MATERNAL BLOOD PRESSURE AND HEART RATE VARIATION DURING INFANT FEEDING: A PHYSIOLOGIC APPROACH TO THE STUDY OF HUMAN INTERACTION

by

Lisa Jeanine Chickadonz, B.S.N.

A Thesis

Presented to
The Oregon Health Sciences University
School of Nursing
in partial fulfillment
of the requirements for the degree of
Master of Nursing

June, 1984

APPROVED:

[redacted]

Barbara J. Stewart, Ph.D., Professor, Thesis Advisor

[redacted]

Christine A. Tanner, R.N., Ph.D., Associate Professor, First Reader

[redacted]

Peg Shepherd, R.N., Instructor, Second Reader

[redacted]

Carol A. Lindeman, R.N., Ph.D., Dean, School of Nursing

This study was supported in part by traineeships NU00250-07 and NU00250-08 from the Division of Nursing, U.S. Department of Health and Human Services.

ACKNOWLEDGEMENTS

I wish to acknowledge the support and encouragement that has been invaluable in the completion of this work. My advisor, Dr. Barbara Stewart and the other members of my committee, Dr. Christine Tanner and Peg Shepherd, have been both nurturing and inspirational. Marie Beaudet has been a delight and lifeline in the new waters of computer technology.

I cannot count all the ways, directly and indirectly, my friends, teachers, colleagues, coworkers, and very loving family have contributed to the accomplishment of what has been my dream for many years.

This paper is respectfully dedicated to my mother.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

CHAPTER I

INTRODUCTION

This study was inspired by the work that has been done at the interface of physiology and psychology. It is now known that thoughts and emotions are electrical and biochemical processes and that there can be no anatomic or functional separation of the psyche from the physical body. As this internal relationship is unraveled, it is natural to explore relationships between people from a similar perspective. The question which formed a background for this study is: what is the physiologic dimension of the interaction between two persons?

The focus of this investigation was the physiologic aspects of maternal-infant interaction, specifically maternal blood pressure and heart rate changes during interaction. Infant feeding was chosen as the time for these measurements to be made because it is assumed to be a period of interaction between mother and infant, and in the case of breastfeeding, a part of that interaction is overtly physical. Blood pressure and heart rate were chosen as the physiologic variables for measurement because they have been shown to be responsive to interaction in a number of studies, (Innes, Millar, & Valentine, 1959; Lynch, Thomas, Long, Malinow, Chickadonz, & Katcher, 1980; Weiner, Singer, & Reiser, 1962; Williams, Kimball, & Willard, 1972), and because they may be affected by the release of hormones that occurs in response to breastfeeding (Jenkins & Perry, 1978; Biswas & Rodeck, 1976).

The significance of the current study comes from its relationship to other studies which are examining the phenomenon of human interaction. As a group, the goal of these studies is to achieve a greater understanding of human interaction, which is a lifelong process of overwhelming importance. This type of inquiry generates basic knowledge which is foundational to clinical practice.

From a nursing perspective, assessments about the quality and quantity of a client's interpersonal interactions are frequently made as part of a nursing diagnosis. Furthermore, the interaction between nurse and client is often a crucial component of nursing interventions. Another focus of nursing intervention is the facilitation of healthy and satisfying interaction between the client and her/his significant others. The greater the understanding of the human interaction process that can be attained, the more effective will be nurses' efforts to assist clients.

Problem Statement

The primary research question posed in this study was: What changes occur in a mother's blood pressure and heart rate as she feeds her infant?

The foundation for this inquiry was drawn from three areas of literature: hormonal control of lactation;

influence of lactational hormones on blood pressure; and cardiovascular responses to human interaction.

Hormonal Control of Lactation

Lactation is the secretion of milk in response to a complex set of physical, hormonal, and psychologic stimuli. The major hormones involved are prolactin and oxytocin. Prolactin is the hormone responsible for lactogenesis, the production of milk. It is released into the bloodstream from the anterior pituitary in response to stimulation from the hypothalamus and stimulates the synthesis of milk proteins and lactose. Baseline levels are determined by the presence of an inhibiting factor, probably dopamine (Tepperman, 1980).

