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Review Article

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The Influence of Using Baby Walkers on the Infant Motor Development: Systematic Review

Samah Saud Alharbi[1*], Weaam Alammar[2] and Halah Abuaish[2]

[1]*King Faisal Specialist Hospital and research Center, Physical Rehabilitation Department, Riyadh*

[2]*Senior Pediatric Physical Therapist at King Faisal Specialist Hospital, Saudi Arabia*

[*]Corresponding Author
King Faisal Specialist Hospital and research Center, Physical Rehabilitation Department, Riyadh.

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Abstract

Background: *Research findings suggest that a significant percentage of families worldwide, ranging from 42% to 90%, utilize baby walkers for their infants. However, there is evidence indicating that baby walkers can delay the natural development of motor skills and may pose a risk of infants' health. Report of injuries related to baby walker range from 7 % to 50 % depending on the source. Consequently, additional research is warranted to investigate the influence of using baby walker on healthy infant motor development.*

Purpose: *Review to explore the effectiveness of baby walker use on Infants motor development.*

Methods: *Seven out of eleven studies were observational cross-sectional studies, two studies were described as clinical trial, and other study was longitudinal study, and the last one semi-prospective case-control study, published between 2002-2023. Data source was collected from, Google Scholar, Cochrane library, ProQuest, articles in Scopus, and PEDro databases.*

Data Extraction: *any articles focused on Baby walker usage without considering the influence of infant motor development. Data Synthesis: The study focuses on the influence of using baby walker on healthy infant motor development.*

Limitation of the Study: *The review study is limited to 11 studies, stemming from inconsistencies in outcome and definitions across the articles reviewed, leading to the need to consolidate results for analysis*

Conclusion: *The literature review showed that there is a significant deficiency in evidence regarding the potential influence of baby walkers' child motor development.*

Keywords: Healthy Infant, Baby Walker, Motor Development

1. Introduction

The prioritization of gross motor development in early childhood is achieved through the provision of proper stimulation. However, a significant obstacle is limited knowledge of parents in selecting appropriate methods of stimulation. Traditionally, baby walkers have been a popular choice for parents looking to encourage early walking in infant between 4 to 12 months of age, dating back to the 1660s [1]. However, according to previous research conducted in Indonesia indicate that the average age at which infants begin to walk is 9-15 months [2]. This disparity highlights the variability in children's developmental timelines and underscores the significance of recognizing individual differences in the developmental progression. Generally, infants typically start walking between 9 to 12 months of age. With the most babies achieving independent walking by 15 months.

According to Janusz et al, parents have confidence in the ability of baby walkers to assist infants in maintaining contact with the ground and facilitating movement while they develop their walking skills [3]. Additionally, baby walkers are seen as a useful tool for strengthening the lower body muscles in infants as they begin to walk. However, previous research has indicated that prolonged

use of baby walkers in infants can determinedly influence gross motor development and lead to injuries resulting from falls [4,5]. There is concern regarding the efficacy of baby walker based on age can effectively enhance motor skills in infants. An added benefit of using a baby walker is its ability to aid in the learning to walk process; assisting infants who are unable to navigate and explore their surrounding while in a standing position [6].

Despite it is long history of usage, there has been ongoing debate surrounding the safety and effectiveness of baby walkers in recent years. While baby walkers continue to be widely utilized globally statistics indicate that approximately 50%-77% of parents of infants use baby walker [5,7]. Parents' attitudes to use BW vary based on their cultural beliefs and lifestyles.

Some pediatric associations do not recommend their use due to safety concerns [8,9]. In fact, safety standards for baby walkers have been revised in the USA to address potential hazards such as fall and accidents [8,9]. Despite the warring, many families continue to use baby walkers as a way to keep their child occupied and to potentially accelerate their development [5]. However, studies examining the effects of baby walker use on child development have yielded conflicting results. Some studies have reported adverse effects such as delays in motor skills, while others reporting no such correlations [10,11].

