

Infant Sleep and Paternal Involvement in Infant Caregiving During the First 6 Months of Life

Liat Tikotzky,¹ PhD, Avi Sadeh,² DSc, and Tamar Glickman-Gavrieli,² MA

¹Department of Psychology, Ben Gurion University of the Negev and ²Department of Psychology, Tel Aviv University

All correspondence concerning this article should be addressed to Liat Tikotzky, Ben-Gurion University of the Negev, Beer-Sheva, 84105, Israel. E-mail: liatti@bgu.ac.il

Received July 21, 2009; revisions received March 29, 2010; accepted March 30, 2010

Objectives The goals of this study were to assess: (a) the involvement of fathers and mothers in overall and nighttime infant caregiving; (b) the links between paternal involvement in infant care and infant sleep patterns during the first 6 months. **Methods** Fifty-six couples recruited during their first pregnancy, participated in the study. After delivery (1 and 6 months), both parents completed a questionnaire assessing the involvement of fathers relative to mothers in infant caregiving. Infant sleep was assessed using actigraphy and sleep diaries. **Results** Mothers were significantly more involved than fathers in daytime and nighttime caregiving. A higher involvement of fathers in overall infant care predicted and was associated with fewer infant night-wakings and with shorter total sleep time after controlling for breastfeeding. **Conclusions** The findings highlight the importance of including fathers in developmental sleep research. Future studies should explore mechanisms underlying the relations between paternal involvement and infant sleep.

Key words father; involvement; infant; mother; sleep.

Introduction

The development of infant sleep has been conceptualized in the context of a transactional model that emphasizes the ongoing bi-directional links between infant sleep problems and intrinsic (e.g., temperament, medical) factors and extrinsic (e.g., ecology, parent-infant relationship, attachment) factors (Sadeh & Anders, 1993; Sadeh, Tikotzky, & Scher, 2010; Tikotzky & Sadeh, 2009). Among these factors, those related to the way parents interact with their infants around bedtime and during the night are especially relevant to the understanding of the development of infant sleep patterns and night-waking problems (Morrell & Cortina-Borja, 2002; Tikotzky & Sadeh, 2009). Breastfeeding is another important factor that may influence infant sleep. Breastfeeding has been found to be associated with more frequent infant night-wakings and with lower levels of infant self-soothing (Burnham, Goodlin-Jones, Gaylor, & Anders, 2002; DeLeon & Karraker, 2007; Tikotzky et al., 2010).

While many studies documented links between parenting and sleep problems in infants, the majority of these studies, focused on *maternal* behavior, neglecting the significant role fathers may have in infant sleep development. This is surprising in light of the fact that many of the father–infant interactions occur around bedtime, when fathers return from work (Keener, Zeanah, & Anders, 1988). In the present study, we aimed to explore the relationships between infant sleep and the involvement of fathers relative to mothers in infant care in a sample of typically developing infants.

The Role of Fathering in Child Development

Over the past 30 years, fathers' involvement in childcare has increased significantly (Coleman & Garfield, 2004; Lamb, 1997). Although still understudied, growing evidence suggests that paternal involvement in childcare has a positive influence on the development of children beginning at infancy. These links were demonstrated specifically

in the domains of children's cognitive and socio-emotional development (Bogels & Phares, 2008; Boyce et al., 2006; Coleman & Garfield, 2004; Lamb, 1997; Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008). Fathers' involvement may be of a different nature than mothers'. Fathers are more likely to interact with their children in physical and stimulating playing (Coleman & Garfield, 2004). In addition, fathers more often have the role of setting limits as opposed to the comforting role of mothers (Bogels & Phares, 2008). Fathers involvement may affect children's development and behavior directly (e.g., direct engagement, decision making, monitoring) or indirectly (Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). For example, fathers may influence their children indirectly through influencing mother-child interactions and supporting the mother's decisions and behaviors. In addition, a positive family atmosphere and strong marital relationships may have an effect on the child via their influence on the parents (Pleck, 2007). In a recent paper, Pleck (2007) described four theoretical perspectives that may explain the underlying dynamics of fathering influences. For example, according to attachment theory and research, father's involvement promotes secure infant attachment to the father. The positive influence of these emotional ties on infants' development is independent of the effects of mother-infant attachment. According to the Ecological theory, fathers provide unique reciprocal interactions with their children in ways that can positively contribute to their development (e.g., rough and tumble play, limit setting) (for a comprehensive review see Pleck, 2007).