In nursing mothers, baseline prolactin levels rise sharply in the first few days postpartum, and then gradually return to prepregnant or nearly prepregnant levels. The release of prolactin associated with feeding periods is dramatic in the early postpartum period and also gradually diminishes (Delvoye, Demaegd, Delogne-Desnoeck, & Robyn, 1977; McNeilly, Robinson, Houston, & Howie, 1983). Prolactin release in response to nursing is well documented, but the releasing factor from the hypothalamus to the pituitary is not known. The present understanding is that prolactin release is a simple neuroendocrine reflex, stimulated only by suckling (Noel, Suh, & Frantz, 1974; Tepperman, 1980). Prolactin levels rise gradually from the onset of suckling and reach peak levels in 30-40 minutes (Tyson, Hwang, Guyda, & Friesen, 1972; Noel et al., 1974).

Oxytocin is released from the posterior pituitary, also in response to hypothalamic stimulation, but the origin of that stimulus appears more complex. It has been demonstrated that oxytocin is released well before the onset of suckling in a given feeding period (Noel et al., 1974), and is responsible for the letdown of milk into the lactiferous sinuses so the infant can remove it by suckling. McNeilly et al. (1983) detected a rise in oxytocin levels in 10 of 10 mothers that occurred when their babies cried or were restless before feeding or when the mother was simply preparing for the feeding. This effect was more consistent in mothers who were later in the postpartum period, a finding which suggests a conditioned response. There was also a further rise in oxytocin levels during nursing, indicating that suckling acts as a stimulus as well, perhaps as the original unconditioned stimulus from which the "letdown" response is learned. Similar findings were reported in an earlier study which demonstrated temperature changes in the breasts of lactating women as they listened to a tape of an infant crying (Vourenkoski, Wasz-Hockert, Kiovisto, & Lind, 1969). It was also noted that many women experienced milk leaking during the cry stimulus.

In addition to its role in milk letdown, oxytocin causes rhythmic contractions of the myometrium, which helps prevent maternal hemorrhage in the early puerperium, (Borell, Fernstrom, Ohlson, & Wiquist, 1964).

From this overview of the actions of both prolactin and oxytocin, one can conclude that lactation is a psychophysiologic process which links the mother and infant.

Hormonal Influences on Blood Pressure

Prolactin has been the object of study in relation to essential and pregnancy induced hypertension, beginning with the observation that some hypertensive men and women had higher plasma levels of prolactin than normotensive controls (Stumpe, Kolloch, Higuchi, Kruck, & Vetter, 1977). This finding was refuted by Holland and Gomez-Sanchez (1977), who found the opposite. Similarly conflicting results have been obtained when plasma prolactin levels were measured in pregnant women with essential or pregnancy induced hypertension (PIH). Higher prolactin levels were found in women with PIH in Jenkins and Perry's 1978 study, in Biswas & Rodeck (1976), and in Redman, Bonnar, Beilin, and McNeilly's sample (1975), which was confounded by treatment with methyldopa and other drugs. Yuen, Cannon, Wooley, and Charles (1978) reported significantly lower plasma prolactin levels in both pregnant essential hypertensives and women with pregnancy induced hypertension, when compared with normal controls.

Using a different approach, Jenkins and Soltan (1980) studied a group of breast feeding and a group of bottle feeding mothers who were taking bromocryptine, (a prolactin inhibitor), for lactation suppression. Measuring on postpartum days 1, 3, 6, and 21, it was found that prolactin levels changed drastically in the early puerperium. Although the breast feeding group had sharply rising prolactin levels and the bottlefeeding group showed quick return to baseline levels, there was no corresponding blood pressure shift.

Despite this confusion, it is likely that a relationship exists between prolactin and blood pressure, perhaps mediated by dopamine. It has been shown that there are dopamine specific receptors in the renal, mesenteric, and celiac vascular beds, that can lower blood pressure by vasodilation (Goldberg, 1978; Woodruff, 1978). It is not known under what conditions dopamine has this effect, nor what the decreased dopamine inhibition of prolactin during lactation might mean to blood pressure regulation. "Prolactin may also affect blood pressure by (i) modulating smooth muscle responses to potent pressor agents [such as angiotensin] and (ii) effects on osmoregulation" (Yuen et al., 1978, p. 297).

The effects of oxytocin on the human vascular system have been extensively studied and are reviewed by Nakano (1973). Most investigations have focused on the effects of bolus intravenous injection of synthetic oxytocin postpartally for the prevention of uterine hemorrhage. Across most studies, a consistent response is seen including a decrease in cardiac output and blood pressure secondary to decreased peripheral resistance. This phenomenon is transient, followed by an increase in heart rate and stroke volume (Hendricks & Brenner, 1970; Nakano & Fisher, 1963; Secher, Arnsbo, & Wallin, 1978). Because oxytocin has an extremely short half-life, and due to the compensatory mechanisms at work, the vascular system stabilizes rapidly. In contrast, the continuous intravenous infusion of oxytocin at 20-80 mU/min has no cardiovascular effects (Caldeyro-Barcia, 1960; Secher et al., 1978).

