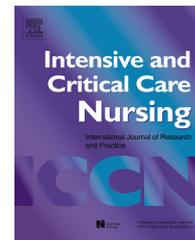




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ORIGINAL ARTICLE

Parental stress management using relaxation techniques in a neonatal intensive care unit: A randomised controlled trial



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KEYWORDS

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techniques;
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Summary

Objective: The objective of this study was to investigate the effect of relaxation techniques on the stress/anxiety of parents with hospitalised premature infants, three months following discharge from the neonatal intensive care unit.

Study design: A randomised controlled trial was conducted in the neonatal intensive care unit of a tertiary maternity hospital including 59 parents, who were randomised into two groups: 31 in the intervention group and 28 in the control group. Parents in the intervention group practiced three different relaxation techniques, in addition to undergoing the same information-based training courses as did the parents of the control group.

Data collection: Data were collected 10–15 days post delivery and three months post discharge. The assessment measures included the Perceived Stress Scale, the State and Trait Anxiety Inventory 1 and 2 and salivary cortisol levels.

Results: The psychometric assessment at baseline was comparable between the two groups. The intervention group showed a significant reduction in trait anxiety ($p=0.02$) compared with

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the control group three months post discharge. The perceived stress decreased in both groups ($p=0.699$). No difference in salivary cortisol levels was detected. The multivariate analysis revealed that higher initial stress levels ($p<0.001$) and university/college education ($p=0.003$) were associated with higher parental stress, whereas moderate-to-high income satisfaction was associated with lower parental stress ($p=0.003$).

Conclusion: Further long-term follow-up of families with a neonatal intensive care unit experience could assess more delayed effects of stress management by relaxation techniques.

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Implications for Clinical Practice

- The application of relaxation techniques, in addition to providing information-based training, in parents of preterm infants admitted to a NICU was associated with a reduction in the parental trait of anxiety after the infants' discharge.
- Higher initial levels of stress in parents of preterm infants admitted to a NICU are associated with more significant parental stress at three months post discharge.
- Parental stress three months after the discharge of a preterm infant from the NICU is greater in parents with lower income satisfaction and higher education.

Introduction

Hospitalisation of a premature infant in the neonatal intensive care unit (NICU) is a highly stressful situation for the parents. Separation from the infant and difficulty in performing parenting activities in the critical care setting seem to be the most important sources of stress (Busse et al., 2013). Although researchers have reached a consensus on emotional imbalance, posttraumatic stress disorder (PTSD) has been proposed as an explanatory model (Chrousos, 2009; Shaw et al., 2009).

The persistent stress, as well as the anxiety and depression, experienced by parents of infants in the NICU for >2 months post partum has been implicated in the disruption of the mother–infant bonding (Busse et al., 2013; Flacking et al., 2012; Field, 2010; Liu et al., 2010; Giakoumaki et al., 2009; Olshtain-Mann and Auslander, 2008), thus potentially affecting the neurodevelopment of the premature infant (Treyvaud, 2014; Field, 2010). Due to the importance of supporting parents of premature infants, early intervention programmes have been implemented (Benzies et al., 2013; Charpak et al., 2005; Cockcroft, 2012; Flacking et al., 2012; Liu et al., 2010; Melnyk et al., 2008; Shaw et al., 2006). Such programmes mainly aim to improve the quality of the infant's environment, by providing psychosocial support and parental education. Some of these programmes may assess the therapeutic effect on the infant, but they do not generally evaluate their direct effect on the psychological status of the parents (Benzies et al., 2013).

The latter can be assessed either by specific questionnaires (Schappin et al., 2013) or more directly by measuring the salivary cortisol levels, which reflect the respective unbound hormone in the blood, thus assessing the stress-associated activity of the hypothalamic–pituitary–adrenal axis (HPAA) (Kirschbaum and Hellhammer, 1994).