The Role of Fathering in the Management and Development of Infant Sleep

Although the issue of whether fathers' involvement in infant care contributes to infant sleep development has not been addressed so far, extensive evidence in the literature suggests that parental nighttime behaviors are strongly related to the development of infant sleep (Sadeh et al., 2010). In general, the studies in this field (based on both clinical and non-clinical samples) support the transactional theory and demonstrate that a parenting approach encouraging self-soothing at bedtime and during the night, contributes to the consolidation of infant sleep (Burnham et al., 2002; Mindell, Kuhn, Lewin, Meltzer, & Sadeh, 2006; Morrell & Cortina-Borja, 2002; Tikotzky & Sadeh, 2009). However, most studies about infant sleep and parenting focus mainly on the assessment of *maternal* perceptions and behavior or do not clearly differentiate between maternal and paternal behavior (Sadeh et al., 2010).

The few studies in the field of infant sleep that have included fathers in their assessment suggest that fathers contribute significantly to the management of infant night-wakings. For example, Ball, Hooker, & Kelly (2000) found that 25% of the parents in their study alternated nights of being the primary caregiver or had split the night and attended to the infant in shifts. In another study it was found that in 38% of the families, both mothers and fathers helped the infant during the night (Goodlin-Jones, Burnham, Gaylor, & Anders, 2001). Bronfenbrenner's Ecological theory (Bronfenbrenner, 1986) regarding the unique interactions fathers have with their children and their influence on child behavior, are very relevant to the infant sleep field. For example, research and clinical experience suggest that fathers may interact differently with their infants at night (e.g., shorter and more remote interventions than mothers) and this may promote the consolidation of infant sleep (Minde, Faucon, & Falkner, 1994; Sadeh, 2005; Sadeh, Flint-Ofir, Tirosh, & Tikotzky, 2007). A few studies demonstrated that fathers may have different perceptions than mothers regarding infant sleep (Keener et al., 1988; Sadeh et al., 2007). For instance, a recent study assessed the links between infant sleep and parental sleep-related cognitions in clinical and control samples (Sadeh et al., 2007). The comparison between parents revealed that when given hypothetical case descriptions of infants with sleep problems, fathers were more likely than mothers to endorse a limit-setting approach. The findings also implied that the risk for infant night-waking problems increases when both parents experience difficulties in limit-setting. Clinical experience suggests that both parents have an important role in infant sleep interventions and that fathers may contribute in a unique fashion to the success of the intervention. Fathers, in general, find it easier to implement the clinical suggestion to reduce active soothing (e.g., feeding, cuddling) of the infant at night. In addition, because maternal care is usually more associated with active soothing, infants may protest more when the mother tries to change her familiar behavior. However, when the father, who is often perceived as more neutral, puts into practice a new attitude, the infant may adjust faster (Minde et al., 1994; Sadeh, 2001, 2005).

The involvement of fathers in child caregiving and the divisions of family roles are influenced by cultural ideologies, expectations and norms (Feldman, Masalha, & Nadam, 2001; Parke, 2000). The present study was conducted in Israel, a country characterized by a variety of ethnic subgroups with different cultural and religious backgrounds. However, the sample in this study represented the Jewish middle-upper socioeconomic status in Israel,

which holds similar attitudes and practices regarding work and family functioning to those of Western societies (Feldman et al., 2001). To the best of our knowledge, there are no studies comparing directly the characteristics of paternal involvement in child care in Israel to other Western countries. Regarding the infant sleep field, there is evidence to suggest that Israeli mothers hold similar expectations about infant sleep patterns and sleeping arrangement to those of parents in other Western societies (Scher et al., 1995).

The growing evidence on the positive influence of paternal involvement on child development underscores the need to expand the knowledge about the fathers' role in the development of infant sleep. Therefore, our study had two main goals: (1) replicating previous findings demonstrating that mothers are more involved than fathers in overall and in nighttime infant caregiving; and (2) expanding the knowledge about parenting and infant sleep, by exploring the concomitant and predictive links between the involvement of fathers and mothers in (overall and nighttime) infant caregiving and the development of sleep, in a group of healthy, non-referred, solitary sleeping infants. Because nursing could be a confounding variable (potentially related to both infant sleep and parental involvement), we aimed at examining these links while controlling for the method of infant feeding.

