



Infant Development and Cortisol: Partial Evidence of a Dynamic System

Nahide Gungordu* Caroline Watson** and Maria Hernandez-Reif***

*College of Education **College of Arts & Sciences ***College of Human Environmental Sciences



Dynamic systems theory by Thelen and Smith (1997) proposes that development is interconnected at multiple levels and time periods, suggesting that individuals develop within systems (Miller, 2002). The current study uses a dynamic systems theory approach to study infants' developmental unfolding and the relation between stress and development. More specifically, the study examined changes in major domains of infant development and cortisol stress hormone levels every six months. Results showed that developmental domains were correlated over time except social-emotional development, and infants stress levels decrease over time. The findings provide support for normalization of cortisol and an emerging developmental system of domains in infancy, with the exception that social-emotional development is not well integrated into the system of infant development.

Participants

The participants (n=24) are typically developing infants, recruited at 8-months at a university childcare, and assessed at 8-, 14- and 20 months of age.



Method

At each 6-month assessment:

- 1) Researchers collected three early morning saliva samples; each sample was collected 20-minutes apart to assay cortisol levels.
- 2) The infants' teachers completed a developmental questionnaire (Developmental Profile-3) to examine physical, adaptive, cognitive, language, and social-emotional changes across infancy.

Data Analysis and Results

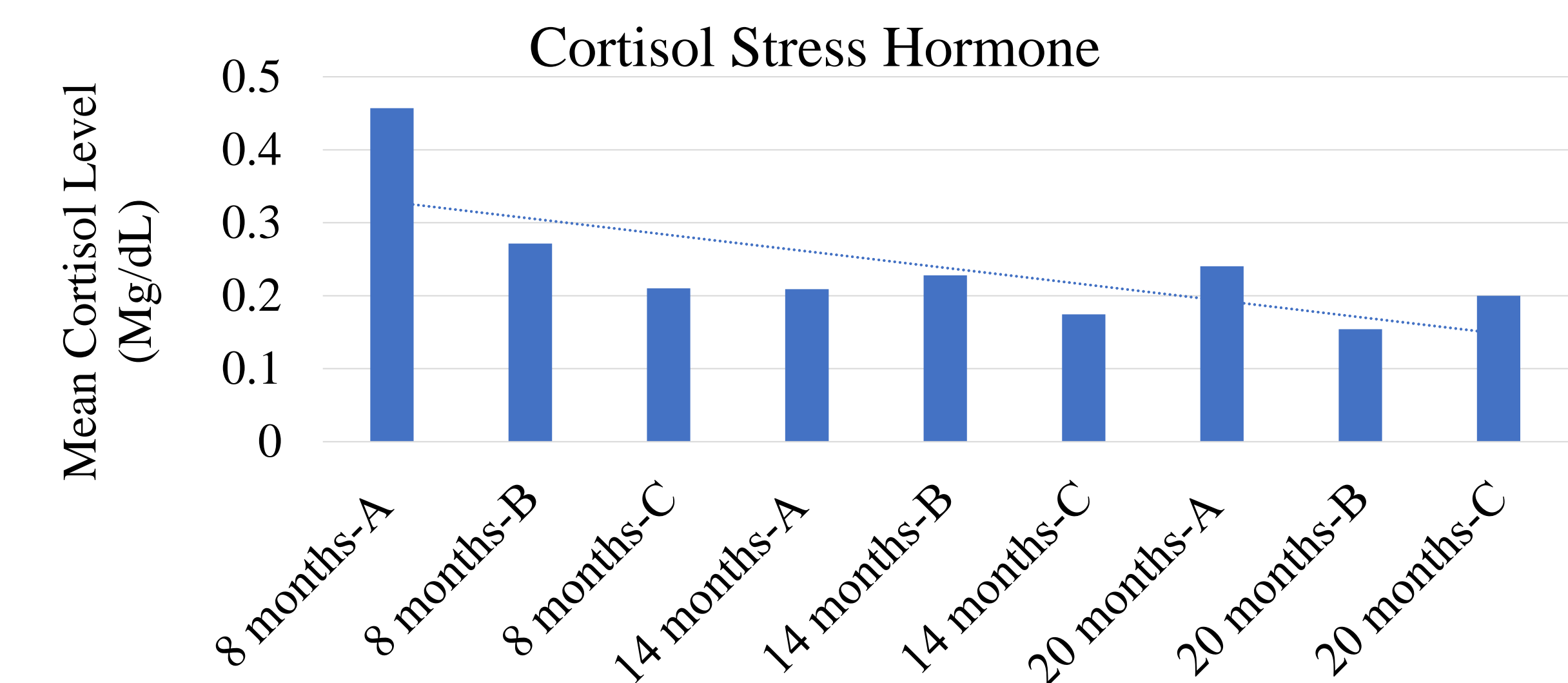
To address the research questions, Pearson product-moment correlations and descriptive statistics were computed. Results showed that