Relaxation techniques constitute a novel method of controlling the perceived stress and anxiety, predicated on evidence-based procedures of promoting well-being

(Varvogli and Darviri, 2011; Manzoni et al., 2008). Progressive muscle relaxation, guided imagery, diaphragmatic breathing, biofeedback, and cognitive behavioural stress reduction have proven to be effective in reducing stress and anxiety accompanying either daily life or chronic illness. These methods have been added to the therapeutic armamentarium of health-care providers, in order to enhance their interactions with patients (Varvogli and Darviri, 2011; Manzoni et al., 2008). Nevertheless, very few studies have applied similar techniques to parents of NICU babies, with the primary aim of increasing milk production (Feijs et al., 2013; Feher et al., 1989) or preventing postpartum traumatic stress in first-time mothers (Shaw et al., 2013a, 2013b; Chuang et al., 2012; Rees, 1995).

The aim of this study was to investigate the effect of applying relaxation techniques, in addition to providing information-based training, on the stress and anxiety experienced by parents of hospitalised premature infants, three months following discharge of infants from the NICU. We hypothesised that relaxation techniques would favourably affect the aforementioned parameters and could help parents cope with possible challenges in infant care in the longer term.

Materials and methods

Study design

A randomised clinical trial was conducted in the NICU of a tertiary maternity hospital between February 2012 and May 2013. Parents of infants <37 weeks of gestational age, who were admitted to the same NICU, with fluency in Greek and no previous NICU experience, were invited to participate in the study. The exclusion criteria were as follows: (a) parents of premature infants with a birth weight of <1 kg or >2 kg, (b) parents of premature infants with major anomalies and fatal diseases, and