The release of oxytocin immediately before and during breastfeeding was measured by McNeilly et al. (1983), who found maximum plasma concentrations of 11-59 ng/l in 10 normal postpartum women. In most of the women, oxytocin was released in a pulsatile fashion from the baby's first cry through the feeding, with the highest concentrations occurring before the onset of suckling.

The plasma oxytocin concentrations were not measured in Caldeyro-Barcia (1960) and Secher et al. (1978), but are roughly approximate to the naturally occurring levels in McNeilly et al. (1983). Because the natural secretion of oxytocin is pulsatile above a baseline that rises during the pre-feeding period and during nursing, it is difficult to speculate as to what cardiovascular responses might occur.

Cardiovascular Responses to Human Interaction

In an investigation of the physiologic component of emotion and interaction, Coleman, Greenblatt, and Solomon (1956) were able to show characteristic patterns of heart rate variation in association with differing affective states. In a series of 44 psychotherapeutic interviews, both the client and the therapist were measured on several physiologic variables, including heart rate. Results demonstrated that the patterns in the client's heart rate were mirrored by those of the therapist but with somewhat less intensity. Although this was a single case study, it was an important step in exploring interaction on a physiologic level.

Meares and Horvath (1974) used measures of maternal attentiveness and infant heart rate during breastfeeding and found that the more attentive mothers had infants whose pulses increased during feeding. In contrast, the infants of mothers who attended more to outside stimuli had more stable heart rates during feeding.

Similar studies of cardiac responses to interaction have been undertaken with animals by Lynch and his associates (Lynch, Thomas, Mills, Malinow, and Katcher, 1974). For example, one study showed an increase in heart rate, systolic blood pressure, and coronary blood flow in dogs at the approach of a human. Petting the dog however, produced a sometimes profound bradycardia in the animal accompanied by a 50 percent reduction in systolic blood pressure. This effect is central in origin, unrelated to movement, as evidenced by the elicitation of the effect in dogs paralyzed with curare. A similar effect can be seen in horses. Bradycardia and increased frequency of partial atrio-ventricular block with dropped beats occurred when the horses were petted by a human.

A number of other studies have looked at arrhythmias in patients in cardiac units (CCU), in response to interaction with nurses and family. An early case study by Thomas, Lynch, & Mills (1975) showed a significant increase in ectopic heart beats during clinical and social interactions ($p<.01$). Another report concerns three CCU patients who exhibited a variety of responses to interaction, including ectopic beats and significant heart rate changes (Lynch et al., 1974).

In a study of patients in a shock and trauma unit who were curarized and artificially ventilated, heart rate changes of up to 30 beats per minute were observed when a nurse held the patient's hand, palpated the pulse, checked the I.V., spoke to the patient, and other actions (Lynch, Flaherty, Emrich, Mills, & Katcher, 1974). The patients were severely injured but were not demonstrating cardiac pathology. Their responses included abrupt increases and decreases in heart rate, as well as the occurrence of ectopic beats. A visit by seven doctors doing rounds was associated with an abrupt increase in heart rate in one patient to almost the same rate as was later associated with tracheal suctioning by the physician.

Several studies have investigated blood pressure responses during interview situations. Innes et al. (1959) demonstrated a parallel response curve of blood pressure and pulse in 40 healthy women during interviews at six days postpartum. The interview content was a family, personal, and health history done in a fairly unstructured format. Results demonstrated that the pulses and blood pressures of the mothers rose initially and gradually returned to baseline after the conclusion of the interview. The diastolic pressure was more reactive, and the effect was greater with increased verbal output. Weiner et al. (1962) studied 45 healthy young men and women and found an increase in blood pressure during interviews. The effect was more a function of the act of speech than of its content, although varying the content had an additional effect. This was studied further by Williams et al. (1972) in a group of eight healthy subjects whose diastolic blood pressures were more reactive during the interview than systolic pressures. In this study, measures were repeated to eliminate novelty of stimulus as a factor. In Lynch et al. (1980), small groups of students were studied under several conditions. In one group, blood pressure and heart rate were measured while the students were giving a speech and demonstrated significant rapid increases during the speech and abrupt decreases at the conclusion of speaking. Another group was measured during a one-on-one interview. Blood pressure and heart rate were again significantly elevated from the resting baselines (*p*<.01). In the third experiment, subjects read aloud, rested, were interviewed, and had their pulses palpated in varying sequences. Results again showed blood pressure and pulse rises that were more related to the act of speaking than the content of speech. In each quiet period the measures returned immediately to baseline. Heart rate, however, was lower during pulse palpation than all other resting periods (*p*<.001).

