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Premature Born Infant's Reaction to the Mother's Voice in Comparison to their Reaction to Music - Effect on Heart Rate and Heart Rate Variability –

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Objective: The aim of the study was to compare stress-reduction effects of the mother's voice and lullaby music in preterm infants and to explore whether the mother's well-being affects her ability to calm down her preterm baby. It was hypothesized that both acoustic stimulation interventions in comparison with a control (no-acoustic stimulation) situation can calm down the baby, i.e. decrease heart rate and increase heart rate variability in preterm infants. Further it was hypothesized that the mother's voice would have greater effect than lullaby music. Furthermore it was hypothesized that the mother's voice from a mother who manages her current stress better, who feels more competent in parent-child interactions and who has a more functional family will have the greatest effect.

Patients and methods: Thirty preterm infants with gestational age of 27 to 36 weeks were acoustically stimulated with the voice of their own mother (reading favourite fairytale) and lullaby music at a postnatal age of 3 to 5 weeks when their cardiorespiration was stable (corrected gestational age 30-41 weeks). Acoustic stimulation with the mother's voice and lullaby music was done on two consecutive days. The order of the two acoustic stimulations was randomly assigned for each infant. A continuous electrocardiogram was recorded by polysomnography device 15 minutes before, 15 minutes during and 15 minutes after the acoustic stimulation. Various heart rate variability measures (NN interval mean value, NN interval median, variance of NN intervals, standard deviation of NN intervals, pnn 6,25, RMSSD, SDSD and RSA) were assessed. Behavioural states were differentiated both by clinical observations according to Prechtl and a PC software program. Non-REM sleep sections of 2 minutes duration (randomly cut out from the respective data sections in the continuous electrocardiogram) were matter of analyses. In order to study a possible influence of the mother's well-being on the calming quality of her voice and thereby on the heart rate variability of her preterm infant, maternal/paternal stress and competences as well as family functionality were assessed via respective questionnaires. Two-way repeated measures ANOVAs, testing for the factor "acoustic stimulation", the factor "time" as well as for the interaction between these two factors, was considered as the most appropriate to test the hypotheses. For the interrelations between well-being of the mother and heart rate variability of her preterm infant, Pearson correlations were conducted.

Results: Heart rate and heart rate variability of preterm infants showed no statistically significant differences *before* acoustic stimulation. *During* acoustic stimulation, both music and mother's voice decreased heart rate and increased different heart rate variability measures. However, statistically significant differences were found for NN interval mean value *during* mother's voice. Beyond expectations, statistically significant differences were found also for NN interval mean value and NN interval median value *after* acoustic stimulation with mother's voice, suggesting thus a prolonged or lasting effect of the mother's voice. Concerning well-being parameters of the mothers', the level of reported burden was elevated. Other well-being parameters of these premature mother's (resources, competences and family functionality) were within the normal range. The correlations between the

mothers' well-being and their babies' heart rate variability *during* and *after* fairytale acoustic stimulation indicate a strong relationship. The correlations point out that a higher family functionality is associated with a higher heart rate variability of preterm babies. Contradictory to the expectations, higher burden and lower resources as well as lower competences of the mothers were associated with a higher heart rate variability of the preterm babies.

Conclusions: In comparison with control situation, both acoustic stimulation interventions induce heart rate decrease, i.e. heart rate variability increase in preterm babies *during* the acoustic stimulation intervention. Statistically significant increase in heart rate variability was however shown only *during* mother's voice acoustic stimulation. The calming effect of the mother's voice maintains also *after* the acoustic stimulation intervention, i.e. mother's voice has a prolonged / lasting effect. The correlations between the mother's well-being and their babies' heart rate variability indicate a strong relationship. A higher family functionality was associated with a higher heart rate variability of preterm babies. Also higher burden and lower resources as well as lower competences of the mother's were associated with a higher heart rate variability of preterm babies.

Mothers should be encouraged to interact (more) with their preterm infants. Simultaneous real-time investigations of the mothers' and the babies' heart rate variability during a live mother-baby interaction seem to be necessary to provide further explanations of the noticed correlations between the mother's stress, her feelings of competence and their babies' heart rate variability.