As Badihian et al, highlighted the limited research available on the impact of baby walker use on child development [4]. While few studies have assessed this relationship, there is insufficient evidence to definitely conclude whether baby walker are beneficial to child's development. The Current data in the literature still are not conclusive and need more research is needed to fully understand the relationship [4,12]. The potential implications of developmental delay associated with the use of baby walkers can be approached from two perspectives [4]. Firstly, these walkers may encourage premature locomotion in infant, potentially disrupting the natural developmental process that infants need to undergo [13]. Secondly, they may hinder the visual experience of infants moving limbs due to their design, which is believed to play a crucial role in the development pf motor skills. Because of these concerns, including injuries related to the use of walkers, baby walker sales have been prohibited in Canada since 1989, and the American Academy of pediatrics does not recommend their use [8,12]. This paper does a systematic review to explore the effectiveness of baby walker use on Infants motor development.

2. Methodology

2.1. Methods

Systematic review of the literature was performed through electronic search from August 2023. By identifying the studies from Google Scholar, Cochrane library, ProQuest, Scopus, and PEDro databases form the August 2023-August 2024 period. All the articles, which filled the inclusion criteria related to healthy children who used baby walker during the first 18 months of age, were included without considering the year of publication.

These search engines include Specific search words were used to filter out unnecessary and irrelevant articles. The search words used were topic-related and were targeted to get the best results from the search engines such as (baby walker AND motor development), (baby walker AND infant gait), (baby walker AND crawling), (development OR walk), (baby walker OR runner), (baby walker Or infant walker), (pediatric OR Walking aid).

2.2. Inclusion and Exclusion Criteria

The inclusion of articles in this review was based on the following:
• The chosen articles in English language focus on clinical trials, randomized control trials, pilot studies, feasibility studies, and systematic reviews that critically evaluated the influence of baby walker on the child development. The interventions recommended for these studies involve physical therapy utilizing baby walkers as a tool for enhancing infants' motor development. Studies that had evaluated the influence of baby walker on health child development from 4-18 months of age, since babies can use walkers as young as 4 months while the majority of infants walk independently by 18 months. The desired outcome of these studies is to analyze the influence of baby walker usage on infants' motor development.
• Studies focusing on children with physical or developmental impairment prior to commencing walker use were excluded.

2.3. Quality of Methodological Reporting

The methodological reporting quality of study was analyzed using the PEDRo scale. All studies met the initial criteria related to participant selection and intervention with the baby walkers, as well as having comparable groups before intervention (criteria #4), only two studies adhered to the criteria for (blinding of subjects), Criteria #5. While, none of the studies met the criteria for blinding of the therapists, Criteria #6. Most of the studies did not meet the criteria for one key outcome for at least 90 % of the subjects, Criteria #8. Intention to treat analysis Criteria #9, and statistical comparisons, Criteria #10. Various strategies were implemented to minimize bias, such as conducting a comprehensive search for published evidence in multiple databases.

2.4. Study Selection

Two investigators selected studies for eligibility based on the preferred reporting items for systematic reviews and Meta-analysis (PRISMA) statement [14]. They conducted a thorough examination of randomized controlled trails, pilot studies, and clinical trials that investigated the influence of baby walkers on infants' motor development. The primary researcher (SA) independently reviewed abstracts to identify articles related to the use of baby walkers and functional motor development. A recursive search of the references from relevant articles was also conducted. Articles were evaluated by second (WA) and third reviewers (HA) to ensure they met the criteria for inclusion. The extracted data were entered into sheet to be compared as reported in this paper.

3. Results

A total of 141,000 articles were identified in Google Scholar, 5 in Cochrane library, 168,041 papers in ProQuest, 21 articles in Scopus, and 1 review in PEDro databases. The process of reviewing the titles and abstracts, followed by a thorough assessment of the full manuscripts of pertinent articles, resulted in the selection of 10 articles that adhere to our criteria, encompassing one clinical trial, eight observational studies, one longitudinal study, and one semi-prospective case-control study. Figure displays the flowchart depicting the process of identification, screening and selection.

