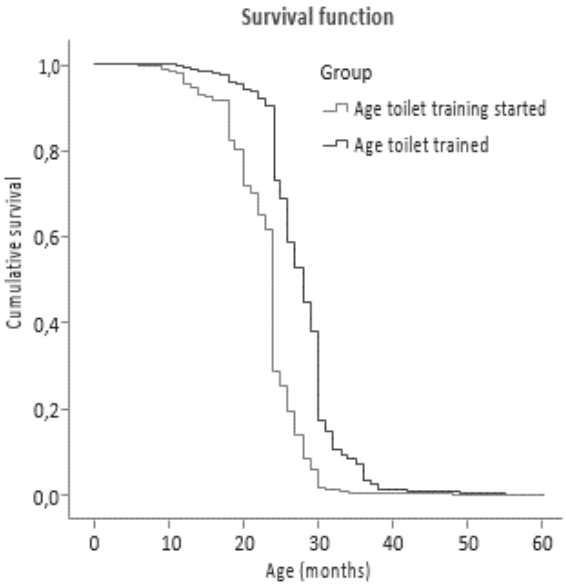

Figure 1: Distribution of the ages at which parents start toilet training and the ages at which children are toilet trained.

In 39% (*n*=338) of the cases the reason to start toilet training was the age of the child. Twenty eight per cent (*n*=189) of the parents started training at the request of the child, which we categorised as the child showing interest in the potty, being proud after he or she went to the toilet or talking about urine and stool. The mean age at which these children were dry was 25.9 months, which differs significantly from 28.5 months if parents did not indicate it (*P*=0.000). The reasons to start toilet trained are outlined in Table 1.

TABLE 1. What was the reason to start toilet training during the day? Multiple answers possible (*n*=873)		
Reason	*n*	**%**
Because the child needs to be ready for nursery school	430	**49.3**
The age of the child	338	**38.8**
At the request of the child	189	**27.8**
At the request of the day care centre	115	**16.9**
Other	96	**11.0**
Tired of using disposable nappies	57	**6.5**
Advice of child and family[1]	32	**4.7**
Comments by family/others	36	**4.1**
The financial cost of disposable nappies	23	**2.6**
I do not remember	19	**2.2**
None of the above	17	**2.0**

[1] Child and family is an agency of the Flemish government which contributes to the welfare of young children and their families by providing services in family support and child care

Toilet training: influencing factors

Family situation

Family status (married or divorced), working status (full-time, part-time, unemployed), education or degree of the parents had no significant influence on the age at which a child was toilet trained ($P>0.05$).

Introducing the potty

The age at which the potty was introduced for the first time was significantly related to the age at which the child finished toilet training ($P<0.000$): the sooner the potty is introduced, the sooner the child will be dry. But, the duration of toilet training is significantly shorter when the potty is introduced after the child is 24 months ($P=0.003$).

Stool problems

Eighty five per cent ($n=696$) of the parents did not report that their child had problems with defecation. If problems were present, the most common were hard stool (55%, $n=113$) and abdominal pain before or during defecation (43%, $n=85$). Also crying during defecation (27%, $n=53$) and a large mass of stool (25%, $n=48$) were indicated frequently.

Using the Bristol Stool Chart (Lewis and Heaton 1997), parents were asked to indicate the type of stool that was seen most common in the defecation pattern of their child. In general, 91% ($n=616$) indicated normal types of stools (Bristol 3 and 4). In 28% ($n=190$) of the cases, the children had frequent harder stools (Bristol 1 and 2) and 18% ($n=124$) of the children had often very soft stools (Bristol 5, 6 and 7); multiple answers were allowed.

Of the children who had stool problems, parents indicated most common stool forms as Bristol type 3 (56%, $n=228$) and Bristol type 2 (47%, $n=189$).

Logic regression analysis showed that the age at which a child finished toilet training has no significant association with stool problems, nor does the age of onset ($P=0.357$ and $P=0.998$ respectively). Neither did the duration of toilet training significantly differ depending on whether the child had stool problems or not ($P=0.771$).

Children showing stool withholding manoeuvres are not significantly later toilet trained compared to those who do not ($P=0.794$). Occasionally wearing a nappy after the age of 2.5 years, when already toilet trained, does not have a significant relation with the presence of stool problems ($P=0.154$), nor does the presence of older siblings in the family situation ($P=0.566$).

A small, but significant correlation between stress in the family situation and the presence of stool problems ($P=0.014$) was found.

A significant negative effect between speaking freely about stools and having problems with stools ($P=0.004$) (Phi=−0.104) was also found. Parents pay more attention to the child's diet when stool problems are present (39%, $n=50$) compared to children who do not have stool problems (4%, $n=33$). In 61% ($n=77$) of the children experiencing stool problems, parents do not take the diet into account during toilet training.

Discussion

The child's readiness to be toilet trained depends on physical and psychological development, and therefore may be highly variable. Results of our survey show that almost 50% (*n*=430) of parents start toilet training because their child needs to be ready for nursery school and in almost 40% (*n*=338) of the cases, age seems to be the main reason to start toilet training. Parents start toilet training when they feel that the time has come or when they have the time during summer holidays (Jansson et al 2008), which was also shown in this study. Therefore focus is on external factors rather than on the child's readiness. This may lead to a suboptimal start of toilet training, which may be too soon but also too late. It has been proposed that readiness signs are the best guidance to decide the time to start toilet training, even though there is no consensus on which signs or how many signs need to be present (Kaerts et al 2012a). The data confirm that parents who begin to toilet train their child at the request of the child, and in that way are guided by the child's readiness instead of external reasons, finish toilet training significantly sooner. Unfortunately, the majority do not seem aware of what signals they need to observe when they commit to toilet training. Also, one out of three parents started toilet training at the age of 24 months, which is the minimal age that is advised by the Flemish government institution Kind en Gezin to start toilet training. Parents need to be informed correctly about readiness signs, how to use them and about the problems that could occur if toilet training is initiated too late or too soon.

Seventy years ago 88% of parents started to toilet train their children before 18 months and 50% before one year (Bakker and Wyndaele 2000). The data in this research show a delay in age at which toilet trained is started and completed, which confirm previously published results (Bakker and Wyndaele 2000). Children are five months older at the time parents initiate training and also the age at which toilet training is completed is later. Seventy years ago, 71% of the children reached urinary continence before 18 months, whereas the mean age for bladder and bowel control is now 28 months.

Cultural differences may also have an impact on the age at which toilet training is started and on the methods used. For example, Duong et al (2013) described how Vietnamese mothers tried to detect signs of need by observing the child, beginning shortly after birth. By the age of nine months, all of these children used the potty and at 24 months, the majority of the children independently managed their toilet training process. Although such a regimen is probably not feasible in western society, it does point out that children are probably ready to be toilet training at a younger age and end toilet training at a younger age. Being toilet trained at a younger age would reduce the growing number of used nappies, which will be good for the environment, and give nursery school teachers more time to spend on educational tasks instead of time-consuming toilet training (Kaerts et al 2012b).

The prevalence of constipation in the 0 to 18-year age group has been reported between 0.7% and 29.6% (Tabbers et al 2010), which is concordant with the 15% reported in this study. A higher prevalence of constipation was seen in two year olds compared to one and three year olds (Tabbers et al 2010). Two is the same age at which children will initiate toilet training.

The changes, frustrations or anxieties that toilet training brings to the child might be a reason to develop stool toileting refusal, which could lead to harder and larger masses of faeces and, finally, constipation. Also in four year olds, constipation occurred significantly more (Roma-Giannikou 1999). Further research is necessary to investigate a possible relationship between the occurrence of stool problems and the age at which toilet training is initiated.

Since there is a link between constipation and bladder function, parents should be informed or instructed on how to recognise signs of constipation and prevent or treat it appropriately. In the study, 11% (*n=83)* of the parents who indicated that their child had no defecation problems pointed to aberrant forms of stool, and almost 80% (*n=275*) of the parents who indicated normal types also pointed aberrant forms of stool as most common in their child's defecation pattern.

Although variation in stool is common in children, parents should be aware of possible underlying stool problems when their child has frequently softer and/or harder stool. Although Rome III criteria to diagnose functional constipation was not used in this study (Drossman and Dumitrascu 2006), the results suggest that parents are not aware of the signs of possible underlying constipation. Better information or education on constipation during toilet training is necessary. Constipation may link defecation with an unhappy experience for the child, therefore avoiding and postponing defecation which, in turn, could lead to behaviours that further promote constipation.

It was hypothesised that a child will have fewer problems with stool when parents talk freely about stool and toilet habits. A significant negative effect between speaking freely about stools and having problems with stools was found. A similar result was found when comparing the presence of stool problems and diet. A fibre-rich diet and sufficient drinking can soften the stool and in that way facilitate bowel movements. Parents pay more attention to the child's diet when stool problems are present compared to children who do not have stool problems.

Limitations

This study revealed a small, but significant relation between stress in the family situation and the presence of stool problems (P=0.014). However, because of the design of our study it is impossible to determine if stool problems may lead to stress or stress to stool problems.

Because of the methodology used, recall bias cannot be excluded, which can be considered a limitation of the study. Furthermore, selection bias cannot be excluded based on the response rate of 38%, and the fact that only parents of children attending nurseries were explored limits the assumptions about children not attending nurseries.

Conclusion

The data In this study confirm a postponement of the age at which children start to toilet train and the age at which they are toilet trained. Fifty per cent of the parents start because the child will soon attend nursery school and only 27% start because their child shows certain signs of readiness. The latter group will end toilet training significantly sooner. Constipation is common and varies considerably in its severity, the complaints should not be ignored.

No significant relationship between toilet training and the general family situation – for example parental status, working status or educational level – was found, suggesting that these factors do not have a significant impact. Evidence-based education of parents concerning toilet training and readiness signs could reduce the uncertainties that exist. In that way, toilet training could be carried out more efficiently and at the right time for the child.

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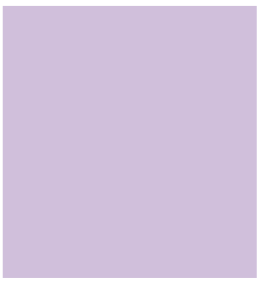

03

DIVERSE INFORMATION

Information as a crucial factor for toilet training by parents

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Abstract

Background: Toilet training (TT) is a milestone in a child's development. Nowadays, children complete TT later than previous generations. This can have detrimental consequences for the child, the parents, and the environment. TT is experienced as difficult and time-consuming; parents could benefit from guidelines to assist in this process.

Methods: Focus group discussions (FGDs) were used to explore parents' experiences in an inductive approach applying purposive sampling. The FGDs aimed to explore the type of information parents wanted to receive on TT, from whom and how.

Results: After six FGDs, including 37 participants with personal experience in TT, data saturation was achieved. The findings of this qualitative study show that reputable agencies, family, friends, day-care workers, and nursery school teachers were considered very helpful and trustworthy sources. TT information should be easily understandable and not contain scientific terms or much text. A colourful and illustrated brochure sent by regular mail is preferred.

Conclusion: Our study allows to develop a source of correct and wanted information about TT that parents can and want to use, which helps them completing this training more easily and timely.

KEYWORDS: child development, focus group discussions, parent perceptions, qualitative research methods, toilet training

Key messages

· The age of initiating and completing toilet training (TT) is postponed in Western society.
· There is a lack of uniform, evidence‐based information on TT for parents.
· This study searched for the desirable sources and information about TT by means of focus group discussions with parents.
· Information on TT for parents should be evidence based, but easily understandable and provided to parents by means of an attractive brochure.

