Reaching Behavior in Preterm Infants During the First Year of Life: A Systematic Review

Elaine Leonezi Guimarães, Andréa Baraldi Cunha, Daniele de Almeida Soares, and Eloisa Tudella

The aim of this systematic literature review was to examine and discuss studies that investigated reaching in preterm infants during the first year of life. Databases were searched using keywords such as reaching, grasping, preterm, and premature, in addition to specific terms from the Medical Subject Headings (MeSH) (motor skills, infant, movement, premature birth, hands) regardless of year of publication. One hundred thirty-five studies were identified, 9 of which were selected. The results showed that preterm infants adopt strategies (bimanual reaches and reaches with less rectilinear trajectories toward an object in motion, reaches with semi-open and open hand, reaches at lower speeds, with increased movement units, and variable postural muscle activity) compared with full-term infants. However, the results on how intrinsic factors (e.g., prematurity) and extrinsic factors (e.g., body position, physical properties of the object) influence early reaching are still limited.

**Keywords**: grasping, premature birth, movement, infant

Goal-directed reaching, defined as the ability to locate an object in space and move one or both hands toward it to touch it (Thelen et al., 1993), enhances the infants’ ability to explore the environment. This skill is typically acquired at around 3–4 months of age (Thelen et al., 1993; Thelen, Corbetta, & Spencer, 1996; van der Fits, Flikweert, Stremmelaar, Martijn, & Hadders-Algra, 1999) and is initially performed with abrupt movements of the hands, with fragmented and irregular trajectories and hands held out horizontally (von Hofsten, 1991; Thelen et al., 1996; Konczak & Dichgans, 1997; Rocha, Silva, & Tudella, 2006), indicating little coordination and motor control (i.e., immature reaching; Thelen et al., 1996; Konczak & Dichgans, 1997). Furthermore, without head and trunk support, reaching movements are typically bimanual between 5 and 6 months and at the end of the first year of life (Fagard, 2000), whereas when head and trunk support exists,
reaching is predominantly unimanual between 5 and 7 months in full-term infants (Carvalho, Gonçalves, & Tudella, 2008a; de Toledo, Soares, & Tudella, 2011).

With age and experience, reaching becomes straighter and has less movement units from 4 to 7 months of age, indicating smoother, more fluent trajectories (Rocha et al., 2006; Carvalho, Tudella, & Savelbergh, 2007; Toledo & Tudella, 2008). Moreover, the decrease in forearm pronation between the prereaching period (1–1.5 months before reaching onset) and reaching onset (Bhat, Lee, & Galloway, 2007) seems to favor the vertical orientation of the hand, making grasping easier (de Toledo et al., 2011). In addition, from the age of 4 months, infants become more proficient at adjusting their hand opening according to the size and rigidity of the object (Rocha et al., 2006).

From the above, it is evident that the development of reaching behavior is shaped by the interaction between intrinsic and extrinsic factors (Thelen et al., 1993). Studies have investigated reaching, addressing the influences of intrinsic factors, such as age (Rocha et al., 2006), postural control (Thelen & Spencer, 1998; Fallang, Saugstad, & Hadders-Algra, 2003a) and prematurity (Heathcock, Lobo, Galloway, 2008; Toledo & Tudella, 2008; de Toledo et al., 2011) as well as extrinsic factors, such as skill training (Heathcock et al., 2008), body position (Savelbergh & van der Kamp, 1994; Carvalho et al., 2007), physical properties of the object (Corbetta, Thelen, & Johnson, 2000; Rocha et al., 2006), and adding weights to the infant’s upper limbs (Corbetta & Thelen, 1992; Out, Savelbergh, Van Soest, & Hopkins, 1997). However, as most studies have investigated full-term infants, the influence of premature birth on early reaching behavior needs to be highlighted.

Low-risk preterm infants, born between 27 and 36 weeks of gestational age, demonstrate poor reaching skill development that differs from full-term infants. Specifically, low-risk preterm infants have performed poorly when regulating muscle strength of the upper limbs during hand function (Plantinga, Perdock, & de Groot, 1997) and performed reaches with less velocity, more corrections and less rectilinear trajectory compared with full-term infants over the first year of life (Toledo & Tudella, 2008; Grönqvist, Strand Brodd, & von Hofsten, 2011). Although there is no defined clinical diagnosis, discrepancies in muscle tone regulation common to preterm infants seem to affect the axial musculature and, consequently, postural control for upper limb-related functions (Plantinga et al., 1997; de Groot, 2000). Some studies suggest that the presence of motor abnormalities during reaching in preterm infants may reveal strategic forms of neuromotor adaptation in response to the early demands of the extrauterine environment to overcome their intrinsic limitations and perform movements with better control (Fallang et al., 2003a; Toledo & Tudella, 2008).