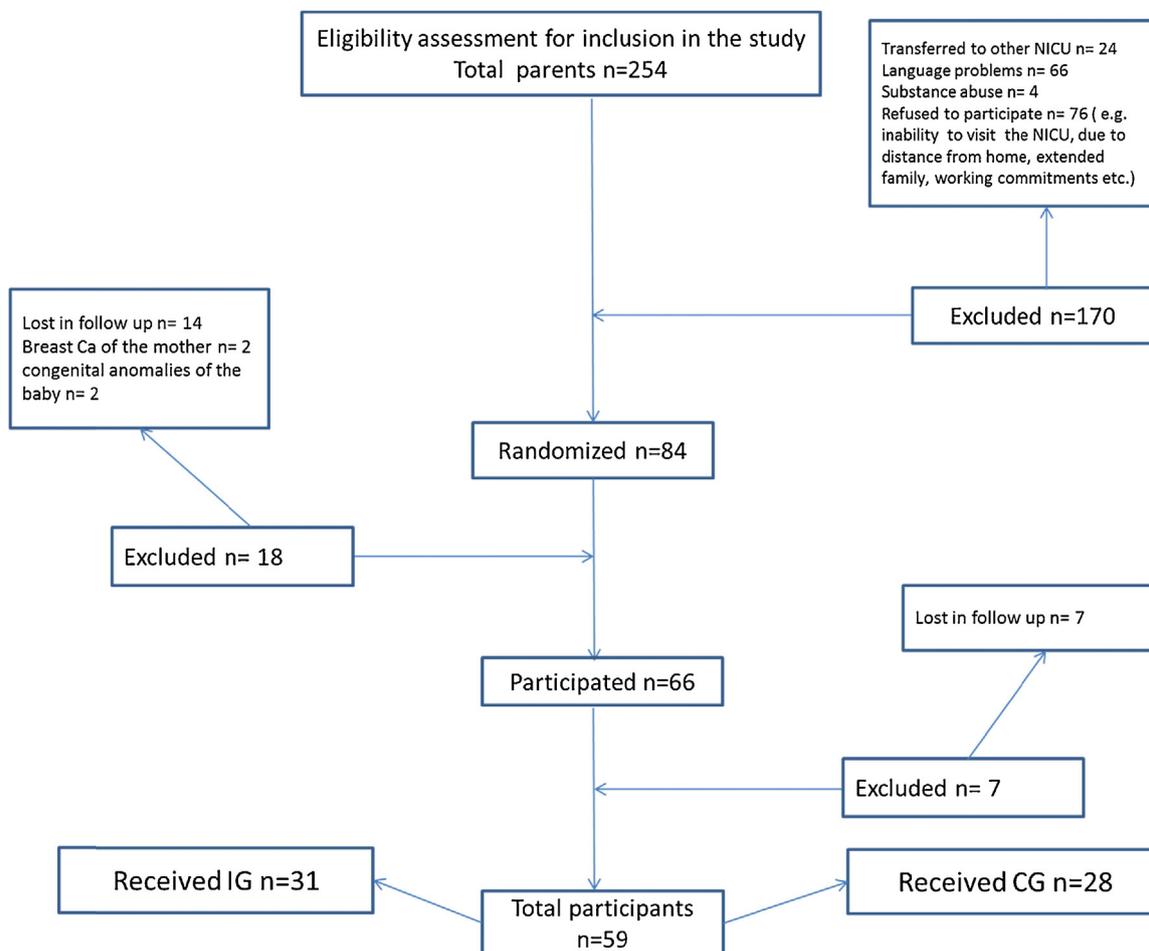


Figure 1 Flowchart for the selection process of study participants.

(c) parents dependent on psychotropic drugs or toxic substances.

The inclusion criteria were initially met by 84 parents, 66 of whom finally agreed to participate (79%). At the end of the study period, seven participants were excluded from further analysis, due to lack of full compliance. The number of parents finally included in the study was 59 (Fig. 1).

The participants were randomised and assigned by a nurse into two groups using the Integer Generator free software (random.org), which produces random numbers in configurable intervals: 31 in Group A (intervention group, IG) and 28 in Group B (control group, CG). The parental pairs were randomised in the same group (either IG or CG) to avoid sample contamination. Consequently, each parent was analysed individually in the group to which he/she belonged.

The study protocol was approved by the ethics committee of the hospital. All participants were asked to sign an informed consent form before enrolment in the study.

Data collection

The sociodemographic data of the parents were collected through a structured questionnaire, by conducting a face-to-face interview, which included assessment of parental gender, age, marital status, educational level and income

satisfaction by a five-point Likert scale (from “not at all” to “very much”). The medical history data of the infants were collected from the hospital records.

The psychometric data were collected at two time points: 10–15 days after the infant’s delivery (baseline), when the standardised questionnaires were administered to the parents for completion by the first author; and three months after discharge from the NICU, when the standardised questionnaires were mailed to the parents by the first author, following respective telephone arrangements, and were collected the following day. The same methodology was applied for the Salivette collection devices as well (described subsequently).

Perceived stress was estimated with the Perceived Stress Scale (PSS-14). The questionnaire had been previously validated in the Greek language, with an internal reliability coefficient (Cronbach’s α) of 0.88 (Andreou et al., 2011). Anxiety was measured with the State–Trait Anxiety Inventory (STAI), which incorporates two subscales that measure state anxiety (STAI-1) and trait anxiety (STAI-2). The internal consistency of this inventory, which had also been previously validated in the Greek language, was found to be excellent for both the initial and final measurements (Cronbach’s α of 0.91 and 0.90, respectively) (Liakos and Giannitsi, 1984).

Salivary cortisol levels in the parents were measured in three daily samples of saliva (in the morning, 30 minutes

Table 1 Content of the informative sessions and interventions provided to parents of hospitalized premature infants (Ackard et al., 2006; Adam and Epel, 2007; Anderson et al., 1999; Armstrong et al., 2005; Baum and Posluszny, 1999; Busse et al., 2013; Callen and Pinelli, 2005; Casper, 2011; Hiscock and Jordan, 2004; Hughes et al., 2002; Kim et al., 2013; Mundy, 2010; Obeidat et al., 2009; Richter and Reck, 2013; Scheier and Carver, 1993; Wolinski, 1993; Wong, 2012).