List of abbreviations

FGD: focus group discussion
GP: general practitioner
TT: toilet training

Introduction

Toilet training (TT) is an important stage and a milestone in the development of the child (Mota & Barros, 2008). Parents could benefit from clear guidelines outlining how to assist their children in the completion of TT. Currently, much of the available literature on this topic is either contradictory or of little practical use, as different schools and associations in Belgium develop their own package, brochure, book, poster, and so forth about TT. Also, because of the variety of available information, parents postpone TT (Blum, Taubman, & Nemeth, 2004). In the last 60 years, a trend towards an older age of initiating TT has been observed in West- ern culture: Currently, parents start TT their child between 18 and 24 months (Bakker, van Gool, van Sprundel, van der Auwera, & Wyndaele, 2002; Bakker & Wyndaele, 2000; Blum et al., 2004; Blum, Taubman, & Nemeth, 2003; Horstmanshoff et al., 2003; Van der Cruyssen et al., 2015; Vermandel, Kaerts, van Nunen, Wyndaele, & Van Hal, 2010). Most parents, however, are not aware of the fact that problems can occur when starting too late with TT (van Nunen, Kaerts, Wyndaele, Vermandel, & Van Hal, 2015), for example, the spread of diseases/infections or increased workload of nursery school teachers caused by insufficiently toilet-trained children (Hadler & McFarland, 1986; Mota & Barros, 2008; Pickering, Barlett, & Woodward, 1986; Vermandel et al., 2010). When starting too late, children reject TT more easily, which may lead to stool toileting refusal (Luxem & Christophersen, 1994) or functional constipation (Mota & Barros, 2008) and could be associated with problems of attaining and maintaining bladder control (Joinson et al., 2009). Later or longer TT also implies higher social, environmental, and financial costs (i.e., longer use of nappies; Kaerts, Van Hal, Vermandel, & Wyndaele, 2011; Vermandel et al., 2010).

A uniform strategy to guide parents is necessary (Mota & Barros, 2008). First, it is important to inform them correctly about when to initiate TT, how long TT takes, and which obstacles they might encounter (Wu, 2010). Subsequently, more efforts are needed to provide parents with this necessary information (Schuster, Duan, Regalado, & Klein, 2000; van Nunen et al., 2015). Scientific research from Schuster et al. (2000) indicates that 22% to 55% of parents would find it useful to receive more information about TT and many parents even wish to pay for this information.

The purpose of this study is (a) to explore sources of information that parents use now and would like to use in the future to handle TT and (b) in what form parents would like to receive information about this subject. The final goal of the study is to formulate an answer to the following question: “How to inform parents about TT to help them understand more about TT and perform TT in a correct manner?” The study should enable us to develop a source of correct and desirable information about TT that will help parents complete TT in an easier and more timely manner.

SUBJECTS AND METHODS

In February and March 2015, a study on TT was performed in the province of Antwerp, Belgium. Because not much is yet known about this topic, we used focus group discussions (FGDs) to explore parents' experiences in an inductive qualitative approach, applying purposive sampling.

Inclusion criteria for the purposive sampling were adults with experience in TT children, such as parents of young children (already toilet trained), nursery school teachers, teachers, educators, or day- care workers. Recruitment of the participants was organized via an informative letter that was distributed to parents at schools, via nursery school teachers, and at day-care centres, explaining the purpose of the study and asking for their voluntary co-operation. Parents within informal social networks of the

researchers were also asked to participate. In total, 37 participants agreed to participate, mainly women (see Table 1).

Based on evidence-based literature and the expertise of the research group (regarding TT), a script was developed to guide the discussion groups and the analysis and comparison of the gathered information (see Table S1). The script consisted of four main questions: (a) When did the parents start with TT; (b) where did they receive information about this topic; (c) were there people who helped them with completing the training; and (d) how would they like to receive information about TT. These main questions were supplemented by several probing questions to stimulate the spontaneous dynamics of the groups. Furthermore, it was made clear that there were no right or wrong answers to these open questions. Anonymity was assured; verbal consent was given by all participants at the start of the FGDs. All FGDs were audio recorded; a few discussions were also video recorded.

Each FGD was organized by a pair of researchers with a back- ground in social sciences. A total of 12 individual researchers participated. One of the two researchers undertook the role of moderator; the other acted as an observer and took notes. After each FGD, transcripts of the FGD were made by the two researchers, and meetings with all the investigators were held to debrief what had been said by the participants and discuss points that had to be kept in mind for following FGDs. No additional focus groups were organized if no new information regarding the research questions arose during the previous focus group.

We were able to formulate a coherent answer after six FGDs with 37 participants in total. The number of participants per FGD ranged from four to eight participants. Each FGD lasted between 1 and 2 hr. All respondents gave their informed consent before the FGD began. A separate informed consent was given in those cases where a video recording was done. The software program for qualitative data analysis Nvivo® (QSR International Pty Ltd.) was used to assist researchers in analysing the data and comparing the gathered information. After each FGD, the two researchers assigned notes to the statements, perceptions, and opinions of the participants in Nvivo. The notes were then translated into an explanatory theory that provided an answer to the research questions. Anonymity was achieved by giving the participants labels instead of using real names. The researchers assigned a number to each participant in the FGD.

	Man	Woman	Average age (years)	One child	Two children	Three or more children
FGD 1 (*n* = 8)	0 (0%)	8 (100%)	33.3	0 (0%)	6 (75%)	2 (25%)
FGD 2 (*n* = 6)	0 (0%)	6 (100%)	34.2	1 (17%)	3 (50%)	2 (33%)
FGD 3 (*n* = 8)	0 (0%)	8 (100%)	31.9	1 (13%)	7 (88%)	0 (0%)
FGD 4 (*n* = 6)	0 (0%)	6 (100%)	42.2	2 (33%)	2 (33%)	0 (0%)
FGD 5 (*n* = 4)	0 (0%)	4 (100%)	25.5	3 (75%)	1 (25%)	0 (0%)
FGD 6 (*n* = 5)	2 (40%)	3 (60%)	36.8	3 (60%)	2 (40%)	0 (0%)
Total	*2* (*5%*)	*35* (*95%*)	*34.0*	*10* (*27%*)	*21* (*57%*)	*4* (*11%*)

Table 1: Participants

RESULTS

3.1 The process of TT: Experiences of parents

Most participating parents considered the age of 2 years as being the right time to start. In some cases, the day-care worker advised parents to start the training. The child often gave signs that he or she was ready for TT, for example, expressing the need to go to the toilet and showing interest in TT.

> *But then, yes, simply because they start to show interest in it and then you yourself also start to talk about it, so that they also … yes, give signals themselves and ask how or what. (FGD 3, S4)*

A few parents noticed clear differences between boys and girls at the beginning of TT, as girls were ready for TT earlier than boys. Boys mostly needed more time than girls to complete TT as well. In addition, parents also planned TT to fit in with their time off, so they could spend enough time TT their children correctly.

> *And then, with the youngest one, we chose more or less the same moment and also took into account our holidays, when we were home, so that they could walk around at home in their underpants. (FGD 3, S7)*

TT could be time-consuming. It took 2 weeks to 4 months on aver- age. According to the parents, an older brother or sister had no influence on a younger child during the process of TT. The parents said that they stopped using nappies for a while to let the child feel what it is like to have accidents, so they experience unpleasant feelings. Parents rewarded their child with a balloon, sticker, sweet, little present, and so forth after using the potty or toilet correctly. Punishing the child when they had accidents was not acceptable. On the other hand, parents thought that it was important to talk to the child about it.

> *You have to bring the child into contact with the potty. You have to give some input and make time for it. You have to indicate what has to happen with the potty. (FGD 4, S6)*

> *You have to be able to talk about it, you should not say "stupid child, did you have an accident again?" It is an extreme example. (FGD 6, S2)*

> *I say that it is okay and that it can happen. (FGD 6, S5)*

> *Punishing a child when it has accidents is not a solution. (FGD 6, S2)*

> *No, you just scare your children in that case. (FGD 6, S5)*

The FGDs pointed out that children should not feel pressure before and during TT. Parents should be positive, enthusiastic, patient, and calm.

> *Finally, simply taking the pressure away, so as the nursery school teacher said to me, you just have to try and make sure that the children do not feel there is a pressure. And indeed, after a week it was OK. Simply as a mum or a daddy, these children seem to really feel it; that you are engaged and that you are concerned and that you react to it differently.(FGD 3, S6)*

Concerns related to TT included the following: parent's goal to send toilet-trained children to primary school and their anxiety about this matter, children thinking that toilets are dirty, the child not knowing the difference between the nappy and the underpants, children having trouble taking off the pants without help, erections making it more difficult to urinate correctly, not willing to use a toilet that is not familiar, and grandparents using a different TT method.

3.2 Receiving help from others

Parents mentioned receiving help from grandparents, day-care workers, and nursery school teachers. A general practitioner (GP) or paediatrician was only contacted when problems occurred. It was mentioned that it was important that grandparents continued the ongoing TT, in which case they could have a great influence if the children stayed over regularly. If grandparents did not continue the ongoing TT, it could lead to a relapse. It was not seen as a problem if grandparents used a slightly different method than the child's parents.

> *Everyone has to join in. From the moment you say: "OK, take off the nappy." At that moment, that's the message when they go to the parents-in-law, or you tell your own parents you are potty training and that they must not put on a nappy. When they, however, suddenly put on a nappy, well then … [it does not really help, ed]. (FGD 2, S6)*

> *Yes, I then told my parents how I was managing and how they had to do it. Preferably this way but if you do it a little bit differently, that's no drama, you know. You should not put a nappy on all day but for a short trip by car, in which case I would not put on a nappy, they put one on, then yes …. (FGD 2, S4)*

The participating parents agreed that day-care centres and the day-care workers had a big influence on TT because of their experi- ence, structure, and the presence in the day-care centres of other children.

> *Nursery is important! They have a lot of experience and many children. They ask whether they can start TT when they think the children are ready for it and when it is needed. (FGD 2, All)*

> *People from the crèche pick up the signals much faster, since they have a lot of experience. This is especially the case with the first child, when you yourself have no experience. (FGD 2, S3)*

Information about the method used was reported to the parents in writing or orally by most day-care centres. Most parents only consulted a GP or paediatrician when they noticed problems during TT. However, problems were not the only reason to visit a physician for some parents as they felt that a GP or paediatrician could give trustworthy information. Some parents asked a GP or paediatrician questions about TT when the actual consultation was for a totally different issue. All participants thought that GPs were trustworthy. Because of their further specialization, paediatricians were considered to be even more reliable than GPs.

3.3 Receiving information about TT: Current situation

The parents mentioned using several trustworthy resources about TT. However, not all parents needed information to handle TT. Agencies like "Child & Family" (Kind & Gezin), "Family Association" (Gezinsbond), and "Child-raising Centre" (Opvoedingswinkel) were viewed as reliable.

> *There is also a child-raising centre. When parents encounter problems, they can go there and then they can get help. (FGD 4, S4)*

According to the parents, information was also (or could be) received via doctors, paediatricians, and urologists. On the other hand, information from family, friends, day-care workers, and kindergarten teachers was highly valued and considered trustworthy as well.

People working in a nursery have many very different cases and they say … you know, they have always reassured me. Or yes, when everything is normal, they also tell me. Because they know your child very well and they also see many other cases. (FGD 1, S4)

The internet was seen as a good source to share experiences and find other people dealing with a similar situation, although the quality of the information was considered doubtful. Information about TT based on experience was the general preference. However, scientific research and thoughts should not be entirely ignored. Some participants expressed their concern about the fact that the available information about TT concentrates too much on averages and not enough on the child as an individual.

Yes, every child is different, you know. Because science or research are based on the average child or the average person. But each child is different and I think it simply is important to follow their rhythm and make use of other people's experiences. (FGD 3, S4)

I prefer experience. Not necessarily information from doctors and researchers. These are often boring documents. (FGD 2, All)

3.4 The necessary and wanted information

Web applications (apps for smartphones and tablets) directed towards parents were generally seen as a good way to inform parents, especially for the next generations of parents. However, some parents also liked to receive the information on paper. Apps directed towards children were not supported by all parents as many of them did not want to confront their young child with a lot of technology.

For a lot of young people an app will be OK but personally I would like to receive it by regular mail. (FGD 4, S5)

I would not use it (for the children, GVH). I prefer booklets. The child will automatically come into contact with technology. I do not want to stimulate it at such a young age. (FGD 2, S5)

Opinions about information on the internet were divided. Websites from known agencies were considered trustworthy. Forums were often not taken seriously. In addition, e-mails about TT were deleted quickly without reading the content closely. Parents also thought that social media were not a good way to give information about the subject.

In a manner of speaking, you simply have to type: the child has not defaecated for five days. Immediately you will find information. But if you start reading and you are not able to add some nuance to that, then you think there is a tumor or they are dying or I do not know what. I think reading on the internet is useful but it depends what or how, you know …. (FGD 2, S1)

Many respondents still preferred a brochure as one of the easiest ways to obtain information. The brochure should be aimed at parents because parents preferred books and movies when they wanted information for their children. In addition, many parents would like to receive information about TT by regular mail. A few parents would like the day-care centre to give them a brochure when they think that their child is ready for TT. Next to parents, grandparents also appeared to be a potential target group for TT information. All participating parents agreed about the most suitable layout: The information should be easy to read and should not contain difficult or scientific terms. In general, parents like an information source with a lot of colours and illustrations and without a lot of text.