In accordance with these aims, we expected mothers to be more involved in infant caregiving than fathers; and that the involvement of fathers would increase during the first 6 months, mainly because many mothers return to work after 3 months of maternity leave, and nursing gradually becomes less exclusive. Furthermore, we hypothesized that higher involvement of fathers in overall and nighttime infant care would be associated with more consolidated sleep after controlling for breastfeeding.

Method

Participants

Sixty couples were recruited for this study during the third trimester of their first pregnancy through hospital's prenatal courses or announcements on Internet forums for expectant parents. The mothers and their infants were participants in a larger longitudinal study assessing the links between maternal sleep-related cognitions and infant sleep (Tikotzky & Sadeh, 2009). The findings of the larger study demonstrated that maternal cognitions emphasizing infants' distress at night predicted more disturbed infant sleep, while maternal cognitions emphasizing the importance of infant self-soothing were associated with more consolidated sleep. The original paper did

not include the fathers and did not address the issue of parental involvement in overall caregiving. Therefore, the question regarding the relations between both parents involvement in infant care and infant sleep is unique to the current study. Two infants who were born before the gestational age of 36 weeks were excluded from the study and two couples dropped out after the 1-month stage. Therefore, the final sample included 56 families (93.3% included), 34 infant boys (61%). The parents represented the middle-upper socioeconomic status in Israel. The mothers' mean age (years) was 29.13 ± 2.8 (range 22–37) and their averaged education (in years) was 16.15 ± 2.32 (range 12–22). The fathers' mean age (years) was 31.3 ± 4.41 (range 25–48) and their averaged education (in years) was 16.03 ± 2.05 (range 12–22). Mean number of rooms at home was 3.3 ± 0.84 (range 2–6). None of the mothers reported medical problems during delivery or following birth. Parents were screened for psychopathology by the Hebrew version of the Brief Symptom Inventory (Derogatis & Melisaratos, 1983). None of the parents met the Israeli cutoff scores (Gilbar & Ben-Zur, 2002). Mean gestational age (weeks) was 39.52 ± 1.59 and mean birth weight (kg) was 3.31 ± 0.48 (range 2.3–4.2). All infants were healthy during the assessment period. At the age of 1 month, all the infants were taken care of by their mother at home. At 6 months, 34% were completely home-reared with their mothers, and 66% were in day care (baby-sitter or nursery). At the age of 1 month 93% of the infants were (fully or partially) nursed, whereas at the age of 6 months 30.4% were still fully breastfeeding and 28.6% were partially breastfeeding.

Procedure

The study was approved by the Institutional Ethical Committee—the University's committee and the hospital's Helsinki Committee. After signing the informed consent, the couples completed a family background questionnaire. The families were contacted again after delivery, and completed a questionnaire aimed at assessing parental involvement in infant care. Mothers and fathers were asked to complete the questionnaire separately at home during the sleep assessment period at 1 and 6 months. Infant sleep was assessed only at the age of 6 months for 4 days by actigraphy and sleep diaries. Sleep was not assessed at the age of 1 month because assessment of sleep at this age period requires extensive continuous monitoring (i.e., 24 hr for 5 days) which raises compliance and reliability problems. Recording four nights of sleep is a reasonable practical recording period providing acceptable reliability in comparison to the recommended five

nights of monitoring (Acebo et al., 1999). Parents were instructed to record sleep only during days in which regular family routine was kept (e.g. infant falls asleep at home and not during trip). No guidelines were provided regarding the days of recording (because of no scientific indications for weekdays–weekends sleep variations in infancy), and as to who should complete the diary (mother or father). Parents were instructed to complete the diaries in real time as events occur (e.g., night-wakings). Parental nighttime involvement was assessed by questions included in the sleep diary. Questions about feeding methods were completed by the mothers. At the end of each stage, parents received a gift (value of about \$10) and obtained a printout of the infant's actigraphic sleep patterns.

Instruments

Assessment of Parental Involvement in Infant Care

The parental involvement questionnaire assesses the relative degree of maternal and paternal involvement in infant care. This questionnaire includes 10 different child-care tasks relevant for parents of infants (e.g., feeding, bathing, playing, soothing, putting to sleep), and parents are requested to rate their degree of involvement for every task, on a 7-point Likert-type scale (e.g., "Who usually feeds the infant"? 1 = only the mother; 4 = mother and father equally; 7 = only the father). The questionnaire asks parents to rate proportional involvement rather than absolute involvement to prevent the possibility that social desirability would lead to high ratings on both paternal and maternal involvement regardless of the weight of actual involvement in child care. An averaged involvement score based on the 10 items was calculated for each parent. Good internal reliability based on Cronbach's alpha of .80 was found for the scale in the present study. Test-retest reliability (1–6 months) was .55 ($p < .0001$). This questionnaire was designed for purposes of the current study. Its infant care items are quite similar to the items of the Who Does What questionnaire (Cowan & Cowan, 1990). However, the "Who Does What questionnaire" asks about the degree of involvement in making decisions regarding child-care tasks on a 9-point Likert-type scale, whereas our questionnaire asks about the degree of involvement in the activities themselves.