IG and CG	IG	
PowerPoint presentation – Discussion	PowerPoint presentation – Discussion	Relaxation techniques
What is a NICU? Prematurity and the needs of the premature infant	Introduction in stress and lifestyle	DB
The stress of parents with infants in NICU	Physical activity and healthy diet	PMR and practice in DB
Breast-feeding. Feeding the premature infant	Positive thinking	GI and practice in DB
Why does a baby cry?	Discussion and examples of positive thinking	Practice in PMR and DB
Taking the premature baby home. Scheduling a discharge from the NICU	Self-awareness	Practice in DB and any RT by choice

Abbreviations: NICU: neonatal intensive care unit, DB: diaphragmatic breathing, PMR: progressive muscle relaxation, GI: guided imagery.

after awakening and before sleeping at night). The parents were given detailed instructions on collecting the saliva samples correctly, with a Salivette collection device (Sarstedt, Nümbrecht, Germany). The samples were processed using the Elecsys Cortisol reagent kit produced by Roche Co. (Basel, Switzerland). The salivary cortisol concentrations were measured using an electrochemiluminescence immunoassay. The analytical sensitivity (lower detection limit) for salivary cortisol concentrations was 0.036 mg/dl (0.95 µg/gl) (Adam and Kumari, 2009).

Intervention

Both studied groups underwent five interactive training courses, lasting approximately 90 minutes each, during the hospitalisation period of infants, in addition to the daily medical parental briefing (Table 1). The related subjects were selected by the first author based on Internet research and the first author's personal experience with parents of infants in the NICU. Further, it was developed in the context of a postgraduate programme in stress management and health promotion. The Internet research included an extensive search of the literature in Medline and Google Scholar using the keywords "parent," "baby," "preterm," "NICU," "question," "information," "communication," "education," and "need," as well as surveying questions frequently asked by parents on online parental fora and referring to parental guidebooks developed by various hospitals mainly across the USA. Certain elements of the highly organised system of care for NICU infants NIDCAP (Neonatal Individualized Developmental Care and Assessment Program) (Als, 2009) were also used, but full programme certification was not possible, due to cost restraints.

The training topics were presented by the first author in PowerPoint format on a large screen. The parents of the CG attended informative sessions on prematurity, stress in NICU, breast-feeding, preparation for discharge, and infant care at home. The parents of the IG attended courses specifically designed by the first author, which not only included the previous information but also provided insight into

positive thinking, healthy lifestyle, and self-knowledge. In addition, parents of IG practiced three different relaxation techniques (diaphragmatic breathing (deep breathing), progressive muscle relaxation, and guided imagery) during each session, and they were encouraged to practice these techniques twice daily.

In the deep breathing exercise, parents learned to manipulate their breath movement, by expanding the abdomen rather than the chest when breathing (Jerath et al., 2006). During progressive muscle relaxation practice, parents learned to tense and relax muscle groups for 10s, sequentially over the legs, abdomen, chest, arms, and face, while focusing on the different sensations produced by these two situations (Titlebaum, 1998). The goal of the guided imagery goal exercise was to enable the parent to engage with his/her own images that were representative of his/her specific health or life issues, in order to develop health-directed insights and health-promoting behavioural changes (Joe, 2006). The investigator asked each parent to choose a relaxing positive image in line with their memories and reproduce it in detail. Each relaxation technique was practiced for 15–20 minutes after the educational course.

After the infant's discharge, the participants were given an audio CD with either recorded relaxation techniques (IG) or general information for infants (CG) to be practiced for the 3 months following the infant's discharge. Reminders for the stress management programme were sent by text messages, or respective weekly telephone calls, during the 3-month post-discharge period.

Statistical methods

Data analysis was conducted using the statistical package Stata 9.2 SE for Windows. The descriptive characteristics included numbers of observations and the corresponding relative frequencies (percentages), whereas the median value and the interquartile range (IQR) were used for the quantitative characteristics. The relationship between the two study groups and the qualitative characteristics at baseline were statistically evaluated with Pearson's χ^2 test.

Table 2 Descriptive analysis of sociodemographic parameters and medical history data of the study sample.