No, that is not important, such a scientific text. In the first place, you should receive tips. (FGD 2, S3)

DISCUSSION

This study is to our knowledge the first to explore (a) the experiences of parents with TT and (b) what sources of information they use and (c) what sources they would like to use in the future about this subject and in what form.

Information about TT is important because TT is a crucial phase in the development of the child (Mota & Barros, 2008) and almost every parent participates in TT. Many problematic consequences have been discussed that arise from suboptimal TT (American Academy of Pediatrics, 1999; Bakker et al., 2002; Barone, Jasutkar, & Schnieder, 2009; Hadler & McFarland, 1986; Kaerts et al., 2011; Luxem & Christophersen, 1994; Mota & Barros, 2008; Pickering et al., 1986; Polaha, 2002; Taubman, 1997a, 1997b; Taubman, Blum, & Nemeth, 2003; Vermandel et al., 2010). Starting too early with TT (meaning that TT is initiated when the child is not [yet] ready for it and TT is per- formed in possibly a more stringent way) can cause stress and frustration to both child and parents, resulting in the possibility of loss of interest by the child (Polaha, 2002), child abuse (Kaerts et al., 2011), and postponing the training (Wu, 2010). At the same time, other authors have pointed out the advantages of early TT, as it would not lead to bladder dysfunction (Duong, Jansson, Holmdahl, Sillén, & Hellström, 2009; Duong, Jansson, Holmdahl, Sillén, & Hellström, 2013; Hellström & Sillén, 2001; Yang, Zhao, & Chang, 2011). Correct information can prevent problems that might otherwise occur in the future. Receiving correct information is, therefore, important as it can help prevent problematic situations. Our study enables the development of a source of correct and desirable information about TT that parents can and wish to use, a source of information that helps them completing this training in an easier and more timely manner.

Looking at the information sources that parents currently use regarding TT, it was made clear in this research that information from well-known, reputable agencies is viewed as reliable. According to the parents, information from family, friends, day-care workers, and nursery school teachers is also very helpful and trustworthy. The results show that the quality of online information is considered doubtful by the parents, but it is a good medium to share experiences and find people dealing with a similar situation.

In the future, parents would like to receive information about TT that is directed towards them and based on experiences (but without ignoring scientific research). Information about TT should be easily understandable and not contain difficult or scientific terms or a lot of text. In addition, parents prefer an information source with a lot of colours and illustrations. It was concluded that a brochure sent by regular mail is the easiest way to present information. If we look at the current manner in which parents receive information, surprisingly, this does not seem to differ that much. “Child and Family” (Kind en Gezin), a Flemish agency that works actively in the Public Health, Welfare and Family policy area, sends regular mails to parents of toddlers aged 0–2.5 years old, informing them about the development and education of their child, for example, TT. The question then arises as to whether it is possible that not only “how” information is distributed is important but also “what” it should contain. In the current FGD, we have not gone into this further, but this would be an interesting topic for future research.

Implementation of the results could be compromised by the lack of consensus in scientific literature. There are several opinions about when a child can or should start TT and when this training ends. Furthermore, signals from the child about when it is ready for TT differ according to the different scientific

sources. The fact that there is no consensus should not be ignored. Although authors of scientific literature about TT agree that starting too early or too late with TT can result in problems, such as stress for children and parents, there is no distinct answer to what is starting too early or too late. It is, there- fore, sometimes difficult to inform parents about the correct timing.

To summarize the findings of this qualitative study, information on TT for parents should be evidence based, but easily understandable and provided to parents by means of an attractive brochure. Future research could aim to investigate the specific content that should be incorporated.

4.1 Limitations

One of the limitations of this study is that generalizations from our study are not possible, because of the design of the qualitative research and the small number of participants. Conclusions about how parents in general would like to receive information about TT are not possible. Qualitative research does not allow generalization of the results of the sample to the whole population; it is more explorative in nature and context sensitive. However, in order to assess transferability (as a response to the conventional external validity), we provide a description of the context in which the study took place. In this way, readers can assess the possibilities of applying the results from this study to their own context or using them in the development of a questionnaire, which could be distributed on a larger scale to gather quantitative data.

The most important advantages of FGDs are the great involvement of the respondents and the possibility to collect a lot of information in a short period of time about complex motivations and attitudes.

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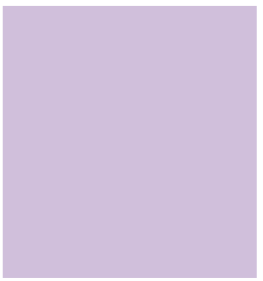

04

BOWEL CONTROL

Observing postprandial bowel movements in diaper-dependent toddlers

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Abstract

The gastrocolic reflex is a response of the colon to the presence of food in the stomach. Our goal was to observe bowel movements in healthy infants and toddlers not yet toilet trained, in response to a meal. Stool behavior of 40 toddlers, aged 18–27 months, was monitored. We observed a bowel movement within the first hour after a meal in 75% of the children. This occurred 15, 30 or 60 minutes after a meal in, respectively, 25%, 48% and 66% of the observations. If we limit to the ones that actually defecated, 37% would defecate within 15 minutes and 72% within half an hour. Fifty-nine percent of all children defecated in the morning, 54% at noon and 28% in the evening. In conclusion, we believe the gastrocolic reflex can be used as a facilitating factor to help a child to defecate on the potty, 15–30 minutes after a meal. In 50% of the cases, a child will have a bowel movement on the potty and learn to defecate on it much easier.

KEYWORDS: Constipation, faeces, faecal incontinence, gastrocolic response, infant, toilet training

PURPOSE

The prevalence of functional constipation (FC) varies in studies between 5% and 27% of infants and toddlers and seems to be higher in toddlers (Chogle et al., 2016; van Tilburg et al., 2015), with a median age of onset of 2.3 years (Malowitz et al., 2016). Young children up to four years old are diagnosed with FC when meeting Rome IV-criteria (see Table 1) (Zeevenhooven et al., 2017). Although the pathophysiology of FC is most likely multifactorial, not going to the toilet at the moment the rectum is filled with faecal mass, and thus withholding stool, is one of the key factors in developing and maintaining FC (Benninga et al., 2004; van den Berg et al., 2006; Zeevenhooven et al., 2017).

Normal bowel movements are regulated by the enteric nervous system. The presence of food in the stomach and duodenum will stimulate this nervous system and initiate higher and more frequent high amplitude segmental contractions (HAPCs) and increase the colonic tone (Di Lorenzo et al., 1995). The gastrocolic reflex can thus be defined as mass movements in the colon that propel its content into the rectum.

To date, little research has been conducted on the clinical presentation of the gastrocolic reflex in healthy toddlers. Colon manometric investigations have never been performed in this population for obvious ethical reasons (Rodriguez et al., 2017). But, in clinical practice, the gastrocolic response is often referred to, to facilitate bowel movements in children with FC and faecal incontinence (Har and Croffie, 2010).

AIM

The main goal of this research was to observe bowel movements in healthy infants and toddlers not yet toilet trained, in response to a meal. A prospective, observational study was performed to explore the occurrence of postprandial defecation: how many of participants defecate shortly after a meal and how long after the start of the meal does this occur?

DESIGN AND METHODS

Subjects and data collection

For this prospective, observational study, parents of toddlers were recruited in different day-care centres in Flanders, Belgium. Fifteen nurseries were found eligible of which seven were willing to participate in the study. Inclusion criteria for participants were aged ranging from 18 months to 27 months and not yet toilet trained. Children were excluded if the parents answered positively to the question whether the child had stool problems or other medical problems.

After approval by the Ethics Committee of the Antwerp University (registration number B300201317927), parents of all included children received the informed consent form and a questionnaire and stool diary for the parents. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Materials and methods

To monitor bowel movements as completely as possible, we deemed it would be beneficial to observe the children in the home situation as well as in day care. This way, we could track bowel movements in the morning, during the day and in the evening. Observing meant 'checking the child's nappy every 5 minutes from the moment he/she finished their meal'. Stool consistency was judged by the Bristol stool form scale and infant stool form scale (for diapers) to assess amount and colour of the faeces (Bekkali et al., 2009; Lewis and Heaton, 1997). The time between finishing the meal and defecation was noted. The study consisted of two parts:

> Part 1: Observation of stool behaviour in relation to a meal by the parents at home. During three consecutive days, a food and stool diary was filled out in which frequency, timing and form of their child's stool was noted. They also noted how many minutes after a meal the child had defecated.
>
> Part 2: Observation of stool behaviour in relation to a meal at the day-care centre. One of the authors observed every child individually for at least one to maximally six days in their day- care centre. That day a food and stool diary was filled out for the duration of their day at the day-care centre. Bowel movements at home, type and amount of food were noted on the diary.

Statistical analysis

All data were encoded and processed in a statistical database using a codebook. Statistical analyses was made in SPSS version 2.0. Descriptive statistics were used to define frequencies, measure of agreement between bowel movements after a meal and type of food was assessed using Cohen's K,.

RESULTS

Participants

In total, 104 children (in seven different nurseries) met the inclusion criteria and were given the information booklet. Forty toddlers (in four different nurseries) participated in the study, 20 of them were girls and 20 were boys (response rate 41.6%). The main reasons for not willing to participate in the study were parents who 'found it too personal', 'recently participated in another study' or 'too much time and effort'.

The average age was 21.25 months, with a minimum of 18 months and a maximum of 27 months. None of the parents reported stool problems or any other medical problems.

Table 1. Rome IV criteria (Zeevenhooven et al., 2017)

Diagnostic criteria for functional constipation

Must include one month of at least two of the following in infants up to four years of age:

1. Two or fewer defecations per week
2. History of excessive stool retention
3. History of painful or hard bowel movements
4. History of large-diameter stools
5. Presence of a large faecal mass in the rectum

In toilet-trained children, the following additional criteria may be used:

6. At least one episode/week of incontinence after the acquisition of toileting skills
7. History of large-diameter stools that may obstruct the toilet

Observations

The observations were performed either by the parents at home or by an expert in the day-care centre. In both cases, the child's diaper was checked for stool after a meal. All 40 toddlers who were included were observed at least one day and at most six days in their nursery. Reason for this difference was that not all toddlers attended day care on daily basis. In total, 70 observations were performed in nurseries. Thirteen out of forty parents did not conduct the observation of their child's stool behaviour at home for three consecutive days.

Frequency

The median number of defecations a day was 2.0 (interquartile range [IQR]:3.0). Toddlers defecated on average 1.4 times a day. Fifty-nine percent of the observed children (n 38.0) had a bowel movement in the morning after breakfast, 54% (n=21.6) after lunch and 28% (n=11.2) defecated in the evening after dinner.

Stool after a meal

In general, 75% of the children (n=30.0) had a bowel movement within the first hour after a meal, during at least one observation (at nursery and/or at home). Twenty-five percent (n=10.0) had a bowel movement more than one hour after a meal or had no defecation at all (8% (n=3.2) and 17% (n=6.8), respectively). In 65% (n=13) of the cases, where we could not observe a bowel movement at the nursery, bowel movement had already occurred at home in the morning.

In 25% (n=10) of all observations, the child had soiled its diaper within the first 15 minutes, increasing to 48% (n=19.2) within 30 minutes and 66% (n=26.4) within one hour after a meal. The remaining 34% (n=13.6) had a bowel movement more than one hour after a meal or not at all.

If we limit our data to the children, who had a bowel movement within the first hour after a meal (n=26), 37% (n=9.6) defecated after 15 minutes and 72% (n=18.7) within 30 minutes.

Seventy-seven percent of all toddlers (n 28) had a bowel movement after eating solid food and 50% (n 20) after eating a combination of solid and fluid food. Only one child ate fluid food. There was a poor agreement between the type of food and bowel movements after a meal ($\kappa < 0$; $p > 0.05$).

Stool consistency

Stool consistency was evaluated by the toilet training (TT) expert during observation in day-care centres and was assessed by the Bristol stool scale and the Bristol stool scale for diapers (Bekkali et al., 2009; Lewis and Heaton, 1997). Bristol stool type 6 (24%), type 4 (22%) and type 5 (22%) were reported most frequently. Type 7 was not observed.