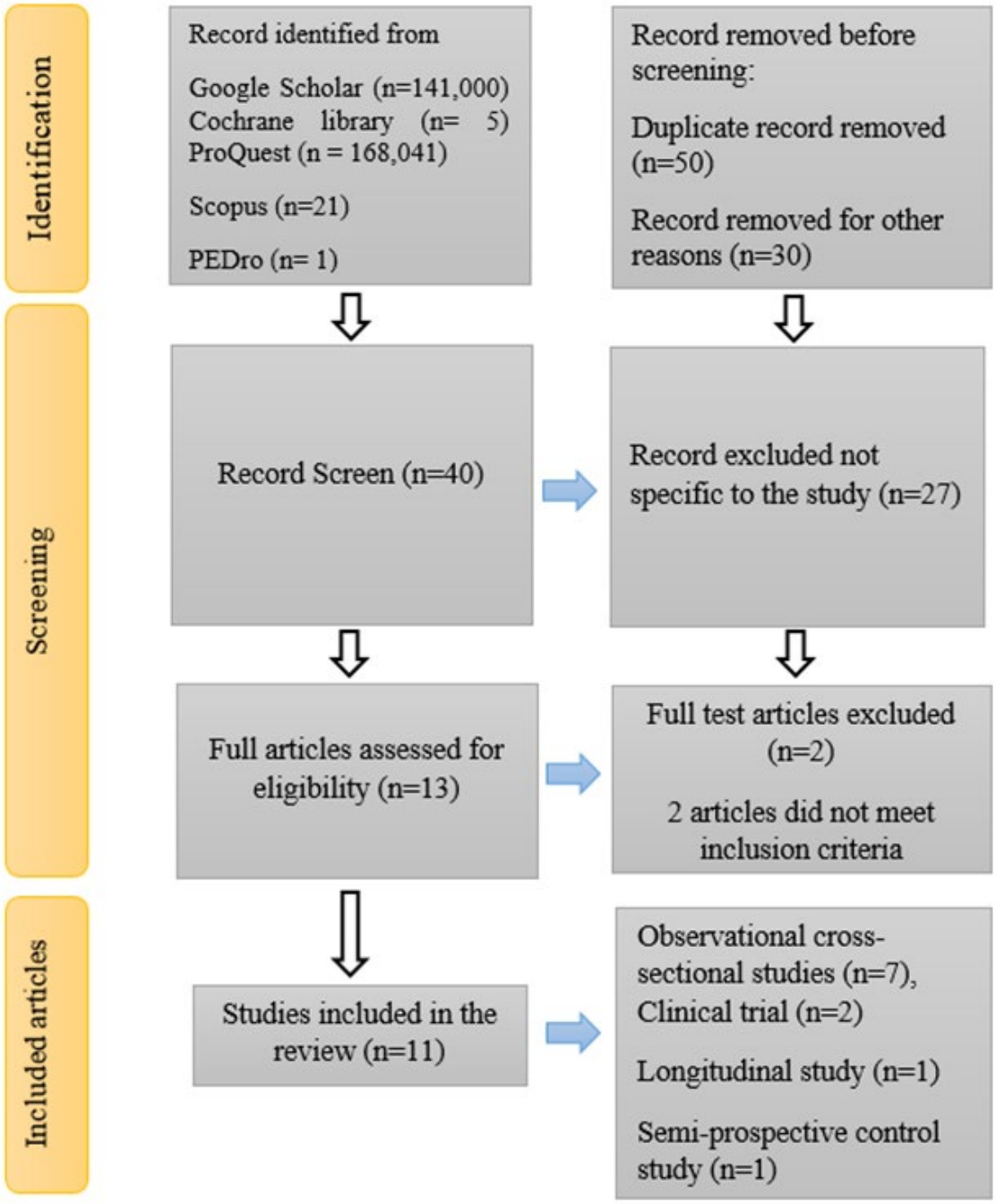

Figure: PRISMA Flow Chart

Author/ Year	Study Design	Sample (N)	Duration of follow up	Age at walker usage	Frequency of walker use	Outcome measurement/ Intervention	Finding	Limitations
Janusz et al [3]	Cross-Sectional Survey	969	-	8.7 months (Mean age)	- Median number of days of baby walker use per week 5 days - The mean length of use per day was 1.9 hours per day.	- The mean age of onset of walking	- The onset of walking was earlier in children using baby walker less than 3 months - Children who used a baby walker were 3 times more likely to not have crawled for mobility than those who did not use a baby walker. - Children demonstrated gait disorders (e.g. toe walking and flat foot) in both groups.	- Recall bias, since the participant were not able to recall details of their children's walker use since the questionnaire was administered with parent whose children were around 5 years of age.
Bezgin et al [15]	Case-Control Study	48	18 months	10.55 months (Mean age)	2.5 months (Median)	- The mean age of acquisition of motor skills including rolling, crawling, moving on hands and feet, sitting without and with help, standing and walking dependently (using AIMS)	- The use of baby walkers might delays the motor development of infants and this may be due to impaired trunk control.	- Small sample size of the study participants and the motor development of children cannot be followed after the study.
Yaghini et al [16]	Cross-Sectional Study	214	At 12 months then at 18 months	1.46 months (Mean age)	Not reported	- Measure gross motor development between users and non-users (using ASQ)	- No significant difference was found between the two groups in the area of gross movements at the age of 12 and 18 months	- Did not determine baby walker usage frequency

METE et al [17]	Semi-Prospective Case-Control Study	336	From birth up to the age of ten years for well-child controls	Not reported	30 minutes or more a day for at least 1 month	- Assess language-cognitive, motor and mental development. Sitting without support and independent walking (Using ADSI)	- There was no developmental problem in any of the children, - There was a statistically significant difference in terms of an atypical gait pattern between the two groups especially toe-walking were more frequent in children who used BW.	- Did not determine the ages of onset using the baby walker