It should be noted that the paucity of specific studies related to the reaching behavior of preterm infants limits the understanding of which body-related factors alter the development of this skill and in what manner. In addition, some of these studies have not investigated manual reaching directly but rather grasping and forearm movements (Plantinga et al., 1997) and postural control during reaching (Fallang, Saugstad, Grogaard, & Hadders-Algra, 2003b). Thus, this review aims to examine and discuss studies that investigated reaching in preterm infants, to identify the methodological procedures used in these studies and to describe the factors that influence the reaching behavior of this population in their first year of life.
Method

The articles were retrieved from an extensive search of the following databases: Medical Literature Analysis and Retrieval System Online (MEDLINE), Biblioteca Virtual em Saúde (BVS), Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), Pan American Health Organization (PAHO) and the National Library of Medicine (PubMed) using the keywords reaching, grasping, preterm, and premature, in addition to specific terms from the Medical Subject Headings (MeSH; i.e., motor skills, infant, movement, premature birth, hands) regardless of the year of publication.

The authors worked independently using the Cochrane Collaboration model (Higgins & Green, 2011) adapted to extract data considering methodological aspects such as experimental design, skill evaluated (reaching), characteristics of participants manipulated, experimental conditions, and technique used to analyze the reaching and presented results (Figure 1).

Initially, three reviewers selected articles based on titles and abstracts, excluding those clearly unrelated to the review subject. In the case of disagreement, the reviewers read the entire paper and engaged in discussion to determine the final selection of articles. The inclusion criteria were studies with experimental design that evaluated the reaching of preterm infants with a gestational age below 37 weeks (World Health Organization, 1995, 1999) during their first year of life.

The experiments were classified according to the methodological aspects identified: number of participants, gestational age, corrected age; experimental design; manipulated experimental conditions: body position (supine, reclined or sitting) and body support (head and trunk supported, or trunk only), physical properties of the object used to stimulate the reaching movements, skill training and additional weight on the upper limbs; and the type of analysis used, such as movement analysis by video recording, kinematic movement analysis and/or surface electromyography to evaluate the reaching behavior.

Results

The electronic search of the literature included publications up until March 2011 and, using the keywords mentioned above, yielded 135 articles in English. Of these 135 studies, 126 were excluded (Figure 1). The final selection was defined by consensus and resulted in nine studies, three developed in Norway, two in Brazil, two in the United States, one in Holland, and one in Sweden. These studies were published in specialized and indexed journals, with an impact factor greater than 1 (JCR). Table 1 presents data on the methodological aspects, identifies the country of origin of the studies included and their journal impact factor.

Discussion

The objectives of this review were to examine studies that investigated reaching behavior in preterm infants during the first year of life, to identify the methodological procedures used in these studies and to describe the factors that influence the
onset and refinement of reaching behavior in this population. To meet the objectives, we conducted a bibliographic search of the literature from 1999 to 2011, and nine studies were included in this review according to the established criteria.

**Methodological Aspects**

The papers included in this review addressed the reaching behavior in preterm infants, with a corrected age of between 2 and 12 months, without serious neurological disorders. Studies investigating reaching behavior in infants with disorders such as cerebral palsy were also found, however, this was in older infants and young children, which did not meet the criteria selected for this review (namely, children younger than 1 year old).

The low number of participants (6–63 in the preterm group and 10–20 in the full-term group) in most of the studies was justified by factors such as crying during the experiment, serious illness, refusal or nonattendance of parents or other responsible adult after inclusion, and experimental error during evaluation (Fallang et al., 2003a; Fallang et al., 2003b; Toledo & Tudella, 2008). The sample loss could be minimized allowing infants for naps, breaks, feeding, coming back later in the same day, as well as scheduling 2 days for assessment when only one is needed and cancel the second day if the first collection is successful. Furthermore, providing transport for the infants with their parents or guardians from their homes to the research laboratory, or using a mobile laboratory to gather data in the homes of the infants could also minimize sample losses, although this would require more financial resources.