The amount of stool was assessed by using the Bristol stool scale for diapers (Bekkali et al., 2009). In half of the observations (n=25), the child had soiled its diapers for 25–50%. In 46% (n=23), the child had soiled its diaper for more than 50%. Soft stool was seen most often (46%, n=23), followed by formed (32%, n=16) and hard (20%, n=10) stool. Watery stool was only observed in 2% (n=1) of the children.

CONCLUSIONS

The gastrocolic reflex plays an important role in emptying the colon, but its precise mechanism is rather complicated and to date has not been unravelled completely. In 1913, Hertz et al. described for the first time, by means of X-rays, that the presence of food in the gastrointestinal system was an important stimulus leading to mass movements in the colon and defined it as the gastrocolic reflex (Hertz and Newton, 1913). More recent colon manometric investigations reported higher and more frequent HAPCs and an increase of the colonic tone after eating (Di Lorenzo et al., 1995; Rodriguez et al., 2017). The presence of stool in the rectum stimulates parasympathetic and local reflexes, which will result in relaxation of the internal anal sphincter. As a consequence, faeces will descend further into the anal canal. In case of defecation, the abdominal muscles and diaphragm will contract with a simultaneous relaxation of the external anal sphincter and puborectal muscle, causing faeces to expel. Therefore, the gastrocolic reflex is seen as the most plausible reason to defecate shortly after a meal (Dobson and Rogers, 2009; Loening-Baucke, 1994; Loening-Baucke, 1996; Sherwood, 2009).

Colon manometric investigations have never even been performed in healthy children (Rodriguez et al., 2017). Patterns of normal colon motility are now based on observations and investigations in children with expected normal colonic physiology (Di Lorenzo et al., 1995; Rodriguez et al., 2017).

The main goal of this research was to investigate the occurrence of postprandial bowel movements in healthy infants and toddlers, because in our daily practice, we meet more and more parents of young children who refuse to use a potty to defecate. We advise them to put their child on the potty three to four times a day, shortly after meals, right at the moment when mass movements in the bowel could be initiated due to the gastrocolic reflex and bowel movements are facilitated. We were very eager to obtain more information about the clinical presentation of this gastrocolic response, however, very little research on the clinical use of it has been conducted so far. In general, it is thought that bowel movements occur in 15 minutes after a meal (Diemel et al., 2010). But Boron et al. described it to be much later between 30 minutes and 60 minutes after a meal (Boron, 2008). From the observations made in our study, we can conclude that 37% would defecate within the first 15 minutes and in total, 72% within the first half an hour. In total, we observed a bowel movement within the first hour after the meal in 75% of our children. In 17.5%, we did not observe a bowel movement because parents did not fill in the stool diary at home and we only had a snapshot of the bowel movements at nursery after their lunch.

The use of the gastrocolic response had already been described to facilitate bowel movements in children with FC and faecal incontinence. The authors emphasized a behavioural modification to establish toileting routines, such as sitting on the toilet for 10 minutes after meals at the moment the gastrocolic reflex occurs (Har and Croffie, 2010).

In more than 95% of healthy children (more than 1 year old) with complaints of constipation, FC is the underlying reason and the most common gastrointestinal pathology in children (Loening- Baucke, 2005). The worldwide prevalence varies between 0.3% and 29% in developed as well as developing countries (Borowitz et al., 2003; Loening-Baucke, 1993; Mota et al., 2012; NVKe NHG, 2009; Rajindrajith et al.,

2016). Three percent of all children that are referred to a paediatrician have constipation (NVKe NHG, 2009), whereas this number increases up to 25% of children, who consult a gastroenterologist paediatrician (Benninga et al., 2004). If a child voluntarily retains stool when feeling the urge to defecate, defecation is suppressed by contracting the external anal sphincter and the puborectal muscle. Faecal mass that remains in the rectum for too long will become dry and hard and will enlarge. The rectum will gradually widen and evolve into a megarectum. As a consequence, rectal sensitivity will diminish, defecation will become difficult, faecal soiling will occur, and in the end, the child will no longer be conscious of the need to defecate (Loening-Baucke, 1993).

In adults, the colonic response to food was absent in 41% of constipated subjects with a normal transit time (Bouchoucha et al., 2006). To our knowledge, no similar studies have been performed in toddlers or children. We do know that during the withholding of stool, the gastrocolic response proceeds normally, but contraction of the external anal sphincter and the puborectal muscle will cause stool to return to the rectosigmoid. If this withholding becomes a habit, faecal mass will become dryer, harder and larger (Partin et al., 1992). During TT, a child is more sensitive to the development of FC (Di Lorenzo and Benninga, 2004). For instance, Blum et al. found hard and painful defecation to be important factors in the development of stool toileting refusal (STR) (Blum et al., 2004). Taubman et al. concluded that STR could lead to retaining stool, harder faecal masses, constipation and encopresis (Taubman, 1997). Parents can be ignorant of this behaviour and even consider this withholding behaviour as an effort to defecate (Loening-Baucke, 1994). Also, some children dislike the toilets in school and will retain stool during the day, causing the development of STR and withholding manoeuvres (Borowitz et al., 2003).

There is an inverse relationship between the age of the child and the number of propagated contractions triggered by the ingestion of a meal (Di Lorenzo et al., 1995). Our data indicate that 45% of all toddlers defecated twice a day. On average, all observed toddlers (aged 18–27 months old) had 1.4 bowel movements per day, which is in line with previous research, where 85% of children aged between one year old and four years old would defecate one or two times a day. Ninety-six percent of these children had a normal defecation pattern, which means defecating between three times a day and once every two days (Weaver and Steiner, 1984).

Concerning the timing, this research shows that 59% of the children defecated in the morning, 54% at noon and only 28% in the evening. Weaver found that 65% of the children will defecate after a meal: 31% in the morning, 16% in the afternoon, 23% at both times and 30% on any occasion during the day (Weaver and Steiner, 1984). We conclude that the majority of toddlers had bowel movements after breakfast and less often in the evening, which is an important message for parents and caregivers, who are initiating TT and want to facilitate TT for stool.

Limitations of the study could be that the observations at the nursery were sometimes com- plicated because children were picked up earlier by the parents, the observations were ended too early and no conclusions could be made. Comparing our results with previous studies is difficult because, to our knowledge, no observational clinical trials in healthy toddlers concerning the timing of postprandial bowel movements have been performed to date.

We can conclude that this is the first report describing the results of a prospective, observational study in day-care centres to evaluate the clinical presentation of a gastrocolic response in healthy toddlers. We found that after a meal, one out of two children defecated and in 72% of the cases, this was within half an hour after finishing a meal. To date, little research has been conducted on the clinical presentation of the gastrocolic reflex. Training children to defecate on the potty is often the most challenging aspect of TT (Christophersen, 1991; Taubman, 1997) and if we could give parents appropriate tips to adequately respond to the postprandial bowel behaviour of their child, we presume less stool problems will occur at a later age.

PRACTICE IMPLICTIONS

One of the important advantages of this study is providing practical guidelines to parents and caregivers, who are initiating TT and want to facilitate TT for stool, to increase their insight, knowledge and tricks concerning normal stool behaviour, which could possibly decrease constipation problems during TT. The gastrocolic reflex could be used as a facilitating factor to help a child to defecate on the potty after a meal. We advise parents and caregivers to facilitate the TT process for stool by putting the child on the potty 15–30 minutes after a meal. In 50% of all cases, the child will defecate on the potty. The majority of the toddlers will have bowel movements after breakfast and less often in the evening. But more research is strongly advised to guarantee an easier TT in young healthy children.

Conclusion: We believe the gastrocolic reflex can be used as a facilitating factor to help a child to defecate on the potty, 15–30 minutes after a meal. In 50% of the cases, a child will have a bowel movement on the potty and learn to defecate on it much easier.

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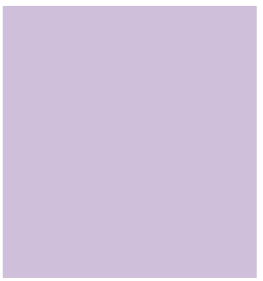

05

IMPLEMENTING A NEW METHOD

Implementing a new method of group toilet training in daycare centres: a cluster randomised controlled trial

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Abstract

Despite the existing methods, a trend towards a later initiation and completion of toilet training has been seen in Western society. This study is the first to investigate prospectively the efficacy of intensive group toilet training in daycare centres. The primary outcome of interest is the duration until the child is toilet trained. A cluster randomised controlled trial was established in daycare centres; clusters of participants were randomly allocated to an intervention or control group. Intervention group was subjected to an intensive toilet training session. Innovative aspects of this toilet training method were a 2-h training on two consecutive days, carried out in small groups in daycare centres. Parents of children in the control group were encouraged to start TT in their own manner. Children were monitored until they were considered to be fully toilet trained during the day. Median toilet training duration in the intervention group was 2 weeks compared to 5 weeks in controls (*p* value log rank test = 0.007). The hazard of being clean during the follow-up of 6 weeks was twice as high in the intervention compared to controls (*p* = 0.018).

Conclusion: The intervention had a significant influence on the duration of toilet training in healthy children, with a median duration of 2 weeks. Our findings are clinically relevant for daycare educators, having a considerable responsibility in the development of children.

Keywords: Child . Toddler . Potty training . Method . Daycare

What is Known:

- *Despite different existing methods, a later initiation of toilet training has been seen in Western society and coherent to this an increasing age of acquiring full bladder control.*
- *Child daycare centres have a growing role in the toilet training process.*

What is New:

- *This is the first prospective report describing the results of a new method of toilet training healthy children in small groups in daycare centres.*
- *The intervention had a significant influence on the duration of toilet training, with a median duration of 2 weeks.*

Abbreviations

AAP	American Academy of Pediatrics
CG	Control group
CRCT	Cluster randomised controlled trial
ES	Elimination signals
HR	Hazard ratio
IG	Intervention group
IQR	Interquartile range
OR	Odds ratio
RS	Readiness signs
SD	Standard deviation
TT	Toilet training

Introduction

A child discovers and develops new skills during the toilet training (TT) process, which is a giant step in expanding in- dependency. When a child shows readiness signs (RS), it is up to the parents and educators to initiate TT, instruct, guide and demonstrate the proper methods to encourage the child to act. But acquiring new milestones varies within each child, and to date, there is no consensus about the appropriate moment or method of TT [1–4].

Over the last century, TT programs described in literature varied between rigorous parent-oriented and more flexible child-oriented methods [5–8]. Despite the existing methods, a trend towards a later initiation of TT has been seen in Western society and coherent to this an increasing age of acquiring full bladder control [3, 8–18]. Several reasons for the postponement of TT have been cited. Apart from aspects like a more liberal attitude towards the child [9, 12, 19], and comfortable and good-quality nappies [9, 10, 12, 19], in many families, both parents have a job and there is an increasing trend in the use of daycare [14, 15], which means that apart from the parents, child daycare centres also have a growing role in the TT process. Daycare providers are among the first to recognise RS; they teach the child the proper TT skills and communicate with parents about the TT methods used and how their child is acquiring these new skills [14].

A child that is toilet trained at a later age has a number of consequences. Firstly, a longer use of disposable diapers has financial and ecological disadvantages [9–13, 20, 21]. Secondly, there could be a negative effect on the educational level in nursery schools [22]. Moreover, delay in completing the TT process could also psychosocially reflect on the individual as well as on the family [1, 11] and delayed training might put children at higher risk for developing bladder and bowel problems [1, 11, 23].

Unfortunately, much of the available literature on this topic is either contradictory or of little practical use. Our research question was whether it is possible for healthy toddlers that are seen as ready for TT (population) to be toilet trained in group (intervention group (IG)); in association with the child daycare, in an efficient and effective manner to shorten the TT process (primary outcome). We hypothesise that children having had an intensive TT are quicker toilet trained compared to children receiving standard care from their parents (control), resulting in a higher proportion of children becoming toilet trained in the IG compared to the control group (secondary outcome).

Most parents probably look for a method of TT that is child friendly, is not complicated, needs a limited time to apply, has a good success rate and induces no conflicts while avoiding unnecessary and fruitless work. We present a child-friendly and attractive method of TT in daycare centres, aimed at reaching these goals: short, safe, highly successful and in healthy children.

The primary outcome of interest in this study is the duration until the child is fully toilet trained. Secondary outcome is the number of children that acquire cleanliness at 6 weeks time.

Materials and methods

Subjects and data collection

The protocol of the study was approved by the Ethical Committee of the Antwerp University Hospital (nr. B300201630079) and registered at ClinicalTrials.gov (NCT04221776). For the recruitment of the participants, a professional association for childcare in Flanders and Brussels (Unieko) was contacted.