Sleep Assessment

Actigraphy. The actigraph is a wristwatch-like device, attached to the infant's ankle during recording. It monitors body motility and the stored data are later translated into objective sleep–wake measures. Different studies have demonstrated the validity and reliability of actigraphy as

a method for studying and assessing sleep–wake patterns in infants, children and adults (Ancoli-Israel et al., 2003; Sadeh, 1994, 1996; Sadeh, Acebo, Seifer, Aytur, & Carskadon, 1995; Sadeh, Lavie, Scher, Tirosh, & Epstein, 1991). In the present study we used the miniature Actigraph (Ambulatory Monitoring Inc., Ardsley, NY), with amplifier setting 18 and a 1-min epoch interval according to the standard working mode for sleep–wake scoring (Sadeh et al., 1995). The actigraphic sleep measures included: (1) sleep onset time—the first minute of the first consecutive 15 min of sleep after parent-reported bedtime; (2) total sleep time—from sleep onset time to morning awakening time, including time spent in wakefulness during the night. Since this is a measure of sleep schedule, time spent in wakefulness is not omitted; and (3) number of night-wakings (5 min or longer). These measures were averaged across the monitoring period. We chose these actigraphic measures in accordance with the hypotheses of the study. The study focused on infant sleep consolidation and the most prominent variable reflecting sleep consolidation is the number of night-wakings. Sleep duration and sleep onset time were chosen as these are the main sleep schedule variables.

Sleep diary. Sleep diaries were used to assess infants' daily sleeping patterns from a parental perspective (Sadeh, 1994, 1996). The information provided by the parents on the sleep diary was also used to review the data for possible actigraphy errors and artifacts. The sleep diary includes questions regarding bedtime (e.g., "who put the infant to sleep?") and questions about sleep at night. The derived measures used in this study included: (1) number of times each parent (mother/father) put the infant to sleep; (2) number of times each parent approached the infant at night; (3) night-wakings—reported number of infant night-wakings. The diary measures were averaged across the monitoring period. The first two diary measures were then converted to a percentage/proportion (i.e., frequency of time fathers/mothers put the infants to sleep and approached them during the night).

Feeding

Feeding was assessed by two scales: (a) general scale—parents reported whether the infant receives: (i) formula, (ii) partial breastfeeding, or (iii) exclusive breastfeeding. This scale was included in a general background questionnaire that was used to obtain demographic data and information about infant development; (b) soothing scale—parents rated (on a 5-point Likert-type scale from not at all to very frequently) their use of breastfeeding as a means

of soothing the infant at night. This scale was part of a longer questionnaire asking about soothing methods that was not explored for the purposes of the current study.

Data Analytic Plan

In order to test the first hypothesis regarding the change in paternal involvement from 1 to 6 months, we used the Wilcoxon matched pairs test. The differences between mothers' and fathers' bedtime and nighttime involvement were assessed using a binomial test of proportion. The second hypothesis focusing on the links between paternal involvement in infant care and infant sleep was examined using Spearman rho correlations. Partial correlations were calculated to control for the effect of breastfeeding. Non-parametric tests were chosen because the involvement scales scores represent proportional data. There were less than 5% missing data for the measures of interest and they were replaced by the relevant group means (Widaman, 2006).

Results

Descriptive statistics for study measures are presented in Table I.

Paternal and Maternal Involvement in Overall and in Nighttime Infant Care

Two separate Wilcoxon matched pairs tests were performed to examine: (1) period changes from 1 to 6 months on the overall involvement scale; and (2) differences between fathers' and mothers' report on this scale. No significant period effects were found. Fathers and mothers did not differ in their assessment of their degree of overall involvement (i.e., both parents rated mothers as being more involved).