The gestational age included in the studies ranged from 24 to 36 weeks, and the majority assessed late preterm infants (34–36 weeks and 6 days; Engle, Tomashok, Wallman, & Committee on Fetus and Newborn, 2007). Late preterm newborns is the fastest growing epidemiological group in the United States (Davidoff et al., 2006) and there is growing literature reporting that these infants have greater risks for developmental delays or neurological disorders than infants born full-term (Engle et al. 2007; Petrini et al., 2009). This may partly explain the predominance of studies on late preterm infants. Future research on reaching behavior should also be alert to preterm infants with a gestational age below 34 weeks and low birth weight, since they represent a group of infants at a greater risk than late preterm infants.

Of the nine papers reviewed, one did not use corrected age for prematurity when assessing the infants (Clearfield, Feng, & Thelen, 2007). In addition, two studies included the emergence of reaching (Clearfield et al., 2007; Heathcock et al., 2008), while the remaining seven focused on reaching as a skill already present. We believe that the difficulty in monitoring the infant week by week to pinpoint the moment at which reaching is acquired determines the lack of studies on this phase of reaching development. However, such methodological rigor would be a much better way of controlling the influence of spontaneous practice in reaching behavior (Carvalho, Tudella, Caljouw, & Savelsbergh, 2008b).

Experimental designs included nonblind randomized controlled trial (Heathcock et al., 2008) and longitudinal (Van Der Fits et al., 1999; Fallang et al., 2003a; Fallang et al., 2003b; Fallang, Øien, Hellem, Saugstad, & Hadders-Algra, 2005; Clearfield et al., 2007; Toledo & Tudella, 2008; Grönqvist et al., 2011;
Figure 1 — Selection of studies for inclusion in the systematic review. (continued)

Excluded Studies
(n=126)

- Full-term infants only (n = 75)
- Atypical full-term infants (n = 9)
  - Methodology not aimed at analyzing reaching movement itself (n = 5)
- Experiments with animals (n = 4)
- Studies that met none of the inclusion criteria (namely, human infants, gestational age below 37 weeks, assessment during the first year of postnatal life, reaching) (n=24)

Included Studies
(n= 9)

Research in Databases

Selection of abstracts by three reviewers
Figure 1 — (continued) Selection of studies for inclusion in the systematic review.
Table 1  Data of Experimental Studies Addressing the Reaching Behavior of Preterm Infants

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study design</th>
<th>Type of analysis</th>
<th>N</th>
<th>GA (weeks)</th>
<th>AF</th>
<th>Groups (PT/FT)</th>
<th>Experimental condition</th>
<th>Site of Study Development</th>
<th>Journal Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>de Toledo et al. (2011)</td>
<td>Longitudinal Comparative</td>
<td>Video recording</td>
<td>19</td>
<td>32–36</td>
<td>5, 6 and 7 months of corrected age</td>
<td>9 PT</td>
<td>Sitting semi-reclined at 50° with trunk and head support. Rubber soft object (10 cm in length × 5 cm in diameter)</td>
<td>Brazil</td>
<td>1.65</td>
</tr>
<tr>
<td>Grönqvist et al. (2011)</td>
<td>Longitudinal Comparative</td>
<td>Kinematic analysis</td>
<td>67</td>
<td>&lt; 32</td>
<td>2, 8 and 10 months of corrected age</td>
<td>47 PT</td>
<td>Sitting upright in a baby chair with support on lower trunk. Small moving object (radius = 2 cm) of unknown material</td>
<td>Sweden</td>
<td>2.22</td>
</tr>
<tr>
<td>Heathcock et al. (2008)</td>
<td>Clinical trial Randomized control clinical trial</td>
<td>Video recording</td>
<td>39</td>
<td>&lt; 33</td>
<td>2–4 months of corrected age</td>
<td>26 PT</td>
<td>Seated. Object with unknown physical characteristics</td>
<td>USA</td>
<td>2.64</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study design</th>
<th>Type of analysis</th>
<th>N</th>
<th>GA (weeks)</th>
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<th>Groups (PT/FT)</th>
<th>Experimental condition</th>
<th>Site of Study Development</th>
<th>Journal Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toledo and Tudella (2008)</td>
<td>Longitudinal</td>
<td>Kinematic analysis</td>
<td>19</td>
<td>32–36</td>
<td>5, 6 and 7 months of corrected age</td>
<td>9 PT</td>
<td>Sitting semi-reclined at 50° with trunk and head support with 50° with head and trunk support</td>
<td>Brazil</td>
<td>1.42</td>
</tr>
<tr>
<td>Clearfield et al. (2007)</td>
<td>Longitudinal</td>
<td>Kinematic analysis</td>
<td>10</td>
<td>32</td>
<td>Weekly until the onset of reaching with 7.5 months and twice a week up to 12 months</td>
<td>02 PT twins</td>
<td>Reclined at 30° Object with unknown physical characteristics</td>
<td>USA</td>
<td>1.45</td>
</tr>
<tr>
<td>Fallang et al. (2005)</td>
<td>Longitudinal</td>
<td>Kinematic analysis</td>
<td>64</td>
<td>29 ± 2.9</td>
<td>4 and 6 months 6 years of corrected age</td>
<td>52 PT (high risk)</td>
<td>Supine Object with unknown physical characteristics</td>
<td>Norway</td>
<td>2.80</td>
</tr>
</tbody>
</table>
de Toledo et al., 2011; Table 1). It is important to stress that the longitudinal design makes it possible to investigate motor development more realistically and facilitates the detection of possible development deficiencies over time. Nevertheless, whenever possible, it would be more interesting to adopt blind randomized controlled trials in future research on reaching behavior, since this experimental design minimizes bias in analysis and is more powerful for evidenced-based intervention.