Sharov et al [18]	Pseudo-Retrospective Cohort Study	268	Not reported	Not reported	18.5 months (Average frequency)	The mean age of achieving standing with support moving around and walking alone.	- No difference between two groups regarding standing with support and moving with support - A delay in walking alone among children who were put into baby-walkers it amounts to 10-13 days depending on frequency and time spent in baby-walkers a day - Significant correlation between using baby walker and tiptoe walking	- Various frequencies of using baby walker
Shafeek and El-Negmy [19]	Clinical trial	87	Until acquisition of independent gait	Before 7 months (Mean)	At least 3 hours daily	- Identify the gross motor development for children (using ASQ-3) - The mean age of gait acquisitions	- Delay the acquisition of independent walking and disturb the normal gait pattern in normal children	- No information on sample size calculation - Failure to define study population clearly

Alessa et al [20]	Cross-Sectional Study	235	Not reported	Not reported	< 1 hour daily (80 patients) 1-2 hours daily (102 patients) 2-4 hours daily (42 patients) > 4 hours daily (11 patients)	- Children skipped sitting without support - Skipped crawling Skipped pulling to stand - Skipped cursing	- The baby walker enhance children motor development and skip major gross motor skills	- Failure to randomize study group - Not reported ages at onset of using baby walker
Shiva et al [21]	Cross-Sectional Study	414	Not reported	The age for the onset of use of walkers was 3–9 (mean age 5.59 ± 1.47) months	Not reported	The mean age of gait acquisitions	No significant difference in the mean age of onset of independent walking was observed between the two groups	Did not determine baby walker usage frequency
Talebian et al [22]	Longitudinal Study	300	2 years	3-15 months (no mean available)	Not reported	The mean age of acquisition of motor skills including rolling, crawling, moving on hands and feet, sitting without and with help, standing and walking dependently	- Baby walkers delays the acquisition of motor skills in infants	- Incomplete reported descriptive data - Failure to report the frequency of using baby walker
Garret et al [23]	Cohort study (retrospective)	190	Until the onset of walking	26 weeks (Median age)	Not reported	The onset age of head control during prone, sitting with support and alone, crawling, standing with support and alone, walking with support and alone	- Delay in achieving normal developmental milestones such as crawling, standing and walking independently, in baby walker user.	- Not reporting the frequency of using walker - Failure to confirm the results of the study - Failure to randomize the study participants