We used a binomial test of proportion to assess the differences between mothers and fathers in frequencies of *bedtime* and *nighttime* interventions (based on the sleep diaries) at the age of 6 months (these variables were not assessed at 1 month). The binomial tests indicated that mothers were significantly more involved than fathers in putting the child to sleep (proportion of mother's involvement higher than .5, $Z = 3.63$, $p < .001$), and approached the infants significantly more often during the night (proportion of mother's involvement higher than .5, $Z = 3.18$, $p < .005$). There were three infants who did not wake at all during the assessment nights. Fathers put the infants to sleep 21.07% (± 30.05) of the time and approached the infants during the night 28.73% ($\pm 24.06\%$) out of all times infants were approached. The percentage of fathers

Table I. Descriptive Statistics for the Main Variables (N = 56)

	Minimum	Maximum	Median	Mean	SD
F-Inv-scale—1m	1.70	4.30	2.89	2.86	0.59
M-Inv-scale—1m	1.71	4.50	2.84	2.86	0.53
F-Inv-scale—6m	1.56	4.80	2.90	2.98	0.69
M-Inv-scale—6m	1.56	4.30	2.90	2.92	0.65
Com-Inv-scale—1m	1.94	4.40	2.82	2.86	0.53
Com-Inv-scale—6m	1.55	4.50	2.85	2.95	0.64
F-D-Bedtime-Inv—6m (%)	0	100	0	21.07	30.06
F-D -Night-Inv—6m (%)	0	100	25.0	28.73	24.06
Awakenings—act (n.)	0	4.50	1.75	1.73	0.97
Awakenings—rep (n.)	0	8.25	2.75	2.86	2.01
Sleep onset time—act	19.08	24.10	21.09	21.19	1.13
Total sleep time—act (hr)	7.06	11.93	9.77	9.77	1.04
Nursing night—sooth	1.00	5.00	3.00	2.87	1.86

F-Inv-scale: father's score on the overall involvement scale (higher scores reflect higher paternal involvement); M-Inv-scale: mother's score on the overall involvement scale (higher scores reflect higher paternal involvement); Com-Inv-scale: average score of both parents on the overall involvement scale; F-D-Bedtime-Inv: frequency of time fathers put the infant to sleep based on sleep diaries; F-D-Night-Inv: frequency of time fathers approached the infant during the night out of all times infant was approached, based on sleep diaries; awakenings—act: number of actigraphic infant night-wakings; awakenings—rep: number of reported infant night-wakings; Sleep Onset Time—act: sleep onset time according to actigraphy; total sleep time—act: sleep duration from sleep onset time to morning awakening according to actigraphy; nursing night-sooth: use of nursing to soothe the infant at night. (rated on a 5-point Likert-type scale from not at all to very frequently).

who were involved at night at least once during the assessment period was 62.5%.

Correlations Between the Involvement Scales and Infant Sleep

Our second goal was to assess the associations between the involvement variables and the infant sleep variables. Because the overall involvement scales of mothers and fathers were highly correlated ($\rho = .73$, $p < .0001$ at 1 month and $\rho = .80$, $p < .0001$ at 6 months), we calculated an average score for each pair of parents and then for the sample, thus creating a combined involvement score.

Correlations Between Breastfeeding and Infant Sleep and Parental Involvement

Because of the possibility that the associations between the involvement scales and infant sleep measures would be explained by the exclusive role of mothers in nursing, we first examined Spearman rho correlations between the study variables and the two feeding measures (i.e., general feeding scale + soothing scale = use of breastfeeding to soothe the infant at night). The feeding measures were significantly associated with infant night-wakings (Table II). Breastfeeding as measured by both scales was associated with more reported night-waking and with more

Table II. Spearman Correlations between the Main Variables of the Study (N = 56)

	1	2	3	4	5	6	7	8
1. Combined-inv—1m	—							
2. Combined-Inv—6m	.54***	—						
3. F-D-Bedtime-Inv—6m	.25	.45***	—					
4. F-D-night-Inv—6m	.30*	.50***	.50***	—				
5. Awakenings—act	-.38**	-.30**	-.10	-.08	—			
6. Awakenings—rep	-.29*	-.29*	-.07	-.02	.67***	—		
7. Sleep onset T—act	.26	.35**	.03	.02	-.25	-.30*	—	
8. Total sleep T—act	-.42**	-.47***	-.13	-.22	.48***	.46***	-.62***	—
9. General feeding S.	-.08	-.22	-.33*	-.24	.32*	.34*	.32*	.15
10. Nursing night—sooth	-.33*	-.26	-.38**	-.24	.37**	.31*	.21	.18