In terms of manipulated experimental conditions (body position, properties of the object, training, the addition of weights), most studies \((n = 6)\) only evaluated the infant in a sitting position (upright or reclined; van der Fits et al. 1999; Clearfield et al. 2007; Heathcock et al. 2008; Toledo & Tudella, 2008; de Toledo et al., 2011; Grönqvist et al., 2011). Some of the studies that evaluated the infant in a sitting position provided head and trunk support \((n = 3;\) Clearfield et al., 2007; Toledo & Tudella, 2008; de Toledo et al., 2011) or only lower trunk support \((n = 1;\) Grönqvist et al., 2011). Other studies adopted the supine position (van der Fits et al., 1999; Fallang et al., 2003a; Fallang et al., 2003b; Fallang et al., 2005). The preferential use of the sitting position can be justified because this position can facilitate the ability to initiate reaching movements (Savelsbergh & van der Kamp, 1994; Carvalho et al., 2007), underlining the fact that extrinsic factors (body position) influence the dynamics of the task according to the approach of the dynamic systems (Rocha & Tudella, 2003; Carvalho et al., 2007).

Only three studies described the physical properties of the object used to stimulate the reaching movements (Toledo & Tudella, 2008; de Toledo et al., 2011; Grönqvist et al., 2011), and of these, only two detailed the material from which they were made, namely, pliable rubber (Toledo & Tudella, 2008; de Toledo et al., 2011). Considering that the physical properties of the object (material, size, rigidity) can influence the reaching behavior (Corbetta et al., 2000; Rocha et al., 2006; Silva, Rocha, & Tudella, 2011), future research should describe these properties in detail to allow a better replication of the studies and offer greater reliability for the application in clinical practice.

A single study dealt with the effect of training on the development of reaching (Heathcock et al., 2008). This demonstrates the need for more studies using this approach, especially in the period of the onset of reaching, when this ability has still not been widely practiced. These studies can greatly benefit the research of therapeutic techniques that could be applied more directly in early intervention for preterm infants. One study used the addition of weights on the wrists of preterm infants, but it was a secondary condition and, due to lack of significant results, was discussed slightly (van der Fits et al., 1999). It is interesting to investigate this experimental condition in preterm infants because in studies with full-term infants, the additional weight on the wrists favored the reaching behavior (Out et al., 1997; Rocha, Costa, Savelsbergh, & Tudella, 2009).

Most of the studies \((n = 6)\) used kinematic analysis to evaluate the reaching movement. The preference for this method may be because it makes it possible to assess more accurately how the movements are being organized functionally when compared with other methods.