The proposed inclusion criteria for the participants were attendance to daycare, knowledge of the Dutch language, aged between 18 and 30 months and not yet toilet trained during the day and night (diaper dependent). All potential participants were screened on their developmental skills by the daycare workers according to signs of readiness (RS) (see Appendix 1). Children were selected to participate in the study if they met at least two of the following three signs: the child expresses a need to evacuate and shows awareness of the need to void or to have a bowel movement; the child insists on completing tasks without help and is proud of new skills; or the child can pull clothes up and down in a TT-related context [24, 25].

Children with urological, neurological, intestinal or behavioural problems were excluded from the study. Parents who were willing to participate in the study and willing to invest time and effort in continuing the TT at home signed an informed consent and were asked to fill out a structured questionnaire. The following aspects were questioned: demographical data, family situation, signs of readiness, if parents had already introduced the potty, at what age, which methods were used and the reasons to start TT.

Randomisation and masking

A cluster randomised controlled trial (CRCT) was established in daycare centres. Clusters of participants (per daycare centre) were randomly allocated to either an IG or one of the two control groups (CG1 and CG2). A daycare centre could not have participants in both intervention and control groups. Using an online randomisation tool, the list of participating daycares was randomly divided into 3 groups to preserve as much as possible equal number of clusters per group.

As the researchers were also the TT experts carrying out the training in the daycare centres, there was no blinding of the randomisation, nor the experimental part of the study. Since study data were encoded, evaluation and analysis of data were blinded.

Study protocol

The IG was subjected to an intensive TT group session lasting 2-h during 2 consecutive days (Thursday and Friday). These training groups were quite small and on average consisted of 3 children per group. A training day started with children being educated in a pleasant and creative way about potty training (books, pictures, a doll, etc.). Then, to facilitate lowering the pants independently and to ease detection of accidents by the tutors, children were asked to take out their diaper and put on their own underpants. Children were encouraged to drink often and were asked regularly if they felt the need to void. The tutors looked for elimination signals (ES) (like facial expression, often combined with body movements and verbal expressions [26]) in the child and quickly responded by putting the child on the potty when he/she expressed the need to void or to defecate. Also, scheduled sitting times every 30 min were applied. Each child had his/her own potty, marked with a photo, symbol or colour. Children were rewarded after voiding on the potty by means of a stamp, sticker or clapping and cheering by the other children, but there was no overcorrection for accidents (meaning children being involved in cleaning up the accident; overcorrection is seen as a punishment [7]). Afterwards, parents received a leaflet containing practical tips concerning ES, RS, the TT methods that were being applied and their child's successes of the past 2

days. They were asked to continue TT at home during the following weekend and longer if necessary. The daycare workers were asked to pay more attention on the TT during the following days and weeks to ensure the effect of the intervention. The children participating in CG1 did not receive the intensive training, but parents got the same leaflet and were encouraged to start TT their child, because they were considered as being ready to initiate TT. Children in CG2 did not receive any intervention, nor the leaflet, but their parents were encouraged to start TT in their own manner. We considered these two groups as the 'standard of care' group.

Evolution of the TT process was monitored in the daycare centre until the child was considered to be fully toilet trained (or 'clean') during the day (this means wearing undergarments, conscious of the need to void and initiating toilet behaviour without a reminder of the parents with a maximum of one leakage a day) [17]. Daycare workers evaluated the TT process of all participating children on a weekly basis and returned this information to the researchers. Parents were asked to fill in an online questionnaire at the end of the 6-week follow-up, to assess their child's progression in the TT process (according to the definition of TT).

Statistical analysis

The primary research question and thus the focus of our analyses was the comparison between the intensive TT group and the standard of care group. The effectiveness of the intervention was determined with the duration of the TT as specific primary outcome measure. Assuming a standard deviation of 2 weeks and a significance level of 0.05, an achieved sample size of 17 children per group is required to detect an effect of 2 weeks difference with 80% power using an independent- samples *t* test.

As the control group with the folder turned out to be quite small, we decided to look at the control group as a whole (CG = CG1 + CG2) as it was clear none of these children got the intensive intervention. Analysis results for the 3 separate groups can be found in an appendix.

Descriptive statistics are reported as mean (standard deviation (SD)) or median (interquartile range (IQR)) as appropriate. Between-group differences were assessed using chi- square test for categorical variables and independent samples *t* test for continuous variables. In case of non-normality, the Mann-Whitney test was used for the continuous variables. The primary outcome was analysed on the one hand with a Mann-Whitney test (using 6 weeks as outcome for the children that were not toilet trained at the end of the study) and on the other hand with a log-rank test censoring the children that were not toilet trained at the end of the study. All children for which primary outcome was observed are used in the analysis, and as they all followed the protocol, intention-to-treat and per protocol population are the same. Duration of toilet training is presented with a Kaplan-Meier curve. We also considered an adjusted analysis. Due to small sample size, only models were considered with intervention and one covariate added at the time. For the TT duration, a Cox proportional hazards model was used, and for the TT effectiveness, a logistic regression model was fitted.

Statistical analysis was performed using R 3·5·2. Level of significance was set at $\alpha = 0.05$.

Results

Participant recruitment

Thirty-six daycare centres reacted positively on the call to participate in the study (call was sent out to 687 daycares by e-mail) and 2 were recruited on the researcher's own initiative, between November 2017 and October 2018. After randomisation, 16 daycare centres cancelled because of lack of time or participants. In total, we had a collaboration with 22 daycare centres (Fig. 1a). One hundred eighteen

children (aged between 18 and 30 months) were screened and 69 of them met the inclusion criteria. Four out of 69 children were eventually not included in the study because parents were not willing to participate. During the training phase, 10 (of the remaining 65) children were considered as a drop out because of a medical condition (*n* = 3), parents stopped the training early (*n* = 6) or parents did not complete the follow-up questionnaire (*n* = 1). In total, the results of 55 children were analysed (see Fig. 1b). On average 2.5 children per daycare centre were included with a minimum of 1 and a maximum of 8 children.

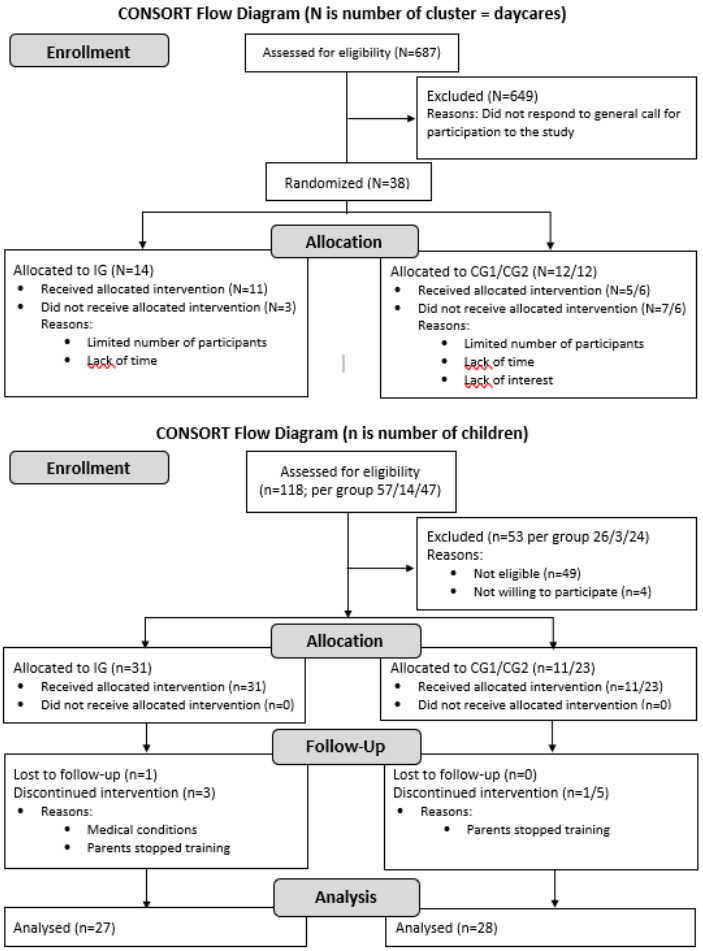

Fig. 1 Flowchart of recruitment and selection a of daycare (N) and b of participants (n)

Statistical analysis

Baseline characteristics per group

Fifty-five children in total (16 boys (29%) and 39 girls (71%)) were trained in both groups: 27 children in 11 different daycares in the IG and 28 in 11 different daycares in the CG. Table 1 reports the baseline characteristics for IG versus CG.

We found no significant differences in any of the baseline characteristics; the majority of the children were girls (74% in IG versus 68% in CG). The mean age of the children in the study was respectively 24·9 months and 24·9 months in the IG and CG.

Variable	Intervention (*n* = 27)	Control (*n* = 28)	*p* value
Gender (% female)	20/27 (74%)	19/28 (68%)	0.612
Age (in months)	24.9 (3.0)	24.9 (2.7)	0.995
Days in daycare	4 (3–4.5)	3 (3–4)	0.218
RS	8 (7–9)	8 (7–9)	0.433
Already started TT	19/27 (70%)	17/25 (68%)	0.853

Table 1: Baseline characteristics per group. RS is total number of RS present of the list of 10 questioned skills (see Appendix 1). Data are mean (SD), median (interquartile range) or n (%).

Compare outcomes between groups

Table 2 reports on the unadjusted comparison of the primary outcome TT duration (expressed in weeks and using 6 weeks as outcome for those who were not toilet trained at the end of the study) and secondary outcome TT effectiveness (proportion of children that were toilet trained at 6 weeks) between the IG and CG.

Because a number of children (*n* = 16) were not yet toilet trained by the end of the follow-up period of 6 weeks, a time- to-event-analysis was performed to censor these observations. Figure 2 shows the Kaplan-Meier curves for IG and CG. An event was defined as being toilet trained; hence, the proportion not being toilet trained at that time is represented. If we censor the children that were not toilet trained at 6 weeks, the median 'survival' in IG was 2 weeks compared to 5 weeks in CG (*p* value log rank test = 0.007). When considering all children in both groups, 39 out of 55 children (71%) had finished TT within the follow-up period of 6 weeks.

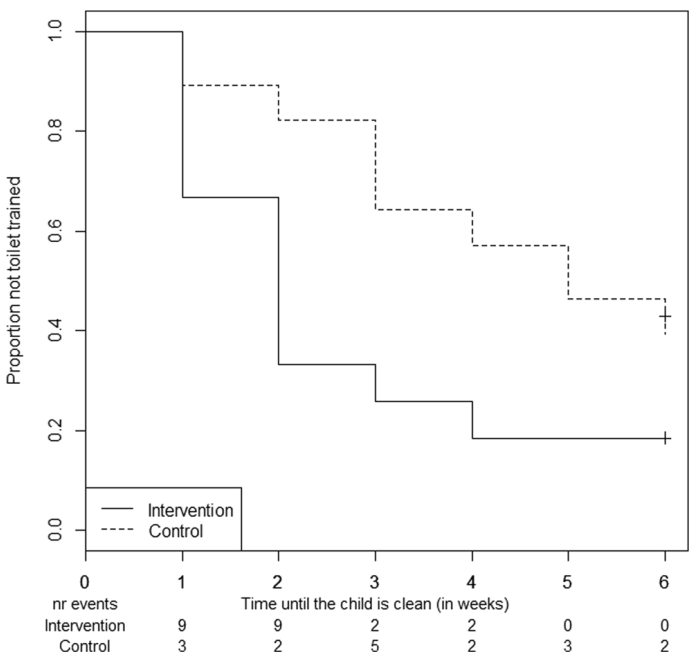

Fig. 2 Survival analysis for the duration of toilet training in intervention and control group. An event was defined as being toilet trained; hence, 'survival' is to be interpreted here as not being toilet trained at that time. At the bottom of the figure, the number of children that were toiled trained per week is given.

Table 3 gives the results of the Cox proportional hazard models on the duration of being toilet trained. For the unadjusted model, the hazard of being clean after 6 weeks is twice as high in the IG compared to the control group ($p = 0.018$). Adding covariates to the model gives a comparable hazard ratio (HR) and in all cases $p < 0.05$. The hazard of being dry is three times higher in girls than in boys. We also see a significant effect of the RS and if they had already started with the training.