Correlations in italics and bold are partial correlations controlling for breastfeeding (general feeding scale). Combined—inv: combined score for fathers and mothers on the overall involvement scale (higher scores reflect higher paternal involvement); F-D-Bedtime-Inv: frequency of time fathers put the infant to sleep based on sleep diaries; F-D-Night-Inv: frequency of time fathers approached the infant during the night based on sleep diaries; awakenings—act: number of actigraphic infant night-wakings; awakenings—rep: number of reported infant night-wakings; sleep onset time—act: sleep onset time according to actigraphy; total sleep time—act: sleep duration from sleep onset time to morning awakening according to actigraphy; general feeding S.: general feeding scale (1 = formula; 2 = partial nursing; 3 = exclusive nursing); nursing night-sooth = use of nursing to soothe the infant at night.

* $p < .05$; ** $p < .01$; *** $p < .001$.

actigraphic night-wakings. In addition, breastfeeding as measured by the general feeding scale was associated with later sleep onset time. Breastfeeding (according to both scales) was also associated with a lower frequency of paternal involvement at bedtime. Finally, a higher overall involvement of fathers at 1 month was associated with lower use of breastfeeding to soothe the infant at night at 6 months.

Associations Between Paternal Involvement in Overall Infant Care and Infant Sleep

To test our main hypothesis, partial Spearman rho correlations (controlling for breastfeeding) were calculated between the parental combined involvement scores (1 and 6 months), and the infant sleep parameters. Since the partial correlations controlling for the general feeding scale were similar to the partial correlations controlling for the soothing scale, only the results with the General feeding scale are reported (see Table II and Figure 1).

The findings demonstrated significant predictive and concomitant links between the involvement scales and infant sleep after controlling for breastfeeding. Predictive links were found between the involvement scale at 1 month and between infant sleep at 6 months. Higher involvement of fathers at 1 month predicted a lower number of infant night-wakings according to actigraphy and parental reports. Similar associations were found for the concomitant links at 6 months. In addition, higher paternal involvement at 1 and 6 months was associated with actigraphic shorter total sleep time at 6 months, and higher paternal involvement at 6 months was associated with later actigraphic sleep onset time.

It is important to notice that the overall involvement scale includes two sleep items ("Who usually put the infant to sleep" and "who usually approached the infant during the night"). After removing these items, the correlations between the involvement scale and infant sleep remained at the same level and therefore we decided to report the results for the overall involvement scale including the sleep items.

Paternal Involvement at Night and Infant Sleep

There were no significant partial Spearman correlations (controlling for breastfeeding) between the diary measures of paternal involvement at bedtime and nighttime and infant sleep.

Discussion

To our knowledge, this is the first study that assessed how paternal involvement in infant care is related to infant sleep. The findings of the study supported our main hypothesis and demonstrated that a higher involvement of fathers in infant care is associated with more consolidated infant sleep. The strength of the study lies in the assessment of parental involvement at two different time points, enabling the exploration of the predictive links between early paternal involvement and infant sleep development. Another advantage is the use of both objective and subjective measures of sleep, thereby limiting the potential bias of shared variance that could result from relying only on parental reports. Our study also had some limitations. The parents in this study represented a middle-upper socioeconomic status in Israel and all of them adopted solitary