Analyzing the studies, it is evident that most of them investigated the effects of prematurity on reaching behavior associated with age and the spontaneous experi-
ence. However, studies relating intrinsic factors (i.e., prematurity) and extrinsic factors (e.g., body position, properties of the object) in the dynamic of reaching are still scarce. Only three studies with preterm infants reported on such factors, investigating the effects of a moving object (Grönqvist et al., 2011), the additional weight on the wrists (van der Fits et al., 1999), and the training of reaching movement (Heathcock et al., 2008).

It is important to point out that some methodological issues should be considered in future studies to minimize errors of interpretation and possible biases and to encourage the comparison between studies. The different studies that investigated similar variables did not always codify them in the same manner, such as the definition of open hand in the study by Heathcock et al. (2008) and in the study by de Toledo et al. (2011). In addition, it would be interesting for the authors to provide information regarding the definition of infant reaching, where the movement starts and ends, and whether they take into consideration when the infants do not pay visual attention to the object.

The Results Presented by the Studies

The results of the studies help to establish important findings about reaching behavior in preterm infants. The age of onset of reaching in preterm infants of 33–35 weeks gestational age was 4.5 months corrected age (Clearfield et al., 2007; Heathcock et al., 2008). At this time, only the study by Heathcock et al. (2008) investigated the distal adjustments of reaching in these infants, observing reaches predominantly with the open hand and with the ventral position of the hand. However, in that study there was no distinction between the semiopen and open hand. In the study by de Toledo et al. (2011), the late preterm infants performed reaches predominantly with the semiopen hand between 5 and 7 months corrected age. This period was also marked by a progressive increase in reaching performed with an open and vertically oriented hand (de Toledo et al., 2011). These authors believe that the progressive increase in external rotation of the forearm during the first months of life facilitated the vertical positioning of the hand for reaching for objects between 5 and 7 months corrected age. Moreover, the improved ability to activate the extensors of the fingers with age appears to be reflected in the increased ability to maintain an open hand to touch the object at this period (de Toledo et al., 2011). Just as in full-term infants (von Hofsten & Rönnqvist, 1988; Rocha et al., 2006), the opening of the hand in preterm infants appears to reflect the ability to perceive the properties of the object and modulate the movements of the hand to reach out and grasp it successfully. This was demonstrated at 6 months corrected age in late preterm infants, who performed more reaching with open hand than full-term infants, possibly due to a longer time assessing the affordances of the object before touching it. According to Gibson (1995), the perception of these affordances guide the execution of the motor action. Furthermore, the low muscle tone, typical of preterm infants, may also have contributed to keeping the hand open at this age (Toledo & Tudella, 2008; de Toledo et al., 2011), which demonstrates that in addition to the extrinsic factors (e.g., the object’s properties), the intrinsic factors (e.g., muscle tone) may also interfere in the accomplishment of a motor behavior (Thelen, 1995).
From 5 to 7 months corrected age, late preterm infants showed a predominance of unimanual reaching when trunk stability and small, malleable objects were provided, similarly to their full-term peers (de Toledo et al., 2011). On the other hand, Grönqvist et al. (2011) found that at 8 months corrected age, preterm infants of less than 32 weeks gestational age performed more bimanual movements to reach an object in motion than full-term infants. The authors believe that infants predominantly used both hands because the strategy is more efficient and more likely to be successful when reaching out to attain an object moving in space and time rather than using just one hand. It is unclear, however, whether prematurity affects unimanual or bimanual strategies at the onset of reaching.

In general, the result of the kinematic variables in preterm infants showed poor quality of reaching (speeds less than 301 or greater than 800 m/s* at 4 months, and at 6 months, the criteria of speed combined with the number of units of movement greater than 3.5). This was related to the development of a minor neurological dysfunction (MND) characterized by learning difficulties, and impaired fine motor skills at 6 years of age (Fallang et al., 2005). The lack of planning and coordination of the reaching movement demonstrates an inability to modulate efferent motor activity (van der Fits et al., 1999), reflected in nonfluent movements (Hellerud & Storm, 2002). In addition, it appears that preterm infants need to decrease speed in order to maintain straight trajectories and successful grasps (Toledo & Tudella, 2008).