Conceptual Framework

From the review of literature it is apparent that a relationship exists between human interaction and the physiologic variables of blood pressure and pulse. Lactational hormones of prolactin and oxytocin may also affect blood pressure. If a pattern of blood pressure and heart rate response emerges in this study, it will most likely be a result of some combination of variables.

Maternal characteristics include levels of prolactin and oxytocin circulating during the measurement period, and the dependent variables of heart rate and systolic and diastolic blood pressure. Variables occurring just prior to and during infant feeding include the mother's readiness to feed (in response to crying or other cues from the infant), which triggers release of oxytocin; suckling, which further raises oxytocin levels and stimulates prolactin release; the mother's speech during the measurement period; and close physical contact between mother and infant that occurs during breasfeeding. Extraneous variables include maternal movements and interruptions during the feeding. The dependent variables of blood pressure and heart rate may be affected by changing hormone levels during the feeding period, by interaction with the infant, or by extraneous variables. Although it is assumed that hormone levels could affect blood pressure, this study will not examine those levels directly.

This study is intended to serve a descriptive purpose. It is hoped that the findings may be used to generate hypotheses. The primary research question was: What changes occur in a mother's blood pressure and heart rate as she feeds her infant? If a pattern of blood pressure or heart rate change emerges, the following statements would be possible explanations suggested by the literature for that phenomenon.

1. The pattern of change in blood pressure and heart rate in mothers during breastfeeding is a function of prolactin and/or oxytocin release.

2. The pattern of change is a function of mother-infant interaction (e. g., crying, speaking, touch).

3. If the physiologic measures vary separately, e.g. diastolic blood pressure showing a greater change over time than other variables, it could mean that the measures

(systole, diastole, heart rate) differ in their sensitivity to one or more of the previous conditions.

CHAPTER II

METHODS

The purpose of this study was to use a physiologic approach to explore human interaction. The study was a repeated measures assessment of maternal blood pressure and heart rate during infant feeding. All subjects were normal postpartum women. Two groups of mothers were originally targeted for study, women who elected to breastfeed their infants, and those who chose to bottle feed. At the time data were collected, very few women in the hospitals involved in the study were electing to bottle feed. Not enough bottle feeding mothers without medical complications could be identified. The study design was therefore changed to be a single group of breastfeeding mothers. Both primiparous and multiparous women are included due to the exploratory, descriptive nature of this study.

Design

The independent variable in this study is a series of time intervals before, during, and after nursing, which were selected for study. The dependent variables used to represent the mothers' physiologic status during infant feeding are blood pressure and heart rate.

Blood pressure and heart rate were measured by an automated manometer. This provided several benefits: reduction of measurement error from observer bias (Thompson, 1981); freedom of the mother to vocalize freely with her infant during the feeding; and minimization of the effects of the researcher's presence on the mother and infant.

In this study, each subject served as her own control. Since the focus was on changes in the physiologic variables rather than absolute values, it was not necessary to control for circadian rhythms, which affect blood pressure (Millar-Craig, Bishop, & Raftery, 1978), or the range in which the values fall.

Sample

The sample consisted of ten women on the postpartum units of two local hospitals. A convenience sample of women meeting the following criteria were invited to participate, with no mothers refusing.

*vaginal delivery

*infant 37-42 weeks gestation

*infant not admitted to medium or high risk nurseries

*blood loss at delivery less than or equal to 500cc by delivery room estimate

*absence of postpartum bleeding disorders

*absence of significant maternal disease, including hypertension

*absence of current, diagnosed psychiatric illness

*mother to retain custody of the infant

*infant fed at least once previously by mother *maternal blood pressure between 90/60 and 140/90 at initial study measurement

All measurements were made between 24-72 hours postpartum, which excluded those patients electing early discharge. This decision was made to allow the major postpartum fluid shift to occur prior to the study measurements.

The sample consisted of ten Caucasian women aged 15 to 30, (M = 24.2, SD = 4.7). Three women had just delivered their first baby, and the remaining seven had delivered their second baby. Only one mother had a previous pre-term infant, and three had at least one previous miscarriage or therapeutic abortion. Of the seven multiparae, all had breastfed their firstborn children, and all the mothers in the sample were beastfeeding this time. The babies in this study were all full term and healthy, weighing 3240 to 4620 grams at birth. The mothers and infants met all the other inclusion criteria for the study.

