Changes in serum cortisol concentrations in response to music in preterm infants

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We assessed the changes in serum cortisol concentrations, a stress-related biochemical marker, in response to music in preterm infants. Nine stable infants (median gestational age 31 weeks, median postnatal age 14 days) were included in the study. The infants were clinically stable and the music was played in neonatal care unit between two feeding periods for approximately three hours in the late afternoon. Blood samples were obtained 15 minutes after completion of the first and second feedings to determine serum cortisol levels. Each infant constituted its own control on the next day. Cortisol concentrations showed consistently increased values after music sessions (median difference 211 nmol/L, p 0.025, Wilcoxon matched pairs). Our study confirmed the idea that "it is possible to detect an objective hormonal changes following a supposedly 'non-therapeutic' intervention in preterm infants", and contrary to common opinion, suggested that playing music in neonatal care unit may not be pleasurable. [Journal of Turgut Özal Medical Center 1(4):272-274,1994]

Key Words: *Music, preterm infant, cortisol*

Prematüre bebeklerde müziğe cevap olarak serum kortizol konsantrasyonundaki değişiklikler

Prematüre bebeklerde, müziğe cevap olarak stresle ilişkili bir biyokimyasal gösterge olan serum kortizol konsantrasyonlarındaki değişmeleri değerlendirdik. Çalışma kapsamına 9 stabil bebek (median gestasyonel yaş 31 hafta, median postnatal yaş 14 gün) alındı. Öğleden sonra yaklaşık 3 saat boyunca, iki beslenme periyodu arasında olacak şekilde, yenidoğan bakım ünitesinde müzik çalındı. Serum kortizol seviyelerini tesbit etmek üzere, ilk ve ikinci beslenmeden 15 dakika sonra kan örnekleri elde edildi. Her bebek ertesi gün bizzat kendisinin kontrolünü oluşturdu. Kortizol konsantrasyonları müzik periyodundan sonra anlamlı bir şekilde artmış değerler gösterdi (median fark 211 nmol/L, p 0.025, Wilcoxon eşleştirilmiş çiftler). Çalışmamız "prematüre bebeklerde tedavi edici olmadığı kabul edilen bir müdaheleyi takiben objektif bir hormonal değişikliği tesbit etmenin mümkün olduğu" şeklindeki düşünceyi doğruladı ve yenidoğan bakım ünitelerinde müzik çalınmasının bebekler için "hoşa gider" olmayabileceğini telkin etti. [Turgut Özal Tıp Merkezi Dergisi 1(4):272-274,1994]

Anahtar Kelimeler: *Müzik, prematüre, kortizol*

Preterm infants in intensive care units are exposed to a number of stresses. Positive interventions, aimed at improving the quality of life for preterm infants in intensive care units, include the use of sheepskins, mattresses filled with polystyrene balls, massage and music[1]. It has been indicated that music therapy is a fertile ground for application of research in practice[2]. Face to face visual stimulation would seem sufficient for infants less than 40 weeks-old until further research is done. Talking to infant who are in states other than sleep is to be encouraged, and planned interventions such as

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taped music and vocal selection need continued exploration[3].

We aimed to make an objective assessment of music therapy in preterm infants. For this purpose, we detected the concentrations of serum cortisol, which is thought a stress related biochemical marker, in response to music.

MATERIALS AND METHODS

Nine healthy preterm infant with a median gestational age of 31 ± 1.64 weeks, a median postnatal age of 14 ± 2.4 days, and a postconceptional age of 33 ± 1.76 weeks were included in this study. All of the infants were stable and they were not receiving intravenous fluid and any other therapy during the study. Eight were male and one was female. We maintained similar environmental condition in incubators for all infants, and the infants were at resting state without any intervention in the study period.

After a consent was obtained from each parent, the study was performed between the same hours in the afternoons in two consecutive days for each infant. In the first day, music was played between two feeding periods approximately for three hours, and the blood samples were obtained by peripheral venipuncture about 15 minutes after the first and second feedings. In the second day, blood samples were obtained from each infant at the same times of day as control samples, but music was not played. Loudness of the played music was between 55 to 81 decibel.

The blood samples were centrifuged at 5000 rpm for five minutes and the serum samples were stored at -20°C until assayed. Serum cortisol concentrations were determined by radio immunoassay and defined as nmol/L[4].