Table 4 gives the results of the logistic regression model on being toilet trained at 6 weeks (effectiveness of the training). For the unadjusted model, the odds of being clean at 6 weeks is almost three times as high in IG compared to CG; however, this is not significant (there is a trend towards significance $p < 0.10$). Adding variables to the model only increases the odds ratio (OR), without reaching statistical significancy. Gender has a significant effect on the outcome, with girls having almost fourfold higher odds of being clean at 6 weeks compared to boys.

We also see a significant effect of the readiness skills (one skill more increases the odds of being clean at 6 weeks with a factor 2) and if they had already started with the training (odds of being clean at 6 weeks is 7 times as high for these who had already started).

Variable	**Intervention (*n* = 27)**	**Control (*n* = 28)**	***p* value**
TT duration with limit median (IQR)	(1.0–3.5)	5 (3–6)	0.001
TT effectiveness	22/27 (81%)	17/28 (61%)	0.09

Table 2: Outcome measures. The outcome 'TT duration' is assessed by the number of weeks until the child is clean. The outcome 'TT effectiveness' is determined by the number of children that was clean after the follow-up period of 6 weeks

	HR intervention	**95% CI**	***p* value**	**Covariate**	**HR covariate**	**95% CI**	***p* value**
Unadjusted model	2.17	[1.14;4.15]	0.018				
Adjusted models	2.73	[1.36,5.49]	0.004	Gender	2.87	[1.25,6.56]	0.007
	2.29	[1.19,4.40]	0.013	Age	1.08	[0.97,1.20]	0.179
	2.22	[1.13,4.36]	0.019	Days in daycare	0.95	[0.67,1.33]	0.746
	3.09	[1.49,6.39]	0.002	RS	1.52	[1.17,1.99]	0.001
	2.28	[1.16,4.47]	0.015	Already started TT	2.81	[1.22,6.44]	0.008

Table 3: Unadjusted and adjusted Cox proportional hazards models, with time to being clean as outcome. A corresponding 95% CI was used. For the unadjusted Cox proportional hazards model, only intervention was included, and for the adjusted models, intervention was included with one covariate added at the time.

	OR intervention	95% CI	*p* value	Covariate	OR covariate	95% CI	*p* value
Unadjusted model	2.85	[0.86;10.52]	0.087				
Adjusted models	2.84	[0.82,11.14]	0.102	Gender	3.87	[1.08,14.71]	0.038
	2.91	[0.87,10.93]	0.083	Age	1.11	[0.90,1.39]	0.344
	2.99	[0.86,11.60]	0.085	Days in daycare	0.94	[0.46,1.87]	0.858
	4.06	[0.98,20.84]	0.054	RS	2.16	[1.32,3.95]	0.001
	3.48	[0.90,16.00]	0.071	Already started TT	7.24	[1.88,32.74]	0.004

Table 4: Unadjusted and adjusted logistic regression with TT effectiveness at 6 weeks as outcome. A corresponding 95% CI was used for the unadjusted logistic regression model and for the adjusted logistic regression model (one covariate added at the time)

Discussion

The rationale used in the present study is that toileting is a complex operant and social learning process. There is a need to reform the current approach of TT in Western society to decrease the disadvantages of postponing it [1, 9–13, 20–22]. We wanted to address the problem of the growing population of children in daycare centres that need to be toilet trained. The focus of this research was the duration of TT in children between 18 and 30 months old that were considered ready for TT.

To our knowledge, this is the first CRCT that investigates the effect of intensive TT in small groups in daycare centres. on the TT process. To analyse our primary research question, we found a significant positive effect of intensive group training on the duration to being toiled trained with an estimated doubling of the hazard on being toilet trained after 6 weeks. As the confidence interval for this ratio was quite wide, we need to reconfirm this in a larger study. It was also apparent that considering the same time frame, girls were more likely to be toilet trained than boys [2, 4]. The mean age of the children was 24.9 months in both IG and CG when TT was initiated. We found no influence of age of initiation on the duration of the training. However, there is nothing sacred about the TT age range.

Over the past 100 years, recommended TT methods have oscillated between rigid and permissive programs: a child- oriented TT method by Brazelton [5], a rapid TT method published by Azrin and Foxx [7], deVries and deVries' diaper-free method [6] and a wetting alarm diaper training introduced by Vermandel et al. [8, 17]. Our study protocol combined different elements of these methods of TT. One of the main elements was to stimulate the imitation behaviour, which was reinforced by training in small groups. Also, a doll was used to illustrate drinking and urinating on a potty [7, 17]. Like Azrin and Foxx and Vermandel et al., children were educated about normal toileting behaviour using illustrated books. As in all methods, we overloaded children with fluids to augment the amount of voiding attempts and, based on the principle of operant conditioning, successful events and proper behaviour were positively reinforced [5, 7, 17]. Similar to the rapid TT of Azrin and Foxx, we included children that were considered ready for TT (assessed according to RS); prompted practice trials on the potty were held and the necessary

dressing skills were exercised, though in group. Apart from the timed voiding in group, children were also encouraged to go to the potty when the tutors observed elimination signals in the child [16, 27]. Having dry pants was continuously praised [7]. The proposed studies focuses on TT in normal developing children, initiating TT for the first time. Different elements of the study protocol also have been eval- uated in children with autism spectrum disorder or children who failed the 'low intensity training'. [27, 28].

The study protocol was according to the newest American Academy of Pediatrics (AAP) guidelines for TT: to begin TT when the child shows RS, but typically not before 24 months; positively praising success but without punishment, shaming or force; in a positive, non-threatening, and natural way of training [29].

Innovative aspects of our method of TT were (1) a 2-h training on two consecutive days, (2) carried out in small groups and (3) in daycare centres. We suspect that participation and commitment of the parents and daycare workers during the following days is crucial to corroborate the effects obtained during training sessions. This is just an assumption, since there was no training group without participation of the parents to compare with, nor did we assess whether parents actually conducted the procedures at home, but we can state that children who were subjected to our intervention were dry significantly quicker than controls. Also, the role of daycare professionals cannot be underestimated. Perhaps one of the most subtle, yet powerful, risk factors is the belief of the childcare professionals themselves. Preschool teachers, daycare workers, program coordinators and developmental specialists are key players for today's young children, providing extensive time spent with the majority of children, as well as sources of comfort and counsel for parents and viable resources of parenting recommendations simply by the nature of their roles.

To tackle discrepancy in the training methods between parents and daycare centres, we established our TT intervention in daycare and provided the parents of the children in IG with a leaflet of the applied TT methods and detailed information of their child's potty skills that were acquired during the 2 days of TT. Feedback from the parents tells us that such a leaflet provides them guidance and is helpful in continuing TT in a similar way at home. We believe daycare providers should be educated on this topic to guide children in a proper manner and to keep parents well informed.

One of the main reasons to carry out this research in daycare settings is the advantage of being able to toilet train in group. Children around the age of 24 months often show imitating behaviour; they experience more learning possibilities and will be highly motivated and stimulated [30]. They are natural imitators and learn new skills through play, including pretend play [31]. Previous research has shown that a toilet school group therapy resulted in a significant improvement of toileting skills when compared to individual treatment [32]. It must be emphasised that this research was outlined in children who failed conventional TT, aged between 4 and 6 years old and is therefore less comparable to our population of toddlers that were toilet trained for the first time. Children beginning to imitate their peers in TT could be the subject of future research.

We also found that children who already initiated TT at home before the start of the study were much more likely to be dry at 6 weeks, although in the past, early initiation of intensive TT (before 27 months) was correlated with a longer duration of TT [2]. Many parents worry that early training can be harmful; they have heard that early training might cause behavioural problems or personality disorders [5]. It is surprising to discover that these worries are misplaced. There is no association found between starting early and bladder dysfunctions [21] nor stool problems [2]. On the contrary, initiating TT after the age of 42 months was associated with a higher chance on functional constipation [11] and a difficult and late TT process can cause problems like bullying and child abuse [3, 11]. Most parents are not aware of these possible negative consequences that can entail [33].

To enhance the awareness of voiding and wet pants in the child and facilitate recognising elimination signals by the tutors, children wore underpants during the training sessions. Previous research has already

suggested that wearing underwear might facilitate the development of toileting skills [27, 34]. We presume this could have been a major contributor to the differences seen in the IG and CGs. A hyper-absorbing, disposable diaper will limit the tactile feedback and the child will not be as conscious of the unpleasant feeling of a wet diaper; they will express less elimination signals, and for parents, it will be more difficult to recognise an urge to void or defecate and to adequately respond to it or even estimate the RS. The use of reusable, cotton diapers has diminished, although they have financial and ecological benefits [9, 11–13, 20].

Children will attend nursery school (at the age of 30 months in Belgium), and as a result of the postponement of TT, about 20% of the children is still not completely toilet trained by that time [14, 18]. This trend might compromise the quality of the educational level [22]. Our results prove that a short 2-day TT intervention already has a significant impact on the TT duration in children with a mean age of 24 months.

A few limitations of this study need to be addressed. Observing RS was performed by a daycare worker and thus different in each daycare centre, which can bias the inclusion of participants. As the sample size is small, we were not able to build a model with inclusion of all covariates at the same time and confidence intervals were quite wide, so we have to be cautious about the conclusions and the findings need to be reconfirmed in a larger trial.

As this is a cluster randomised trial, a correction for cluster (daycare) is recommended. In a sensitivity analysis, models including daycare as a random effect were fitted but this led to similar conclusions.

Conclusion

This CRCT describes a new method of TT: a 2-day training in daycare, in small groups of children that show a certain level of TT readiness, with a mean age of 2 years old. After the follow-up period of 6 weeks, more than 80% of the children trained in daycare were fully toilet trained. Also, the experimental intervention of group TT had a significant, positive influence on the duration of TT in healthy children, with a median duration of 2 weeks. Our findings are clinically relevant for parents as well as daycare educators and nursery school teachers. We believe raising and educating young children is no longer a task for the family and school only, with daycare becoming more and more accepted as a third educational environment. Future research is necessary to further implement this new method of TT in group in daycare settings.

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Appendix 1

List of readiness signs which was used during the screening of children for allocation to the study [25].

1. Child expresses a need to evacuate and shows awareness of the need to void or to have a bowel movement.
2. Child insists on completing tasks without help and is proud of new skills.
3. Child can pull clothes up and down in a toilet training- related context.
4. Child wants to be clean and is distressed by wet or soiled diapers and indicates most of the time by himself/herself that he/she has wet/dirty pants.
5. Child begins to put things where they belong.
6. Child can imitate behaviour.
7. Child can say NO as sign of independence.
8. Child wants to participate in and cooperate with toilet training, and shows interest in toilet training.
9. Child can walk and is capable of sitting stably without help.
10. Child wants to wear grown-up clothes.

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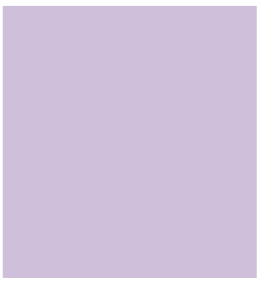

06

GENERAL DISCUSSION

6.1 GENERAL DISCUSSION

There is a remarkable delay in the age of initiating and completing TT. We questioned which factors related to the TT process could be of influence and how we could handle them.

This thesis focused on four possible contributing factors in the postponement of TT and also presented a new TT method to address TT difficulties that arise today in our Western society. None of the outlined research projects specifically focused on the effect of disposable diapers on the delay in TT, although their influence has been brought up in literature many times. Moreover, wearing cloth diapers facilitates the TT process and children will end the training sooner[(1)]. But disposable diapers are an integral part of our 21st century Western society. For that reason, we focused on those factors that could be of influence on TT which are also changeable, like the lack of knowledge in parents, the manner and the moment they get informed, as well as aspects of stool TT. We aimed to find a method of TT that matches contemporary standards and culture.

With the knowledge that we gathered throughout this research, we will discuss below several TT related topics and put them in the broader field of scientific literature concerning TT. We also propose some conclusions and a critical view on the influencing factors on the delay in TT and on the implementation of our new TT method.