Blood Pressure Measurement

Thompson (1981), in a thorough review of blood pressure measurement studies, identified many potential sources of error. The use of the automated sphygmomanometer eliminates most of these, most particularly observer bias, and varying end point criteria for diastolic blood pressure, since the reading is made with the use of oscillometry rather than ascultation by the researcher. Other problems include selection of the appropriate cuff width and controlling for physical activity level. The position of the healthy, non-pregnant individual (e.g. supine, sitting) does not affect the value obtained, but the arm must be at heart level and supported (Mitchell, Parlin, & Blackburn, 1964; Thompson, 1981).

A major limitation exists in the traditional method of blood pressure measurement by mercury manometer, in that the patient must remain silent during measurement to facilitate ascultation. Using the automated manometer, Lynch et al. (1980) demonstrated dramatic rises in blood pressure during and after speech which, along with their exhaustive review of literature, supported the idea that social interaction has physiologic implications.

Instruments

Blood pressure and heart rate were measured using an Invivo Omega 1000 automated sphygmomanometer. This instrument measures systolic, diastolic,and mean arterial pressure, as well as heart rate. In tests comparing this monitor with intra-arterial monitoring, the Omega 1000 measured within + or - 4mm Hg for both systolic and diastolic pressures, and was accurate within 2 percent of the actual heart rate (Invivo, 1984). The standard sized cuff proved appropriate for all the mothers and was used exclusively.

Demographic data were collected on a tool designed for that purpose (see Appendix A). All demographic data were collected from the mothers' charts, with the exception of a question about whether they had breast or bottle fed a previous infant, (when applicable), which was obtained by the mothers' report. This variable could affect the mother's comfort with her current feeding method, and thus her anxiety level during the feeding. Demographic variables assessed include age, parity, race, and infant birth weight.

An additional tool was designed for use in recording the activities of the mother and infant as well as any miscellaneous stimuli which occurred during the data collection period (see Appendix B). The tool was designed so that notations could be made continuously during the data collection period, and analyzed in relation to the timing of physiologic measurements.

Setting

Because the focus of this study concerns a normal process in a healthy population, a naturalistic setting was preferable to the laboratory, in which the interaction between mother and infant could be significantly affected. In this study, all measurements were made during regular feeding periods in the mothers' hospital rooms. The drawbacks of this choice were the inevitable interruptions and unintended stimuli in the mothers' rooms, and attempts were made to minimize these problems.

Procedure

After determining by a review of the chart that a patient met the criteria for inclusion in the study, the patient was approached by the researcher with a request to participate and an explanation of the data collection procedure. A more detailed explanation of this procedure appears in Appendix C. If she agreed to participate, a consent form was signed (see Appendix D). The mother's blood pressure was then taken using the study instrument to familiarize her with the procedure, and to obtain a baseline blood pressure unrelated to infant feeding. If that measurement fell within the study limits, (90/60-140/90), the patient was notified of her inclusion and arrangements made regarding which feeding period would be used for data collection.

The infant feeding method was by patient choice, made prior to inclusion in the study. Infants were fed on demand to maximize the success of the feeding period. Mothers were asked to hold their babies in the same position throughout the feeding to minimize maternal movement. This proved impossible for most of the mothers, although their movements were generally minor adjustments. Measurements were made with the mother in her bed, following her usual feeding procedure as closely as possible. Because feeding instruction is usually given prior to twenty-four hours postpartum, the session did not include assistance with feeding from the nurse.

Each mother was asked to notify the researcher when her infant seemed ready to eat. The sphygmomanometer was connected to the mother, whose arm was supported with pillows at heart level. A measurement was made just prior to the initiation of feeding. A series of measurements followed at 1, 3, 5, 7 and 9 minutes after the initial measurement. Final measurements were made at 3 and 5 minutes after the infant finished sucking, but with the mother still holding the infant. The measurements were initiated manually, using a stopwatch to increase the accuracy of the intervals between measures. Notes were made continuously during the first ten minutes of the feeding period and during the post-feeding period on the activities of both the mother and infant, such as crying, sleeping, and speaking.

Interaction with the researcher was kept to a minimum during the measurement period to avoid the possible effects on maternal physiology from that source. Inevitably, the feeding was affected by the presence of the researcher and the instrument, but all attempts to keep the setting as normal as possible were made in order to protect the subjects from undue stress during the study period.