- 1) Infants' development at 8, 14, and 20 months were correlated across domains, except for social-emotional which was inconsistently related (See Table 1).
- 2) Cortisol decreased over time, $p < .05$ (See Figure 1).
- 3) 8-month cortisol did not correlate with 20-month developmental scores.

Table 1. Correlations of Developmental Profile Scores

		Correlations														
		T1					T2					T3				
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	
T1	1 Phy.	.707**	.616**	.690**	.861**	.805**	.676**	.737**	.783**	.728**	.550*	.680**	.659**	.742**	.642**	
	2 Adp.		.745**	.756**	.701**	.712**	.614**	.611**	.622**	.627**	.786**	.691**	.805**	.761**	.699**	
	3 SocEm.			.752**	.613**	.474*	.619**	.651**	.539*	.472*	.447	.431	.597*	.500	.444	
	4 Cog.				.730**	.606**	.579**	.650**	.673**	.768**	.551*	.583**	.721**	.744**	.652**	
	5 Com.					.740**	.667**	.710**	.723**	.758**	.599*	.728**	.693**	.820**	.778**	
T2	6 Phy.						.731**	.673**	.801**	.743**	.644**	.576*	.638**	.632**	.532**	
	7 Adp.							.868**	.794**	.772**	.428	.677**	.606*	.607*	.542*	
	8 SocEm.								.864**	.716**	.340	.515*	.509	.557*	.384	
	9 Cog.									.841**	.594*	.650**	.627*	.718**	.565*	
	10 Com.										.564*	.702**	.704**	.858**	.724**	
T3	11 Phy.											.748**	.812**	.754**	.721**	
	12 Adp.												.802**	.754**	.761**	
	13 SocEm.													.820**	.815**	
	14 Cog.														.830**	

Note. ** $p < 0.01$, * $p < 0.05$ Non-significant social-emotional scores are in bold
T:Time, Phy: Physical, Adp: Adaptive, SocEm: Social-Emotional, Cog: Cognitive, Com: Communication



Note. A=Time 1, B=Time 2, and C=Time 3

Figure 1. Children's cortisol levels over the 1st two years

Questions

- 1) How does infants' stress (cortisol levels) change over time?
- 2) Is there a relationship among developmental domains?
- 3) What is the relationship between children's stress levels and their developmental domains?

Hypotheses

- 1) The developmental domains would be correlated if they were part of a system.
- 2) Infants' cortisol levels would decrease over time suggesting a normalization of the HPA axis and based on previous studies (e.g., De Weerth & van Geert, 2002).
- 3) A negative correlation is expected between 8-month cortisol and 20-months developmental outcomes, if stress impacts children's development.



Discussion

We found that developmental domains were correlated over time, suggesting they operate as a system, except for the infants' social-emotional development. This exceptional finding requires further research to explore why the social-emotional domain appears to be outside the system of infants' overall development and what it predicts to in a larger sample. Previous studies report that infant cortisol levels decrease as they age (De Weerth & van Geert, 2002), and cortisol is negatively related to self-regulation (Gunnar & Donzella, 2002). Our cortisol analysis supported the literature suggesting that infants were typically developing and regulated. Elevated cortisol at 8-mo did not correlate with the 20-mo developmental domains, perhaps because of the small sample size.

References

De Weerth, C., & van Geert, P. (2002). A longitudinal study of basal cortisol in infants: Intra-individual variability, circadian rhythm and developmental trends. *Infant Behavior and Development*, 25(4), 375-398.
Miller, P. H. (2002). *Theories of developmental psychology*. Macmillan. New York, NY.
Thelen, E., & Smith, L. B. (1997). Dynamic systems theories. In R. M. Lerner (Series Ed.) & W. Damon (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (5th ed., pp. 563-634). New York: Wiley.