6.2 FACING AND FIXING INFLUENCING FACTORS ON THE DELAY IN TT

6.2.1 Educating parents

The data in our study confirmed a delay of the age at which children begin and end TT. Most parents initiated TT because the child would soon be attending nursery school. Only one out of four parents started because their child showed certain signs of readiness, although the latter group appeared to end TT significantly sooner. Parents find TT an unimportant matter: it is time consuming, so parents start when they have some time off[(2)]. At the same time, when interrogating daycare providers, half of them would decide to initiate TT based on the presence of RS only and another 44% decided the right moment to start based on both the presence of RS and the age of the child [(3)]. It is remarkable that parents seem to rely on external factors to start training, rather than taking into account the maturity or readiness of the child. The reason to initiate TT nowadays does not depend on the readiness of the child or on the physical development, but on the parents. According to Bakker et al., seventy (almost eighty)

years ago, 88% of parents started to toilet train before their child was 18 months old; and even 50% initiated before the age of 1.[4] 71% of the children achieved daytime continence before 18 months, whereas the mean age for bladder and bowel control is 36 months nowadays[5].

Some demographic aspects are also associated with an early start of TT, like having only one child and a lower educational level of the parents[6, 7].

Previous research has also confirmed that 80% of parents questioned believe that the postponement in TT does not cause problems in any form[8]. Most parents are not aware of the possible negative consequences that a delay in bladder control can lead to[8].

At the same time, we need to address some of the gaps in the evidence that exists concerning the consequences of early or late TT. We already mentioned the study from Yang et al. concluding early TT for urine does not appear to be associated with bladder dysfunction[9]. They did find that starting nighttime TT for urine earlier was associated with early attainment of nighttime continence and lower rate of enuresis, although the conclusion cannot be drown that delayed TT is associated with higher rates of enuresis[9]. The sample size of this study was small and a long-term follow up is lacking. Other researchers have shown that delay of TT (after the age of 1) induced a significant increase in the prevalence of enuresis and LUTS in children and adolescents[10-12]. The effects of 'early' (How early?) or 'late' TT (How late?) on bladder function needs to be further investigated in the future in longitudinal studies, with larger sample size and from different cultural background[13]. Also, looking at the cultural aspects, we need to ask ourselves if it is feasible to introduce early TT, before the age of 1, into our society with its own habits and expectations.

Evidence-based education of parents concerning TT and the importance of searching for RS could reduce the uncertainties that exist. In that way, parents are encouraged to initiate TT early and TT could be carried out more efficiently and at the right time for the individual child.

6.2.2 Clear, evidence based information on TT

Similar to the previous point, it is important to inform parents correctly about when to initiate TT, how long TT takes and which obstacles they might encounter[14]. More efforts are needed to provide them with this necessary information[8, 15]. Our second study directs the development of a source of scientifically correct, but also helpful

information about TT that parents can and wish to use, a source of information that helps them completing this training in an efficient manner.
In the future, parents would like to receive information about TT that is directed towards them and based on experience, but without ignoring scientific research. Information about TT should be easily understandable and not contain difficult or scientific terms. It was concluded that a brochure sent by regular mail is the easiest way to present information.
Previous research confirmed that 52% of the parents will most likely ask for information on TT from the daycare provider for their child. Only 1% would direct their questions to a general practitioner or other caregiver[7]. Up to 55% of parents would find it useful to receive more information about TT and many parents even wish to pay for this information[15].
We do need to reflect on the possible bias of the small sample size of our study (with 37 participants), all having experience in TT. It might have been interesting to interrogate people with less experience in TT, for example young couples or primipara women; or people with less background on the subject.

6.2.3 TT for stool guidelines

Problems concerning TT as well as bowel and bladder problems in toddlers are rising[5, 16]. One of the phenomena related to TT and stool problems is stool toileting refusal (STR), which was first described by Blum and Taubman in 1997 showing a prevalence rate of 22%[17]. The same research group also stated that children who were toilet trained at a later age had a higher risk of STR, of hiding while defecating and of being frequently constipated[18]. This emphasizes the importance of our third research, regarding postprandial bowel movements in non-toilet trained toddlers.
The main finding was that in 50% of attempts, a child would defecate on the potty. The majority of the toddlers had a bowel movement after breakfast and less often in the evening. Keeping in mind the occurrence of the gastrocolic reflex by putting the child on the potty 15 to 30 minutes after a meal might facilitate the TT process for stool. Defecation can be classically conditioned, largely by establishing a consistent toileting schedule.
A cross-sectional research on the perception and knowledge of school nurses on paediatric toileting showed that 39% have never been educated on bladder and bowel problems in children[19]. One of the clinical implications of our study was providing practical guidelines to parents and caregivers who are initiating TT and want to facilitate TT for stool. The biggest challenge will remain to discover the defecation habits of the individual child. By making use of a bowel movement diary, parents can

be more aware of the daily routine of their child. Blum et al. cautiously concluded that childhood constipation is a chronic problem that might not be treated effectively, leading to problems like STR and hiding while defecating[5]. Future studies should look for the impact of increasing parents' insight and knowledge concerning normal stool behaviour during TT on the occurrence of specific stool toileting behaviour like STR, withholding or hiding during TT and prevention of bowel dysfunctions during childhood.

6.2.4 Implementing a new method

The rationale for this study was multiple and prompted by the results of previous research. There is an increasing need to reform the current approach of TT in Western society for several reasons. We wanted to address the problem of a growing population of children in daycare centers that need to be toilet trained[3, 7]. Also, delay in TT has several disadvantages that need to be increased, like the longer use of disposable diapers, nursery school teachers encountering un-toilet trained children and possible medical or psychosocial effects on the child[1, 4, 5, 9, 13, 16, 20-24].
We presented a new method of TT: a two-day training in daycare, in small groups of children that show a certain level of TT readiness, with a mean age of 2 years old. The median duration of TT was 2 weeks in the experimental group. After 6 weeks, more than 80% of the children in that group were completely toilet trained.
Parents were provided with a brochure containing tips and tricks (also for stool) and were informed of the methods of TT that were used during the intervention in group. They were also individually informed about the progress their child had made that day. In this way, we tried to tackle the first three influencing problems that were described in this work.

An important part of the interventional training was observation of the children and responding promptly to the elimination signals they showed, like body movements or facial expressions. Previous literature already showed that the implementation of these elimination signals in assisted TT, will positively influence the TT process and acquisition of bladder control is reached at a younger age[25]. The study protocol was according to the newest AAP guidelines for TT: to begin TT when the child shows RS, but typically not before 24 months; positively praising success but without punishment, shaming or force; in a positive, nonthreatening, and natural way of training[26].

As far as we know, this is the first study investigating TT of young healthy children in group. Around the age of 24 months a child often shows imitating behavior, children

experience more learning possibilities and will be highly motivated and stimulated[27]. They are natural imitators and learn new skills through play, including pretend play[28]. Previous research has shown that a toilet school group therapy resulted in a significant improvement of toileting-skills when compared to individual treatment[29]. It must be emphasized that this research was outlined in children who failed conventional TT, aged between four and six years old and is therefore less comparable to our population of toddlers that were toilet trained for the first time.

A continuation of this study in the future might focus on the implementation of the protocol in younger children and searching for the feasibility of this TT in group in children aged 12-18 months. Parent's motivation should be carefully considered.

Finally, we need to address some limitations of this work. The number of participants in three out of four proposed studies is small (37 in Chapter 3, 40 in Chapter 4 and 55 in Chapter 5). Although we could find some significant results, the sample size might have been too small to represent the entire population. The biggest barrier we encountered when including participants, was most of the time parents' motivation. On the contrary, the different daycare settings we worked with, were all very enthusiast and stressed the importance of studying toilet training and the need for good, clear guidelines for parents and educators.

6.3 CONCLUSION

The purpose of this research was to investigate several factors that are related to the delay of the TT process and to propose a new method of TT in healthy children that can be implemented in daycare settings.

Most parents appear to initiate TT based on external factors to start training (like the start of schooling). Evidence-based education of parents concerning TT and the importance of searching for RS could reduce the uncertainties that exist[30].

Parents would like to receive information on TT that is based on experience, but without ignoring evidence based medicine (EBM). A brochure sent by regular mail is the easiest way to present information and could help parents to complete TT in an efficient manner[31].

One of the clinical implications of our research was providing guidelines to parents and caregivers who are initiating TT and want to facilitate TT for stool. The majority of toddlers will defecate after breakfast and less often in the evening. We believe that

putting a child on the potty 15 to 30 minutes after a meal might ease the TT process for stool

We wanted to address the problem of the growing population of children in daycare centers that need to be toilet trained and established an innovative method of TT in group, with a two-hour training on two consecutive days, carried out in small groups in daycare centers. Children were screened for RS prior to the study. We found a significant positive effect of intensive group training on the length of time taken to become toiled trained. The fact that the identified strategies are always used as a part of a multicomponent treatment package means it is difficult to draw strong conclusions regarding the effectiveness of these approaches if used alone[32].

6.4 RECOMMENDATIONS FOR FUTURE RESEARCH

The findings of this thesis are clinically relevant for parents, daycare educators and nursery school teachers. Raising and educating young children is no longer a task for the family and school only, with daycare becoming more and more accepted as a third educational environment. Future research is necessary to develop evidence based information, providing it to parents and daycare workers and to implement our new method of TT in group on a large scale in daycare settings. Education of parents and daycare workers on the assessment of the child's readiness and evidence based guidelines for conducting TT could be the first steps in tackling the postponement of TT in healthy children.

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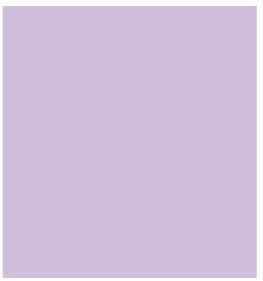


SUMMARY / SAMENVATTING

SUMMARY

TT is a universal issue for children and one of the most important first steps toward independence. Researchers emphasize the importance of starting TT at the moment the child is ready and shows certain developmental skills and characteristics. But at the same time, parents tend to initiate TT at a later age, leading to a delayed acquisition of volitional bladder and bowel control. Delay in TT can lead to several disadvantageous consequences, both for the child and for their environment.

The main objectives of this thesis were to address four factors contributing to the postponement of TT: 1. parents' perception; 2. diverse information; 3. stool problems ; and 4. time.

In chapter 2 the perception of 832 parents on TT was investigated by means of a questionnaire. 50% of parents initiated TT because the child would soon be attending school and parents seem to rely on external factors to start training, rather than taking into account the maturity or readiness of the child, although the latter group ended toilet training significantly sooner.

Chapter 3 highlighted the diverse information on TT that is available nowadays and the insecurity of parents on how and when to initiate TT. Six focus group discussions (FGD), involving 37 participants, were used to explore parents' experiences on TT. The findings of this qualitative study show that reputable agencies, family, friends, daycare workers and nursery school teachers were considered trustworthy sources. TT information should be easily understandable and not contain scientific terms. A colourful and illustrated brochure sent by regular mail seems to be preferred.

A prospective, observational study was performed in Chapter 4 to explore the occurrence of postprandial defecation in 40 healthy infants not yet toilet trained. We observed a bowel movement within the first hour after a meal in 75% of the children. Of them, 37% would defecate within 15 minutes and 72% within half an hour. Fifty-nine percent of all children defecated in the morning, 54% at noon and 28% in the evening.
We believe the implementation of the gastrocolic reflex in TT, as scheduled toilet seats 15–30 minutes after a meal, might help a child in his learning process to defecate on the potty.

In Chapter 5 we addressed the problems of the growing population of children in daycare that needed to be toilet trained and parents that are insecure about the right timing and manner or lack initiative and time to start TT. In a prospective

clustered randomized controlled trial 55 children in total (16 boys and 39 girls) were trained: 27 children in 11 different daycares in the intervention group and 28 in 11 other daycares in the control group. Innovative aspects of this toilet training method were a 2-hour intensive training on two consecutive days, carried out in small groups in daycare centres.
The intervention had a significant influence on the duration of toilet training in healthy children, with a median duration of 2 weeks, compared to 5 weeks in control groups. The hazard of being clean during the following 6 weeks was twice as high in the intervention group compared to control groups.

Education of parents and daycare workers on the assessment of the child's readiness and evidence based guidelines for conducting TT could be the first steps in tackling the postponement of TT in healthy children.

SAMENVATTING

Zindelijkheidstraining (ZT) is een universele kwestie voor kinderen en één van de belangrijkste stappen in hun groei naar onafhankelijkheid. Onderzoekers benadrukken om de ZT te starten op het moment dat het kind zelf er klaar voor is en bepaalde ontwikkelingsvaardigheden en kenmerken toont. Maar tegelijkertijd hebben ouders de neiging om de ZT op een latere leeftijd aan te vatten, waardoor het bereiken van vrijwillige controle over blaas en darmen wordt vertraagd. Een latere ZT kent meerdere nadelige consequenties, zowel voor het kind als voor de omgeving.