CHAPTER III

RESULTS

The collected data were entered on the Harris computer and analyzed using the Statistical Package for the Social Sciences (SPSS) software (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975).

Maternal Activity During Nursing

Use of the observational tool (Appendix B) generated support for the study's assumption that breastfeeding is an interaction process between mother and infant. By totalling the activities of the ten mothers during eight measurement periods, it was found that mothers spoke during 44 of the 80 observed periods. The actual number of times each woman spoke could not be recorded, but the total number of periods during which they spoke ranged from two to six ($M = 4.4$). On the average, then, mothers spoke during more than half the observed periods. The number of women who spoke one or more times during each measurement interval is presented in Table 1. Most of the speaking clustered at pre- and post-feeding. Almost all of the observed speech was directed at the infants.

No attempts were made to measure non-verbal interaction, but a variety of behaviors, including various kinds of touching and eye contact, occurred during the feedings.

Table 1

Incidence of Maternal and Infant Activity During Measurement Intervals

Activity	Pre-		During Feeding				Post-	
	Time 1	T2	T3	T4	T5	T6	T7	T8
No. of mothers speaking during interval	9	5	2	3	5	4	8	8
No. of mothers repositioning infant	8	4	1	1	0	1	8	2
No. of infants crying	7	1	0	0	0	0	1	2
No. of infants resting	4	0	0	5	1	2	9	8

Note. number of cases = 10, number of intervals = 8.

Although mothers were discouraged from moving during the measurement period, repositioning occurred in 25 of the measurement periods, clustered at the beginning of the feeding and from the cessation of nursing to the post-feeding measurements (see Table 1).

Infant Activity During Nursing

During the pre-feeding measurement, six babies were crying. Three others were quiet and/or making sucking movements with their mouths. One baby did both. Once nursing began, only one baby cried once. There were only eight periods of resting out of fifty observations made during the actual nursing periods. Most of the babies rested post-feeding although there were brief crying incidences. The behavior during each interval is reported in Table 1. Although observations were not recorded after the first ten minutes of nursing, it was noted that many more rest periods occurred later in the feedings, until often the infants fell asleep and the feeding ended.

Physiologic Variables

Initial analysis was done using the SPSS program to calculate the mean and standard deviation for each variable at each time measured. Those statistics appear in Table 2. In addition, when the mothers were recruited, heart rate and systolic and diastolic blood pressure were measured once; the means were 91.4, 127.4, and 77.1 respectively.

Table 2

Means and Standard Deviations of Physiologic Variables Over Time

Variable		Pre-	During Feeding				Post-			Grand Mean
		Time 1	T2	T3	T4	T5	T6	T7	T8	
Systolic B.P.	*M*	129.56	129.80	123.90	126.40	122.60	120.90	125.40	123.70	125.28
	(*SD*)	10.99	14.16	9.85	16.99	14.26	8.85	12.09	8.42	
Diastolic B.P.	*M*	75.78	76.00	74.50	72.90	73.50	71.50	73.10	73.30	73.82
	(*SD*)	10.30	8.35	11.29	12.60	7.15	5.82	5.26	7.50	
Heart Rate	*M*	88.89	89.90	89.60	89.40	89.50	89.70	91.20	90.50	89.84
	(*SD*)	9.70	12.73	13.08	12.36	11.60	13.50	12.62	10.75	

Note. number of cases = 10, number of intervals = 8.

Systolic Blood Pressure

A one-group, repeated measures analysis of variance (ANOVA) was done using the SPSS reliability program. The results are reported in Table 3. There is a significant difference in mean systolic blood pressures across the eight measurement occasions ($F(7,63) = 2.728$, $p = .015$).

To test differences between pairs of means, a Newman-Keuls procedure was done by arranging the means in rank order and testing them in stair-step fashion. The results are reported in Table 4. Significant differences occurred between the mean systolic blood pressure at Time 6 and that at Time 1 and Time 2. Specifically, the mean systolic blood pressure at Time 6 (M = 120.9 mmHg) was significantly lower ($p<.05$) than the mean systolic blood pressure at Time 1 (M = 129.6 mmHg) and at Time 2 (M = 129.8 mmHg).

Pearson correlation and Kendall's Tau values are reported in Table 5 to represent the stability of systolic blood pressure over time for each of the possible pairs of time periods. Systolic blood pressure is correlated over time at the $p<.01$ level of significance for most pairs of time periods with very few correlations not reaching $p<.05$. The Pearson correlations ranged from .427 to .924 with a median value of .816.