Another interesting feature was the relationship between the kinematic variables and different ages (4, 6, and 8 months). At 4 months corrected age, preterm infants at low risk of delayed neuromotor development compared with full-term infants and preterm infants at high risk, displayed a higher frequency of good quality of reaching (an average speed between 301 and 800 m/s* regardless of the number of units of movement; Fallang et al. 2005). At 6 months corrected age, preterm infants compared with full-term infants performed reaching at lower average and final speeds and spent more time decelerating the arm before touching the object (Toledo & Tudella, 2008), which reflects functional compensatory strategies for reaching out and grasping the object successfully. Furthermore, at 6 months corrected age, preterm infants of low and high risk showed nonoptimal quality of reaching when compared with full-term infants, which reflects a dysfunction in the ability to modulate the movement (Fallang et al., 2003b). These studies allow us to infer that preterm infants need to carry out dynamic adaptations such as decreasing the speed of movement and increasing the number of movement units to overcome their inherent limitations (low tone, problems with visual perception, visuomotor integration and fine motor skills) to improve their reaching behavior. In the study by Touwen (1980), the author suggests that the extraterine experience gained by preterm infants at low risk may provide a temporary advantage compared with full-term infants. However, for those of high-risk, the additional extraterine experience may often be outweighed by the negative effects associated with their premature birth (Fallang et al., 2003b), such as low birth weight, increased energy expenditure to maintain body temperature and hospitalization in the neonatal intensive care unit.

At 8 months corrected age, Grönqvist et al. (2011) demonstrated that very preterm infants showed less rectilinear paths when reaching for an object in motion than full-term infants did. These authors reported that the trajectories of movement of the very preterm infants are more tortuous, reflecting the inability to predict the
motion of the object, and that the longer extrauterine experience did not benefit their reaching performance. Thus, we suggest that very preterm infants require greater effort to plan and execute reaching movements, which may be influenced by intrinsic factors such as the negative effects related to premature birth, and extrinsic factors, such as the moving object. This fact seems to confirm that the disadvantage in reaching behavior observed at 6 months corrected age in preterm infants remains at 8 months corrected age.

Studies using electromyography (van der Fits et al., 1999; Clearfield et al., 2007) showed that preterm infants between the (corrected) ages of 4 and 18 months have a deficit in their ability to adjust their postural activity during the onset of reaching, requiring greater effort and restricting the development of the coordination and execution of the movements. Clearfield et al. (2007) analyzed the coactivation of the biceps, trapezius, deltoids, and brachial triceps during reaching between 4.5 and 13 months of age and observed that all infants showed activation of the four muscles tested. However, this activation did not reveal tendencies to favor general skills of the infant during reaching. Van der Fits et al. (1999) considered that in healthy preterm newborn infants, the high levels of postural activity may cause a deficiency in the ability to adjust for the performance of specific tasks. This being so, training in posture and reaching would be essential to improve the development of reaching in this population as early as possible.

As for the development of reaching, preterm infants acquire this skill later than full-term infants, show a predominance of unimanual reaching when head and trunk support is provided, bimanual reaching when stimulated with a moving object, and reaches with semi-open and open hand, at lower speeds, of nonoptimal quality and with less rectilinear trajectories than full-term infants. In addition, these infants have variable postural muscle activity with reduced ability to modulate postural adjustments during movements in general, which seems to make the performance of specific tasks, such as reaching, more difficult. These strategies, which change depending on age, seem to be adopted as a way to overcome the negative effects related to premature birth.

In general, the studies that have investigated reaching behavior in preterm infants during the first year of life are based on the premise that reaching is a complex skill in which the infant must learn to combine intrinsic factors to the specificities of the task. However, there is still much to learn about how prematurity associated with extrinsic factors affects the dynamic of reaching. Investigating how intrinsic factors related to organic immaturity respond to the manipulation of extrinsic factors during the performance of reaching may increase the understanding of health professionals as to how to intervene, how to create a more suitable environment and adapt the characteristics of the task to minimize the negative effects associated with preterm birth. This may be even more relevant for high risk preterm infants, because it appears that they require greater effort to perform reaching movements compared with low risk preterm and full-term infants.

**Acknowledgments**

This study was supported by Sao Paulo Research Foundation (FAPESP). We also thank the anonymous reviewers for their suggestions and constructive comments on the manuscript. Cunha and Soares contributed equally to this work.
References