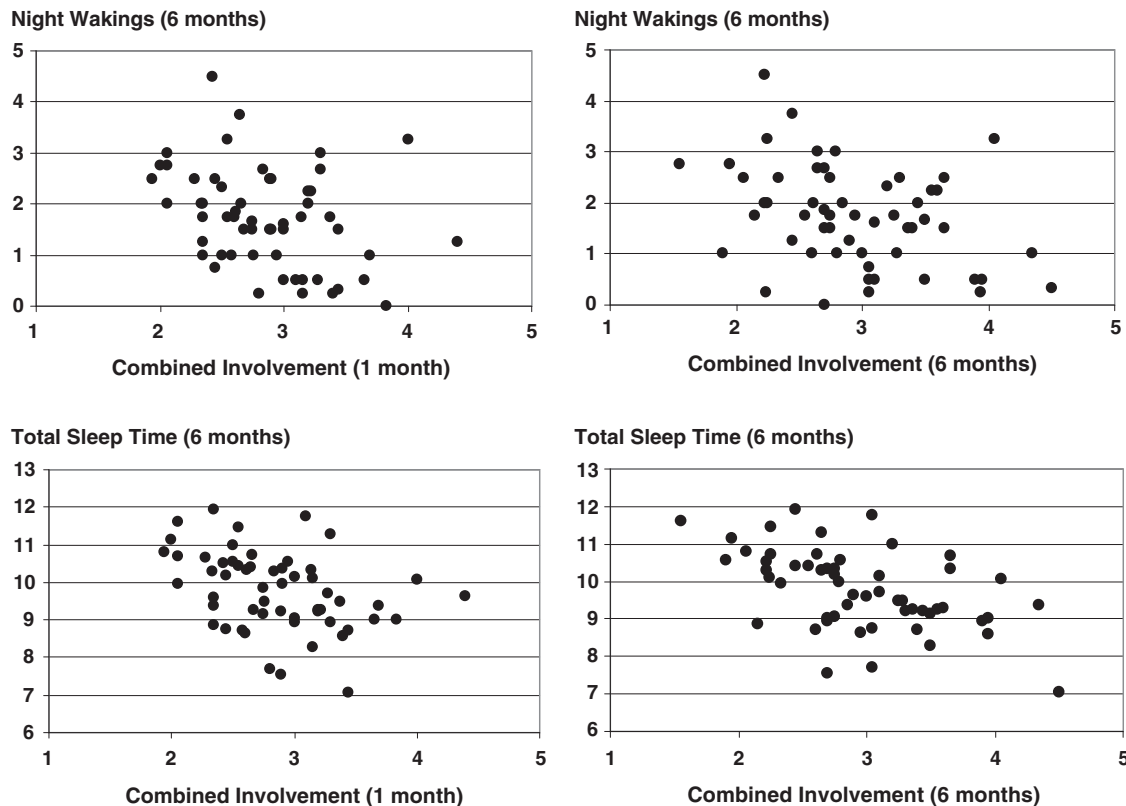


Figure 1. Scatter plots for the combined involvement scales at 1 and 6 months (higher scores represent higher paternal involvement) and the sleep measures: actigraphic number of night wakings (upper plots) and total sleep time (lower plots).

sleeping arrangements. These sample characteristics limit the generalization of the findings. In addition, given the small sample size, and the limitations of the involvement scale as a new measurement tool, there is obviously a need for replication of the study findings.

Parental Distribution of Infant Caregiving

As expected, our findings demonstrated that mothers were more dominant in infant caregiving at the age of 1 and 6 months. We anticipated fathers' overall involvement to increase from 1 to 6 months because most mothers returned to work after 3 months of maternity leave, and because of the gradual decrease in breastfeeding. However, the findings did not indicate a significant increase in fathers' involvement. This may result from the fact that already at the age of 1-month parents rated mothers as being only a little more involved than fathers on average. It seems also reasonable that fathers increase their involvement in certain types of activities such as playing, later in the infant's life. Our findings resemble a previous study focusing on parents of 5-month-old infants in Israel, in which even among dual-earner couples mothers

spent more time with the infants than fathers (Feldman, 2000).

The findings regarding the distribution of caregiving between parents around *bedtime and night* demonstrated that although mothers are more dominant in nighttime caregiving, still many fathers do take part in putting their infants to sleep and in soothing them during the night. These findings are in line with other studies showing that fathers do participate in the management of infant sleep (Ball et al., 2000; Goodlin-Jones et al., 2001).

This study did not assess the reasons for paternal involvement or non-involvement at night. However, it is reasonable to assume that paternal nighttime behavior is multiply determined; Paternal involvement is naturally influenced by whether the infant is breastfed to sleep or not. In addition, mothers may be more activated by the crying of their infant (Swain, Lorberbaum, Kose, & Strathearn, 2007) and therefore may respond faster to the infant during the night. Fathers, in general, may endorse to a higher degree a limit-setting approach that encourages the infant to self-soothe (Sadeh et al., 2007). Moreover, researchers have suggested that mothers play

the role of "gate-keeping" by either encouraging or inhibiting the father's involvement (Schoppe-Sullivan, Brown, Cannon, Mangelsdorf, & Sokolowski, 2008). Regarding nighttime, some mothers may feel ambivalent about fathers' increased engagement and may believe they are more competent in soothing the infant back to sleep (Weissbluth, 2003). The full employment of fathers and their inability to compensate for sleep loss during the day, may also explain why parents prefer to spare fathers from nocturnal involvement.