A graph representing the pattern of variation across measurement intervals (see Figure 1) shows the downward trend of the means during the nursing period, and the rise which follows the cessation of nursing.

Table 3

ANOVA Summary Table for Systolic Blood Pressure

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Probability
Between People	8518.944	9	946.549		
Within People	3014.454	70	43.449		
Time	707.475	7	101.068	2.728	0.015
Residual	2333.978	63	37.047		

Note. Number of cases = 10, number of intervals = 8.

Table 4

Comparison of Pairs of Means for Systolic Blood Pressure Using the Newman-Keuls Procedure

	Time 6	T5	T8	T3	T7	T4	T1	T2		q(.05)	Critical Difference
M:	120.9	122.6	123.7	123.9	125.4	126.4	129.6	129.8	Number of steps (r)	for r and 63df	α = .05
T6		1.7	2.8	3.0	4.5	5.5	8.7*	8.9*	8	4.44	8.6
T5			1.1	1.3	2.8	3.8	7.0	7.2	7	4.31	8.3
T8				0.2	1.7	2.7	5.9	6.1	6	4.16	8.0
T3					1.5	2.5	5.7	5.9	5	3.98	7.7
T7						1.0	4.2	4.4	4	3.74	7.2
T4							3.2	3.4	3	3.40	6.6
T1								0.2	2	2.83	5.5
T2											

Note. Number of cases = 10, number of intervals = 8.
$^*p < .05$.

Table 5

Correlational Stability of Repeated Measures of Systolic Blood Pressure

	S1	S2	S3	S4	S5	S6	S7	S8
S1		0.627*	0.699*	0.828**	0.593*	0.608*	0.427	0.889**
S2	0.600**		0.906**	0.924**	0.908**	0.831**	0.858**	0.782**
S3	0.614**	0.796**		0.889**	0.745**	0.736**	0.704*	0.790**
S4	0.674**	0.809**	0.690**		0.912**	0.832**	0.816**	0.903**
S5	0.467*	0.689**	0.568*	0.809**		0.912**	0.924**	0.777**
S6	0.387	0.614**	0.581*	0.644**	0.796**		0.828**	0.817**
S7	0.333	0.556*	0.432*	0.629**	0.779**	0.750**		0.601*
S8	0.705**	0.704**	0.605**	0.828**	0.659**	0.674**	0.523*	

Note. Pearson correlation above diagonal, Kendall's Tau below diagonal.
Number of cases = 10, number of intervals = 8.
$^{*}p < .05$. $^{**}p < .01$.