De voornaamste doelen van deze thesis waren erop gericht om 4 factoren die bijdragen aan de verlating van de ZT aan te pakken: 1. de perceptie van ouders; 2. verspreidde informatie; 3. stoelgangsproblemen; en 4. tijd.

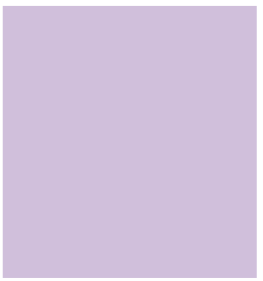
In Hoofdstuk 2 wordt de perceptie op zindelijkheid onderzocht van 832 ouders door middel van een vragenlijst. 50% van de ouders begon de ZT omdat het kind weldra zou starten met school en ouders leken meer te vertrouwen op externe factoren om de training te starten, eerder dan de maturiteit of rijpheid van het kind in acht te nemen, al bereikte deze laatste groep zindelijkheid significant vroeger.

Hoofdstuk 3 belicht de verspreidde informatie over ZT die tegenwoordig ter beschikking is en de onzekerheid van ouders over hoe en wanneer de ZT te starten. Zes focusgroepen met 37 deelnemers, werden gehouden om de ervaringen van ouders over ZT te verkennen. De bevindingen van dit kwalitatief onderzoek tonen dat gerenommeerde instanties, familie, vrienden, kinderdagverblijven en leraren in het kleuteronderwijs als betrouwbare bronnen werden beschouwd. Informatie over zindelijkheid moet makkelijk te begrijpen zijn en geen wetenschappelijke termen bevatten. Een kleurrijke en geïllustreerde brochure die per post wordt verstuurd draagt de voorkeur.

Een prospectieve, observationele studie wordt uitgevoerd in Hoofdstuk 4 om het optreden van ontlasting na de maaltijd in kaart te brengen bij 40 gezonde zuigelingen die nog niet zindelijk waren. Ontlasting werd geobserveerd binnen het eerste uur na de maaltijd in 75% van de kinderen. Hiervan had 37% ontlasting binnen 15 minuten en 72 binnen het halfuur. 59% van alle kinderen maakte stoelgang in de ochtend, 54% ‘s middags en 28% ’s avonds.
We geloven dat het gebruik van het gastrocolisch reflex in de zindelijkheidstraining, onder de vorm van geplande toiletmomenten 15-30 minuten na de maaltijd, het kind zou kunnen helpen in zijn leerproces om stoelgang te maken op het potje.

In Hoofdstuk 5 kaarten we het probleem aan van de groeiende populatie van kinderen in kinderdagverblijven die zindelijk moeten worden en ouders die onzeker zijn over de juiste timing en manier van ZT of gebrek aan initiatief en tijd tonen om te starten met trainen.
In een prospectieve, geclusterde gerandomiseerde gecontroleerde studie werden in totaal 55 kinderen (16 jongens en 39 meisjes) getraind: 27 kinderen in 11 verschillende kinderdagverblijven in de interventiegroep en 28 kinderen in 11 andere kinderdagverblijven in de controlegroep. Innovatieve kenmerken van deze methode van ZT waren een 2-uur durende intensieve training gedurende 2 opeenvolgende dagen, uitgevoerd in kleine groepjes in de kinderdagverblijven.
De interventie had een significante invloed op de duur van de ZT in gezonde kinderen, met een gemiddelde duur van 2 weken, vergeleken met 5 weken in de controlegroep. De kans om zindelijk te worden in de 6 weken van opvolging was twee keer zo groot in de interventiegroep vergeleken met de controles.

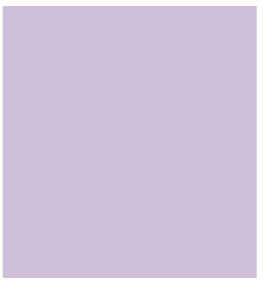
Educatie van ouders en opvoeders over de beoordeling van de rijpheid van een kind en richtlijnen gebaseerd op wetenschap voor het uitvoeren van de ZT zouden de eerste stappen kunnen zijn in de aanpak van de verlating van de ZT in gezonde kinderen.



ABBREVIATIONS

LIST OF ABBREVIATIONS

AAP	American Academy of Pediatrics
EBM	Evidence Based Medicine
ES	Elimination signals
FC	Functional constipation
FGD	Focus group discussions
OVAM	Openbare Vlaamse afvalstoffen maatschappij
RS	Readiness signs
STR	Stool toileting refusal
TT	Toilet training
CRCT	Clustered randomized controlled trial
WAD-T	Wetting alarm diaper training



CURRICULUM VITAE

CURRICULUM VITAE

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2021	‘Academic Vocabulary’ online refresher course – UA-Linguapolis
2020	Webinar “Diastasis Recti” - BICAP
2018	Three-day congress “Pelvic health” – BICAP, Antwerp, Belgium
2017	Symposium: The pudendal nerve – BLUG, Brussels, Belgium
2017	Basic Principles of statistics – Antwerp Doctoral School
2016	Child Urotherapy – Wilhelmina Kinderziekenhuis Utrecht, Netherlands
2015	Congress The Female Pelvis Lifetime – BGKVGPR
2013	Interuniversity course: pelvic floor rehabilitation and perinatal physiotherapy – Antwerp, Leuven, Brussels, Ghent

2011 Course “The assessment and treatment of adults with neurological conditions: the Bobath-concept” – IBITA
2011 “Beginning assistants” – ECHO - University of Antwerp
2010 Course “Psychomotor skills in children” - IRSK-Wings - Gent
2009 “Study career coaching” – Utrecht

Manuscripts related to the thesis

- Implementing a new method of group toilet training in daycare centres: a cluster randomised controlled trial.
  Van Aggelpoel T*, De Wachter S, Neels H, Van Hal G, Roelant E, Vermandel A.*
  Eur J Pediatr. 2020 Nov 23. doi: 10.1007/s00431-020-03879-y.

- Observing postprandial bowel movements in diaper-dependent toddlers.
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- Information as a crucial factor for toilet training by parents.
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Manuscripts related to the thesis subject

- 'Elimination signals' in healthy, NON toilet trained children aged 0-4 years: A systematic review.
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  Van der Cruyssen K, De Wachter S, Van Hal G, De Win G, ***Van Aggelpoel T,*** *Vermandel A.*
  Eur J Pediatr. 2015 Sep;174(9):1129-42.

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- Common errors made in attempt to contract the pelvic floor muscles in women early after delivery: A prospective observational study.
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  Eur J Obstet Gynecol Reprod Biol. 2018 Jan;220:113-117.

- Observing shadow motions: resonant activity within the observer's motor system?
  Alaerts K, ***Van Aggelpoel T****, Swinnen SP, Wenderoth N.*
  Neurosci Lett. 2009 Sep 25;461(3):240-4.

Abstract presentations related to the thesis

- Toilet training in healthy toddlers: is the sequence of acquiring bladder and bowel control changing? Current training VS 50 years ago.
  ***T. Van Aggelpoel**, A.Vermandel*
  Accepted for presentation at ESPU Nurses Congress – Lisbon, Portugal, April 2020 (postponed to September 2021)

- Can the gastrocolic reflex facilitate toilet training for stool in diaper dependent toddlers?
  ***T. Van Aggelpoel,** H. Neels, S. De Wachter, A. Vermandel.*
  Oral presentation ESPU Nursses Congress – Lyon, France, April 2019

- A new method of group toilet training in daycare centers.
  ***T. Van Aggelpoel**, S. De Wachter, H. Neels, A. Vermandel.*
  Poster ESPU Congress – Helsinki, Finland – April 2018

- Intercultural differences in toilet training.
  ***T. Van Aggelpoel**, K. Van der Cruyssen., S. De Wachter, I. Veeckman, V. De Clippele, A. Vermandel.*
  Poster ICS Congress – Firenze, Italy – September 2017

- The gastrocolic reflex in healthy children during toilet training: an observational study.
  ***T. Van Aggelpoel**, S. De Wachter, J. Vercruyssen, K. Van der Cruyssen, A. Vermandel.*
  Poster presentation ESPU Congress - Harrogate, Yorkshire, UK – June 2016

- The gastrocolic reflex in healthy children during toilet training: an observational study.
  ***T. Van Aggelpoel**, S. De Wachter, J. Vercruyssen, K. Van der Cruyssen, A. Vermandel.*
  Poster ESPU Congress & ICCS, joint meeting - Prague, Czech Republic– October 2015

- Stool problems during potty training: contributing factors.
  ***T. Van Aggelpoel**, S. De Wachter, G. Van Hal, G. De Win, J.J. Wyndaele, A. Vermandel*.
  Poster presentation ESPU – Innsbruck, Austria - May 2014

Invited Lectures

2021	Online lecture at 'Het Raster vzw' - Antwerp, Belgium
2020	Course 'Kennismaking over pathologie en therapie voor bekkenbodemreeducatie bij volwassenen en kinderen' – IPVK – Gent, Belgium
2019	Wellspect National Urology Symposium – Rotterdam, The Netherlands
2019	SIG symposium 'toilet training' – Aalst, Belgium
2019	Moderator Mini-symposium 'Multidisciplinaire aanpak van urinaire en fecale urge-incontinentie' – UZA, Edegem, Belgium
2019	Bijscholing Urotherapie 2019 – Wilhelmina Kinderziekenhuis Utrecht, The Netherlands

2018 Two-day course Physiotherapy in pelvic floor dysfunctions in the child - Grupo de interesse de Physiotherapia em Saúde da Mulher APFisio – Lisbon, Portugal
2018 Invited speaker + Workshop 'Anorectal balloon training' - ICS Physiotherapy Forum, Philadelphia USA
2018 Moderator Mini-symposium OASI – UZA, Edegem, Belgium
2018 Pelvic floor seminar – Helsinki, Finland
2017 Lecture at 'Regioavond Kindergastro' – Antwerp, Belgium
2017 Symposium 'Toilet training' – Unieko – Gentbrugge, Belgium
2017 Congress 'Toilet training' UZA-UA – Wilrijk, Belgium
2017 Congress 'Incontinence and obstipation in children: full spectrum therapy' – BICAP – Leuven, Belgium
2014 Educational course urotherapy and urodynamics – ICCS – Utrecht, The Netherlands
2014 BGKVGPR: 'Pelvic rehabilitation in children' – Antwerp, Belgium

Scientific grants

2019 Winner of the ESPU-Nurses Wellspect Research Grant
2018 FWO Grant for participation at a congress abroad (ICS - Philadelphia, USA)
2014 Best poster in poster session: Paediatric urology: Bladder and external genitalia at the 29th Annual EAU Congress in Stockholm

Non peer reviewed publications

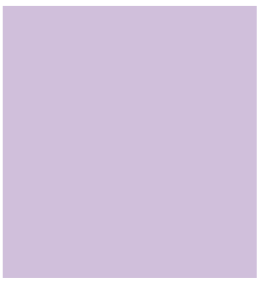
2020 'Droge billen in twee weken? Het is mogelijk' – De Standaard (21/12/2020)
2020 'Eliminatiesignalen' bij gezonde, NIET zindelijke kinderen van 0–4 jaar: een systematische review' – News lettre ABCIG BICAP (2)
2019 'Als we nu eens wat meer zouden hurken' – De Standaard (01/10/2019)
2018 'Zindelijkheidstraining' – Urobel magazine 51:1(2018), p. 22-25
2018 'Een kind is zindelijk als de ouders er klaar voor zijn' – MagUZA (December 2018)
2017 Co-author book 'Je kind zindelijk krijgen: dat doe je zo!' - ACCO by Alexandra Vermandel

Media

2021 Host of Podcast Episode 6: 'Children and pelvic floor' of the ICS Physiotherapy Podcast Series
2019 Radio interview 'Stoelgang kinderen staat onder druk' – Dutch NPO Radio 1 – (01/10/2019)
2019 Television interview 'Verlating van de zindelijkheid' – VTM Journaal (07/01/2019)
2020 Television interview 'Implementing a new method of group toilet training in daycare centres' – VTM Journaal (22/12/2020)

Educational activities

- Guest Lecturer Interuniversity course 'Pelvic floor rehabilitation and perinatal physiotherapy' - Antwerp, Belgium (since 2014)
- Guest Lecturer Thomas More Turnhout, Belgium – Midwifery (since 2013)
- Guest Lecturer KdG Antwerp, Belgium – Midwifery (2013 – 2017)



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DANKWOORD

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