Sociodemographic parameters	Intervention group, <i>n</i> (%)	Control group, <i>n</i> (%)	Total, <i>n</i> (%)	<i>p</i> -Value
Men	15 (48.4)	13 (46.4)	28 (47.5)	0.183
Women	16 (51.6)	15 (53.6)	31 (52.5)	0.183
Married	31 (100.0)	23 (82.1)	54 (91.5)	0.170
Tertiary education	12 (38.7)	13 (46.4)	25 (42.4)	0.806
Decent income ^a	20 (76.9)	18 (69.2)	38 (73.5)	0.454
Medical history data				
Caesarean section	15 (93.8)	14 (93.3)	29 (93.5)	0.962
Primiparae	8 (50.0)	12 (80.0)	22 (64.5)	0.170
IVF	14 (45.2)	4 (14.3)	18 (30.5)	0.062
Sociodemographic parameters	Median value (IQR)	Median value (IQR)	Median value (IQR)	<i>p</i> -Value
Parental age (years)	34.5 (30.5, 39.5)	37.5 (33.0, 41.0)	34.5 (32.5, 40.5)	0.321
Infant gestational age (weeks)	33.0 (31.0, 35.0)	33.0 (32.0, 34.0)	33.0 (31.0, 35.0)	0.916
Apgar score at the first minute	8.0 (7.0, 9.0)	8.0 (7.0, 9.0)	8.0 (7.0, 9.0)	0.878
Total days in NICU	34.0 (19.0, 42.0)	28.0 (20.0, 34.0)	32.0 (20.0, 40.0)	0.370

Abbreviations: IQR: interquartile range, IVF: in vitro fertilisation, NICU: neonatal intensive care unit.

^a Income satisfaction from moderate to very high.

The nonparametric Mann–Whitney test was used to test for potential baseline differences in quantitative variables between the study and control groups.

A linear mixed-effects model was used to explore the potential association between sociodemographic parameters and the final stress status at the end of the study, after controlling for the intervention condition and considering the interaction between the parental couples, as well as individual subject contributions. Logarithmic transformation was applied to cortisol measurements in order to approximate the normal distribution.

Results

The descriptive statistics are shown in Table 2. The sociodemographic and medical history data did not differ between the two groups. A significant percentage of caesarean section delivery (93%), a rather high educational level (42.4% university/college graduates) and satisfactory income (73.5%) were observed. Of the parents, 91.5% ($n = 54$) were married, and the median parental age was 34.5 years.

The baseline psychometric assessment 10–15 days after the delivery of the premature infant was found to be comparable between the two groups. Three months after discharge, both groups showed reduced levels of anxiety, more so in the IG, but without a statistically significant difference as a total ($p = 0.186$). Nevertheless, the IG showed a significant reduction of trait anxiety compared with the CG ($p = 0.02$, Table 3).

Perceived stress decreased in both groups, but with no statistically significant difference ($p = 0.699$, Table 3). However, the effect of intervention seemed to differ, depending on the initial score of perceived stress (as measured by PSS-14). In fact, an interaction coefficient of -0.53 was determined, suggesting that the effect of the intervention was better with higher initial scores.

Finally, no difference between the IG and CG was detected in terms of salivary cortisol levels either at baseline or after the intervention ($p = 0.282$, Table 3).

Multivariate analysis revealed that an increase in the initial PSS-14 score was associated with more significant parental stress at the end of the study, after controlling for the intervention condition. Furthermore, parents with moderate-to-high income satisfaction were less stressed than were their counterparts with lower respective satisfaction ($p = 0.003$), whereas university/college graduates scored higher ($p = 0.003$) than did parents of lower educational level (Table 4).

Discussion

This randomised controlled study aimed to investigate the effect of applying relaxation techniques, in addition to providing information-based training, on the stress and anxiety of parents with hospitalised premature infants, 3 months following the infants' discharge from the NICU.

The results of the present study demonstrated a significant reduction in the trait of anxiety, which can more or less reflect the personality of the parents (Spielberger, 2010; Barnes et al., 2002) who received the intervention even three months after the infants' discharge from the NICU. Although such a change may seem unprecedented initially, it could support the infant more substantially in the long term. Indeed, parents who learn to be less anxious in general can cope with adverse situations or emotions more easily, and they function more effectively in the interest of their child. Conversely, the reduction in the state of anxiety in both groups seems reasonable, as it largely depends on the causal factor or situation. It should be mentioned that parents of the IG were given the opportunity to choose from a variety of relaxation techniques with similar positive evidence-based impact on anxiety and stress, depending on their mood,

Table 3 Baseline parental psychometric assessment during hospitalisation of the premature infant and respective differences at 3 months post discharge.

