



Department of Medical Studies

Effect of Environmental Stressors on Biobehavioral Responses of Preterm Infants in Neonatal Intensive Care Unit

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By

Walaa Nasr Ahmed El-Ghitany

M.B.B.CH., M.Sc. Pediatrics

Supervised by

Dr. Mohamed Sami El Shimi

Professor of Pediatrics

Faculty of Medicine

Ain Shams University

Dr. Ehab Mohamed Eid

Professor of Public Health

Institute of Postgraduate Childhood

Studies – Ain Shams University

Institute of Postgraduate Childhood Studies

Ain Shams University

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

"وهو الذي أنشأ لكم السمع و
الأبصار والأفئدة قليلاً ما تشكرون"

صدق الله العظيم

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Abstract

Although research has demonstrated that the neonatal intensive care unit (NICU) is a stressful environment for preterm, little research validates the suspected relationships between infant biobehavioral responses and environmental stress in the NICU. This study examined the relationship between environmental stress and biobehavioral responses of preterm infants. The study used a repeated-measures research design to examine research variables in one group of preterm infants. Measurements of research variables were recorded every 2 minutes during two 60-minute observation periods for each research day (1 hour in the morning and 1 hour in the afternoon) and conducted over 2 days. A convenience sample of 84 preterm infants was recruited from Almaza NICU. A total of 10416 observations were made and recorded during the study. There was a statistically significant ($P < 0.05$) relationship between environmental stressors and changes in physiological signals. There were also statistically significant ($P < 0.05$) relationships between environmental stress and some specific stress behavioral responses. This research is applicable to neonatal clinical practice because it demonstrates the importance of recognizing the preterm infant's biological stress responses to environmental

stressors, allowing for early interventions to reduce the possibility of more serious physiological or pathological changes in the status of the preterm infant.

Key words:*environmental stress, preterm infant, stress behavioral responses, stress physiological signals.*

List of Abbreviations

AAP	American Academy of Pediatrics
ACTH	Adrenocorticotrophic hormone
BPD	Bronchopulmonary dysplasia
dB	Decibel
Ft-c	Foot candle
GA	Gestational age
HC	Head circumference
ISO	International Organization for Standardization
IUGR	Intrauterine growth retardation
KC	Kangaroo Care
KMC	Kangaroo Mother Care
L/S	Lethicinsphyngomylien ratio
LMP	Last date of menstrual period
LUX	unit of measurement of light
NEC	Necrotizing enterocolitis
NICU	Neonatal intensive care unit
NIDCAP	Neonatal Individualized Developmental Care and Assessment Program
NREM	Non Rapid Eye Movement

OHC	outer hair cells
ONB	Observation of Newborn Behavior
PG	Prostaglandin
PROM	Premature rupture of membranes
RDS	Respiratory distress syndrome
REM	Rapid Eye Movement
RHT	retinohypothalamic tract
SCN	suprachiasmatic nuclei
SLM	The sound level meter
SPL	decibels of sound pressure level



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Introduction

The neonatal intensive care unit (NICU) provides treatment for maintaining the vital functions of preterm infants because of immaturity of all major body systems, especially the nervous system. However, some researchers have pointed out that the NICU environment involves sensory overload and is a mismatch to the requirements of the developing nervous system in preterm infants. In order to not only assure survival but also foster the development of preterm infants, it is critical to understand the interaction among the environment and the function and progression of preterm infants (***Niang and Bachman, 2009***).

Light, sound, and caregiving interventions are the main environmental stressors that are harmful to preterm infants in NICUs (***Nair et al., 2003***).

Preterm infants have often been cared for in NICUs typically illuminated 24 hours a day by a mixture of natural and artificial light. The ambient light levels range from 12 to 99 foot-candles (ft-c) with a mean light illumination of 46.29 ft-c in the NICU (***Slevin et al., 2000***).



Sound levels in the NICU have also been a major source of environmental stress for premature infants. The American Academy of Pediatrics recommended that noise levels should not exceed 40 to 45 dB in the NICU and basic sound levels should be less than 35 dB to promote infant sleep (*Levy et al., 2003*).

Caregiving interventions in the NICU often combine multiple stimuli that include sound, light, tactile stimuli, and pain. In interventions that require opening the plastic sleeve of the incubator, the mean decibel level has been found to be 67 to 86 dB. Nursing and medical interventions sometimes include painful stimuli. These painful interventions may produce a physiological response and induce stress behaviors in preterm infants (*Bremner et al., 2003*).

Environmental stimuli in the NICU can cause initial increases in heart and respiratory rate in acutely ill infants, along with possible increases in oxygen consumption and caloric requirements. If the stressful stimulation continues without any intervention, the initial increases in cardiac and respiratory rates cease and the infant will become bradycardic and apneic (*Philbin and Klass, 2000*).