Siegel and Burton [13]	Prospective cohort study	109	3 months until onset of walking	4.8 months (mean age at walker onset)	2.3. hours per day	Age at onset of sitting, crawling and walking (using Bayley motor and developmental scores)	-Delay motor development related to sitting, crawling and walking in walker users showed lower Bayley III scores	- Various ages at onset of using walkers - Various frequencies of using walkers
*Alberta Infant Motor Scale (AIMS); Ages & Stages Questionnaires-3 (ASQ-3); Ankara Developmental Screening Inventory (ADSI)								

Table: Summary of Studies Characteristics and Outcomes

3.1. Study, Participant and Intervention Characteristics

3.1.1. Study Characteristics

In the current review, the study characteristics of the included studies varied widely in terms of design. Seven out of eleven studies were observational cross-sectional studies, two studies were described as clinical trial, and other study was longitudinal study, and the last one semi-prospective case-control study. Using the baby walker during the first 18 months of child life is a common intervention taken by parent to aid in their motor development. However, Studies have shown that the use of baby walkers may have negative effect on the child's functional motor development. Some of the expected outcomes of using a baby walker include developmental delay, child gait disorders, parents' attitude and knowledge, parents' satisfaction, hindered acquisition of early walking skills, enhancement of the mental, fine motor and sensory skills. Research has also shown a documented association between the use of baby walkers and infant motor development, with some studies reporting high levels of parental satisfaction.

3.1.2. Participants Characteristics

The total sample sizes were reported, with interventions were designed for healthy infants aged 0-18 months. Notably, one study did include participants between the ages of 18-30 months.

3.1.3. Key Intervention Characteristics

Interventions aimed at using baby walkers often focus on measuring the average age at which children acquire certain motor skills, as well as providing the parents with targeted information. The frequency with which baby walkers are used with children can vary significantly, ranging from 30 minutes once/day to over 240 minutes daily. The interventions are typically followed up until the child begins walking independently.

3.1.4. Characteristics Most Frequently Associated with Significant Improvements

The findings presented in table shed light on the impact of baby walkers on infant motor development. The data revealed that two studies showed a significant improvement in outcomes, the overall mean improvement in outcomes across studies was only 18%. Additionally, four articles did not show a significant improvement in outcome measures, highlighting the limited effectiveness of baby walkers. Six studies only reported that the use of baby walkers delayed the achievement of normal motor development in infants. The type of intervention also seemed to negatively influence infant motor development by 54.5%, with four studies indicating that it could result in gait disorders such as toe walking and flat foot, which were found to be more prevalent among baby walker users compared to non-users. The literature review emphasized the frequency and duration of using baby walkers influencing children's improvement. Ultimately, these results confirm that the use of baby walkers is 54% inefficient for children's motor development, with a significant negative impact on their gait and overall development. Additionally, parents and caregivers should be more aware of these findings to make informed decisions regarding the use of baby walkers with infants.

4. Discussion

Claims have been made that use of baby walkers may result in delays in the development locomotor function [10]. Shafeek and El-Negmy discovered that 56.3% of children in Egypt use baby walker frequently, indicating a high rate of usage in Egyptian population [19]. Similarly, also Shiva et al, found that 54.5% of Iranian children use baby walkers [21]. Many studies conducted worldwide have reported a high prevalence of baby walker usage. In urban areas of Turkey, Dogan et al, observed a usage percentage of 75.4%, while in Ireland; Garrett et al, found that 54% of children use baby walkers [23,24]. Thein et al, reported a usage rate of 50% in the United Kingdom, and Marcella and McDonald documented a usage rate of 70-90% in the United States [10]. Majority of parents who utilized walkers for their infants did so with the belief that it would help the infant in reaching the developmental milestone of independent walking at an earlier stage.