Psychometric tools	Intervention group ^a		Control group ^a		Intervention group ^b		Control group ^b		p-Value
	Mean value (SD)	p-Value	Mean value (SD)	p-Value	Mean difference (SD)	p-Value	Mean difference (SD)		
^c PSS-14	28.3 (8.0)	0.056	27.3 (8.1)	0.113	-3.3 (7.4)	0.113	-3.0 (6.4)	0.699	
^d STAI 1	46.3 (11.4)	0.026	45.7 (13.6)	0.069	-5.8 (11.0)	0.069	-4.3 (10.5)	0.515	
^e STAI 2	41.7 (11.3)	0.071	38.1 (14.2)	0.190	-4.2 (9.7)	0.190	2.6 (9.3)	0.020	
^f Salivary cortisol									
^g Morning	0.6 (0.2)	0.114	0.6 (0.3)	0.292	0.1 (0.3)	0.292	0.1 (0.4)	0.940	
30 minutes after	0.5 (0.3)	0.012	0.7 (0.4)	0.749	0.1 (0.3)	0.749	-0.0 (0.4)	0.263	
awakening									
^h Evening	0.2 (0.1)	0.659	0.3 (0.1)	0.342	0.0 (0.2)	0.342	0.0 (0.1)	0.636	

Abbreviations: PSS: Perceived Stress Scale, IQR: interquartile range, STAI: State-Trait Anxiety Inventory, STAI 1: State Anxiety Inventory, STAI 2: Trait Anxiety Inventory.

^a Baseline measurements.

^b 3 months post discharge.

^c Maximum score: 56.

^d Maximum score: 80.

^e Maximum score: 80.

^f In µg/gl (1 gl = 3.79 lt).

^g Normal value < 1.825 µg/gl.

^h Normal value < 1.13 µg/gl.

Numbers in bold indicate statistically significant results.

personality, and available time for practice (Varvogli and Darviri, 2011; Pagnini et al., 2010, Manzoni et al., 2008).

Studies that used the trait scale of the STAI to estimate the efficacy of relaxation techniques in treating anxiety showed a lower within-group effect size than those that used the state scale. This result is in concordance with the general notion that changing a trait is harder than changing a state (Schappin et al., 2013; Charpak et al., 2005). Nevertheless, there are indications that relaxation techniques could influence both the physical and emotional domains through concentration (Manzoni et al., 2008; Eppley et al., 1989), thereby producing measurable changes to parameters of the trait scale (Wild et al., 2014).

By contrast, no statistically significant difference in parental stress reduction (as estimated with the use of PSS-14) was found in the present study between the two groups three months after the discharge of the premature infants.

In the multivariate analysis, higher initial levels of stress were associated with more significant parental stress at the end of the study. Moreover, parental stress was greater in parents with lower income satisfaction and higher education. The former may be due to weaker social welfare support in the current economic crisis, as observed even before the crisis, causing more anxiety to people who cannot afford private care and are obliged to rely on public health-care provision. The latter may indicate that educated parents experience more stress and need more detailed information and personalised encouragement to overcome their anxiety. Nevertheless, a recent meta-analysis suggested that maternal education alone does not represent a significant moderator of stress (Schappin et al., 2013).

The inability to modify salivary cortisol values within and between groups of parents of premature infants during the two periods of time could be explained by the moderate to severe perceived stress recorded. Moreover, premature birth could be the end point of a challenging, life-threatening condition resolved by delivery, temporarily shifting the responsibility of caring for the infant to the medical and nursing staff (Lau and Morse, 2013). However, salivary cortisol values could also be altered during several night and morning awakenings depending on parental duties (Thorn et al., 2006).

Determining the salivary cortisol levels as a stress biomarker reflects the respective unbound hormone in the peripheral blood in a valid and reliable manner (Kirschbaum and Hellhammer, 1994). The secretion of cortisol from the adrenal glands follows a basic circadian rate, reaching the lowest value in the night and approaching a peak 30–40 minutes after awakening.