Relations Between Paternal and Maternal Involvement in Infant Care and Infant Sleep

Our findings demonstrated significant predictive and concomitant links between the involvement scale and infant sleep variables. These findings are in line with previous findings linking paternal involvement in childcare to positive children's outcomes (Coleman & Garfield, 2004; Lamb, 1997; Sarkadi et al., 2008). However, to our knowledge, this is the first study that demonstrates these links in the domain of infant sleep. The findings showed that higher paternal involvement in overall infant care, at the age of 1 month (based on ratings of both parents) predicted more consolidated sleep at 6 months after controlling for breastfeeding, as reflected by a lower number of infant night-wakings according to objective and subjective sleep evaluation methods. Similar results were found for the concomitant associations at 6 months. It is important to clarify that the range of scores on the involvement scale varied in average between mothers assuming sole responsibility for caregiving and between parents sharing equally. Therefore, our findings suggest that the presence of multiple parenting styles or having two parents sharing infant caregiving responsibilities, contributes positively to the consolidation of infant sleep during the first 6 months.

Possible Explanations to the Links Between Paternal Involvement and Infant Sleep

Although, it is unclear within the constraints of this correlational study what are the underlying mechanisms for these associations, there are several hypothetical explanations that could be further explored in future studies. For instance, couples who share infant caregiving, are perhaps characterized by higher levels of support and lowers levels of stress, which could exert a calming and positive influence on the sleep of the infant. On the other hand, family stress and marital discord have been found to be related to children's sleep problems (El-Sheikh, Buckhalt, Mize, & Acebo, 2006; Sadeh & Anders, 1993). It may also be

possible that couples, who share infant care giving during the day, hold similar expectations about nighttime behavior. These expectations if transferred consistently to the infant may facilitate the process of achieving consolidated sleep. Another possibility is that involved fathers influence maternal behavior and encourage mothers to reduce nighttime soothing, which has been shown to be associated with more consolidated sleep (Burnham et al., 2002; Morrell & Cortina-Borja, 2002). It could also be that, unrelated to paternal influences, "sharing" mothers behave differently with their infants and are more likely to encourage infant autonomy, than mother who assume sole responsibility for infant care (Frascarolo, 2004).

We assumed that the relation between the involvement of fathers in overall caregiving and infant sleep would be explained by paternal involvement at bedtime and during the night. It seems reasonable that fathers who are more involved in overall infant caregiving would also be more involved in nighttime caregiving. Furthermore, because fathers find it easier to adopt an approach that encourages infant self soothing, their engagement may lead to a more consolidated infant sleep (Minde et al., 1994; Sadeh et al., 2007). However, the findings of our study do not support this explanation. Although the overall involvement scale was significantly and positively associated with the bedtime and nighttime involvement measures, we did not find any significant correlations between paternal nighttime involvement and infant night-wakings. In addition, because breastfeeding has been found in previous studies to be significantly associated with more disturbed infant sleep (Burnham et al., 2002; DeLeon & Karraker, 2007), we examined whether the link between the involvement scores and infant sleep could be explained by breastfeeding. Our findings demonstrated that the relationship between these variables remained statistically significant even after controlling for breastfeeding. Therefore, the explanation about the global positive influence of sharing infant care (e.g., reduced parental stress, improved family atmosphere) on infant sleep consolidation appears more probable, but more research is required to test this interpretation.

In addition to the relation found between higher paternal involvement and lower infant night-waking, we also found that paternal involvement was significantly associated with shorter total sleep time (which is positively correlated with the number of night-wakings) and with later sleep onset time. This finding raises the hypothesis that higher involvement of fathers leads to delayed infant sleep onset time, thereby shortening sleep duration which leads

to more consolidated sleep (as a compensatory response to sleep restriction) (Morin et al., 2006; Sadeh, Gruber, & Raviv, 2003; Spielman, Saskin, & Thorpy, 1987). However, it is also possible that sleep consolidation would lead to a decrease in sleep duration if basic sleep needs were met in shorter consolidated sleep.

Conclusions

Our findings suggest that paternal involvement in infant caregiving is associated with both infant sleep consolidation and shorter sleep duration after controlling for breastfeeding. These findings emphasize the importance of including fathers in developmental and clinical sleep research (Sadeh et al., 2010). Future longitudinal studies with larger samples are needed to replicate these findings and to explore causal mechanisms underlying the relations between paternal involvement and infant sleep. Such studies could clarify the developmental implications of sleep variations associated with paternal involvement in childcare.

Acknowledgement

The authors are thankful to Dr. David Hamburger and Ornit Arbel for their help.

Funding

Grant from the Israel Foundation Trustees.

Conflicts of interest: None declared.

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