There has been a lot of research performed in various countries in different years on assessing influence exerted by baby walkers on motor skills and the results are rather controversial. This review included eleven articles examining the influence of the baby walker on the infants' motor development. While some of the studies suggest that using baby walker may delay locomotion function and cognition in infant, there is limited research supporting these

claims. The current evidence is insufficient to justify banning the use of baby walkers [12]. Regarding child development, Badihian et al., concluded a systematic review on the effect of the walker on motor development [4]. They found that there was insufficient and conflicting evidence on the effects of using a walker, suggesting they caution should be exercised until further studies with higher levels of evidence are concluded. Burrows and Griffiths also concluded a second review, pooling their analysis of various studies, and found a delay of 11 to 26 days in the acquisition of independent walking [12]. However, they remained uncertain about the significance of this delay.

Yaghini et al., the relationship of ASQ test result and baby walker usage among 107 infants was assessed [16]. The findings indicated there was no significant developmental delay among infants who used baby. This study marks the first attempts to examine the relationship of ASQ test result and baby walker usage in existing literature. However, previous studies have yielded contradictory outcomes. Garret et al., a study with large sample size 190 children identified that there was a relationship between the frequency of the baby use and extended of developmental delay [23]. The children used baby walker acquired motor milestones such as crawling, standing alone and walking alone later than children who did not use baby walker. However, the reliability of these findings is called into question due to their significant issues. Nonetheless, Siegel and Burton support these findings [13]. Their prospective cohort study indicated that the use of occluding-walker, which are modern walkers that prevent infants from seeing their legs, delay the development of sitting and walking skills. Conversely, the see-feet walker, which are traditional walkers that allow babies to see their legs, did not have a significant impact on motor development. These studies had a more robust design compared to other observational studies, with relatively large sample size and evaluation of child development using two distinct methods (ASQ and Bayley development Scale). Furthermore, these findings are consistent with the longitudinal study conducted by Talebian et al., which also found a significant delay in the acquisition of motor skills in a baby walker group [22]. Kauffman and Ridenour concluded that while the use of baby walkers may lead to temporary mild motor delay, these delays not relevant in real life situations for normal infants [25].

On the other hand, despite the delayed onset of crawling in the baby walker user group, there was no significant difference in the onset of independent walking between the users and non-users [26]. Three other studies also showed no difference on the age of gait acquisition between these two groups [11,18,21]. The findings of these studies were found to be contradictory to Shafeek and El-Negmy, which suggested a delay in acquisition of independent walking among walker [19]. This delay was found to be greater with increased use of baby walkers, resulting in a delay of up to 16 days compared to lower walker users. This opposed to the latest studies Janusz et al., revealing an earlier onset of walking skills development among users, Alessa et al., have asserted that the use of baby walkers can actually improve infant's motor development and potentially lead to the skipping of significant gross motor milestones [3,20].

Some of the researchers have suggest that the use of baby walkers may lead to tiptoe walking [3,18]. Moreover, there have been limited number of studies examining the differences in gait patterns between baby walker users and non-users, with varying evaluation methods included subjective evaluations based on researcher observations, which result in weak evidence to support their findings [25,27]. More studies that are rigorous contradict the idea that baby walkers lead to developmental delays, while larger observational studies have less methodological issues suggest that there may be a connection. Insufficient and conflicting evidence regarding the negative effects of baby walkers on child development makes it difficult to draw a definitive conclusion. It recommended using baby walkers cautiously until further robust studies are conducted on the matter. Multiple obstacles were faced during this study, initially, stemming from inconsistencies in outcome and definitions across the articles reviewed, leading to the need to consolidate results for analysis. Secondly, despite the prevalent correlation between injuries and use of baby walkers, there was a lack of review on injuries related to walkers in the current paper assessed.

5. Conclusion

There is a significant deficiency in evidence regarding the potential influence of baby walkers' child motor development. Some studies suggest that baby walkers may aid in motor development, while others indicated potential disadvantages such as delaying infants' gait acquisition and causing gait disturbances in normal children. The existing literature does not provide sufficient data to outright ban the use of baby walkers; however, it does not demonstrate any clear advantages for child motor development either. This matter warrants greater attention from researchers to assist parents in making informed decisions for their children and to guide pediatrician in advising their patient on this topic [28,29].

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