The strengths of the present study include the randomisation of parents into two groups, while their baseline comparability in terms of socioeconomic, demographic, and psychometric characteristics (Tables 2 and 3) prevented any bias in the final findings. In addition, by examining score changes instead of comparing the mean values during the psychometric assessment of the parents, we attempted to consider the initial score value for every participant. This was deemed necessary, as the outcome of interest was a potential change in scores after the intervention. Hence, a simple comparison of means at the end of the study could have introduced an overlooked risk that parents at baseline may have different levels of stress, anxiety trait,

Table 4 Multivariate analysis of parameters associated with parental stress at the end of the study.

Parameters	IG and CG mean difference	95% C.I.	p-Value
Age ^a	0.536	(−1.313, 2.385)	0.570
Female gender (^c R.C.: male gender)	0.367	(−2.690, 3.423)	0.814
Initial PSS-14 Group	0.693	(0.438, 0.948)	<0.001
Intervention	0.053	(−3.822, 3.929)	0.978
Control	0		
Decent income^b (^c R.C.: not decent income)	−6.278	(−10.385, −2.171)	0.003
Tertiary educational level (^c R.C.: elementary/high School graduates)	6.409	(2.145, 10.673)	0.003

Abbreviations: IG: intervention group, CG: control group, C.I.: confidence interval, R.C.: reference category.

^a In 5-year intervals.

^b Income satisfaction from moderate to very high.

^c Assumes the value ‘‘0’’.

Numbers in bold indicate statistically significant results.

etc. Finally, by employing a linear mixed-effects model, the interaction between the mother and father in every parental couple was considered, along with the individual parental contribution in the respective group (intervention, or control), when determining the final parental stress status at the end of the study.

The limitations of the present study include the subsequent reduction in parental stress eventually over time following the infant’s discharge from the NICU (Holditch-Davis et al., 2009; Lau and Morse, 2013). Nevertheless, this process is not likely to be completed within the first 3 months post discharge (Lau and Morse, 2003), and parents are always at the risk of experiencing a delayed stressful reaction (Busse et al., 2013). In addition, the study limitations included the lack of a control group that did not receive any intervention. A control group of parents of hospitalized preterm infants who did not attend informative sessions was not considered feasible by the authors for both ethical (i.e., due to the respective parental anxiety status) and practical reasons (i.e., because parents tend to talk to each other). Nevertheless, care was taken to prevent the relaxation technique sessions for the IG from coinciding with the informative sessions for the CG.

Further limitations include that the use of standardised self-assessment questionnaires for evaluating anxiety and stress, do not allow accompanying information to be provided; combining such questionnaires with clinical interviews could result in a better diagnostic approach (Olde et al., 2006). Nevertheless, standardised questionnaires prevent any bias during data interpretation. Finally, the nonstatistically significant findings of the present study are inconclusive, due to the relatively small sample size. Nevertheless, the inevitable decrease in statistical power does not affect the statistically significant findings of the study.

To the best of our knowledge, the effect of stress management with relaxation techniques on parents and parental couples with hospitalised preterm infants has not been previously investigated, especially when the observation period extends well beyond the infant’s discharge. Only one study

investigated mothers of preterm infants after implementing progressive muscle relaxation for one month. The results indicated a similar reduction in anxiety between the two groups, while symptoms of stress trauma and depression were significantly reduced in mothers practicing progressive muscle relaxation (Shaw et al., 2013a, 2013b).

Conclusion

Applying relaxation techniques, in addition to providing information-based training, in parents of preterm infants admitted to a NICU reduces the trait of anxiety ($p=0.02$) three months after the infants’ discharge, but not the respective state. No statistically significant difference in parental stress reduction was found in the present study between the two modes of stress management. Higher initial levels of stress were associated with more significant parental stress at the end of the study. Moreover, parental stress was greater in parents with lower income satisfaction and higher education. Further long-term follow-up of families with a NICU experience would be useful in assessing more delayed effects of stress management by relaxation techniques (in addition to information-based training) in terms of the parent–infant bonding, as well as the neurodevelopmental progress of the affected infants.

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Conflicts of interest

The authors have no conflict of interest to declare.

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