Non-parametric tests were used for statistical analysis.

RESULTS

Nine preterm infants were included in the study. Median gestational age was 31 weeks (ranged from 28 to 33 weeks), median postnatal age 14 days (ranged from 7 to 28 days), and median weight in the study time was 1900 g (ranged from 1400 to 2100 g).

Figure 1 depicts the serum cortisol concentrations before and after the music session and control silent session.

Table 1 shows the median cortisol concentrations (minimum-maximum) before and after the music session and control silent session, and shows the significance between the matched pairs.

Cortisol concentrations showed an increase after the music session and the difference between the first and second samples was statistically significant (median difference 211 nmol/L, $p<0.025$, Wilcoxon matched pairs). In the other hand, the difference between the cortisol concentrations of first and second samples in the silent session was not statistically significant (median difference -55 nmol/L, $p>0.05$).

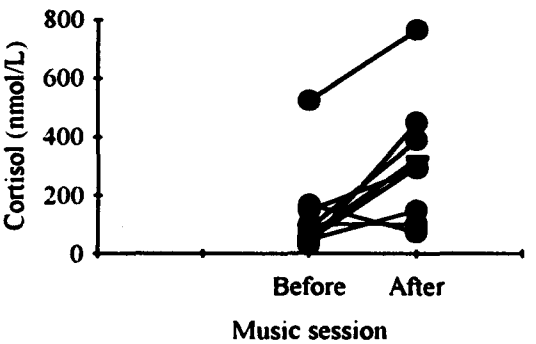

Figure 1. Cortisol concentrations before and after the music session and control silent session.

DISCUSSION

It is often difficult to assess the response of patients to the positive interventions in children, especially in preterm infants. Behavioural assessment is often subjective and open to observer bias, also positive interventions, designed to improve the quality of life for preterm infants, have rarely been objectively evaluated[1].

Some studies performed on adults makes us enable to get an idea about the influence of music on human biochemical parameters[1,5-7]. Escher et al.

Table 1. Median cortisol concentrations (minimum-maximum) and the significance between the matched pairs.

	Music session		Control silent session	
	Before	After	Before	After
Cortisol (nmol/L)	87 (30-524)	298 (71-764)	358 (43-904)	303 (81-496)
Significance of difference	$p<0.05$		$p>0.05$	

investigated the effects of music on the plasma levels of the stress hormones ACTH and cortisol in patients undergoing gastroscopy for various reasons, and showed the rise in the plasma levels of ACTH and cortisol to be significantly lower under the influence of music[5]. VanderArk and Ely examined biochemical and galvanic skin responses to music stimuli on biology and music students. Their data indicated that the cortisol levels and galvanic skin responses were significantly higher for music majors than the biology majors. They stated that music majors were listening more critically and analytically to music than biology majors, and cortisol levels were associated with this[6]. In a similar study, VanderArk and Ely found same results and concluded that music which elicits specific emotions induces physiological changes which may be beneficial to relaxation and behavioural therapies[7]. Recently, Acolet et al. assessed the biochemical and clinical response to massage in preterm infants and found a significant decrease in plasma cortisol levels after massage, but not in control infants. They concluded that it may be possible to detect an objective hormonal change following a supposedly 'non-therapeutic' intervention in preterm infants. They could not imply that massage was either beneficial or pleasurable for preterm infants[1].

In our study, we observed a significant increase in serum cortisol concentrations after the music session (in all cases expect one), contrary to our expectation at the beginning ($p<0.05$). It may not be pleasurable for preterm infants to play music in intensive care units. However, previous studies have shown that increases in cortisol were not always associated with behavioural distress in infants, and at times quiescence may be the behaviour associated with large elevations in cortisol[8].

It was interesting for us to observe lower cortisol levels in the first day with music session (median values: before music 87 nmol/L, after music 298 nmol/L) than the levels in the second day with control silent session (median values: before silent session 358 nmol/L, after silent session 303 nmol/L). It has been stated that, at least under certain conditions, the adrenocortical system of the infant appears to rapidly habituate or attenuate its response with repeated exposures to the same event[8]. However, in the early period of repeated exposures to the same painful event, as venipuncture, the infant may have increased response to the event before habituating it.

It appears that we need further studies to be able to decide whether playing music in neonatal care units is beneficial or not. These studies should evaluate greater number of infants in various clinical conditions at different loudness of music.

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