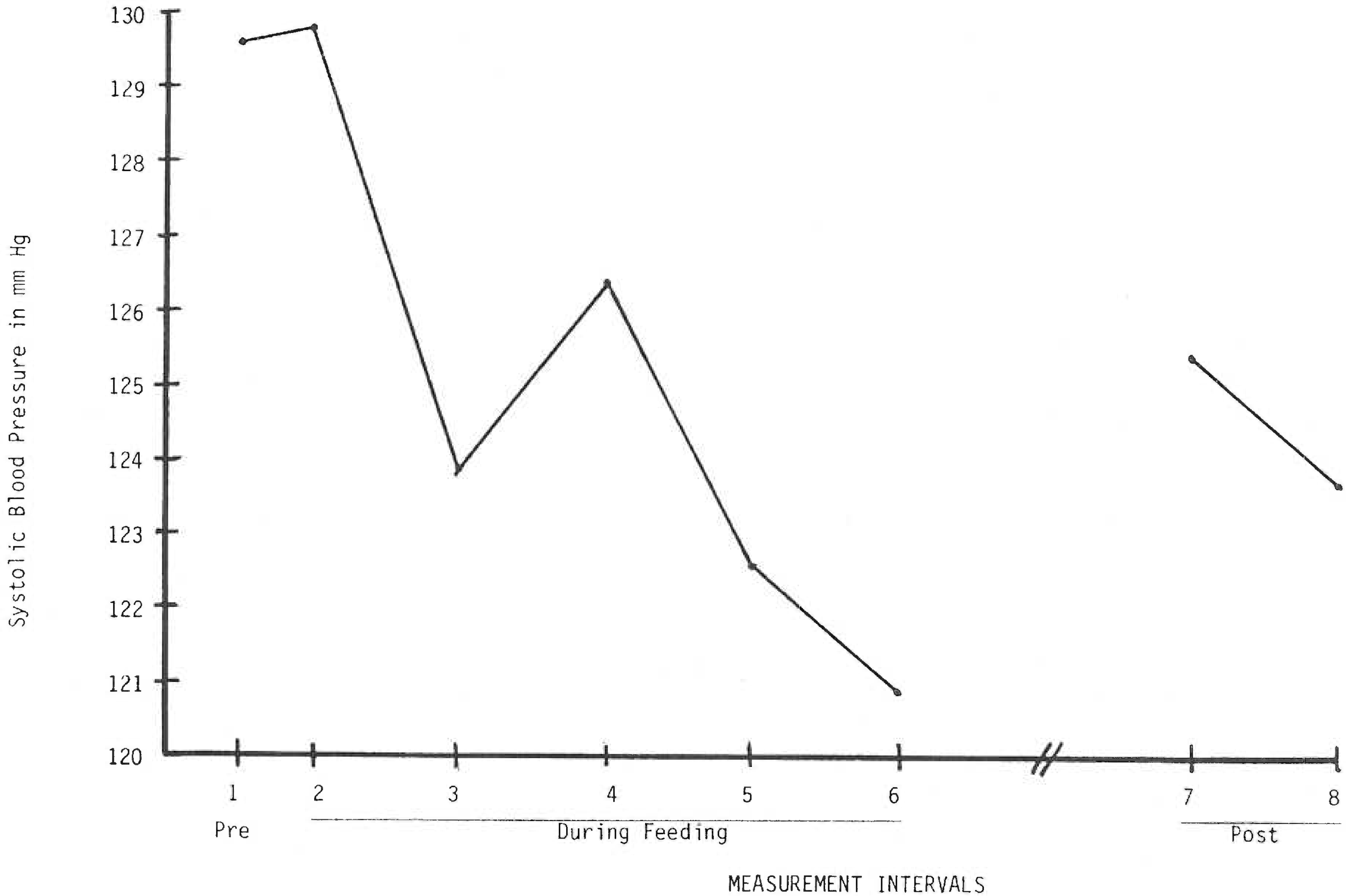

Figure 1. Systolic blood pressure; group mean over time.

Diastolic Blood Pressure

A summary of the repeated measures ANOVA for diastolic blood pressure appears in Table 6. There are no significant differences between the measures as evidenced by $F(7, 63) = 1.142$, $p = .349$.

Pearson correlation and Kendall's Tau values are reported in Table 7 to represent the stability of diastolic blood pressure over time. Diastolic blood pressure is correlated over time at the $p<.01$ level of significance for most pairs of time periods. Only two correlations did not reach the $p<.01$ level but were significant at the $p<.05$ level.

The Pearson correlations ranged from .558 to .958 with a median of .809. Pearson correlations between systolic and diastolic blood pressure at each time period ranged from .338 to .922 with a median of .689.

The mean diastolic blood pressures over time are plotted in Figure 2, which has a similar character to Figure 1, but less variation among means. No further analyses were done.

Heart Rate

Variation in heart rate was analyzed with the same procedure as systolic and diastolic blood pressure. The results appear in Table 8. Heart rate proved most stable of all the measurements over time, ($F(7,63) = 0.351$, $p = 0.927$).

Table 6

ANOVA Summary Table for Diastolic Blood Pressure

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Probability
Between People	4404.315	9	489.368		
Within People	1436.318	70	20.519		
Time	161.677	7	23.097	1.142	0.349
Residual	1274.641	63	20.232		

Note. Number of cases = 10, number of intervals = 8.

Table 7

Correlational Stability of Repeated Measures of Diastolic Blood Pressure

	D1	D2	D3	D4	D5	D6	D7	D8
D1		0.869**	0.794**	0.758**	0.558*	0.826**	0.899**	0.870**
D2	0.494*		0.839**	0.876**	0.651*	0.846**	0.883**	0.910**
D3	0.477*	0.552*		0.913**	0.824**	0.763**	0.714**	0.958**
D4	0.511*	0.719**	0.568*		0.880**	0.785**	0.710**	0.904**
D5	0.289	0.360	0.568*	0.600**		0.778**	0.769**	0.784**
D6	0.552*	0.558*	0.612**	0.552*	0.690**		0.757**	0.867**
D7	0.494*	0.386	0.184	0.360	0.225	0.486*		0.763**
D8	0.494*	0.659**	0.828**	0.674**	0.584**	0.628**	0.159	

Note. Pearson correlation above diagonal, Kendall's Tau below diagonal.
Number of cases = 10, number of intervals = 8.
$^{*}p < .05$. $^{**}p < .01$.

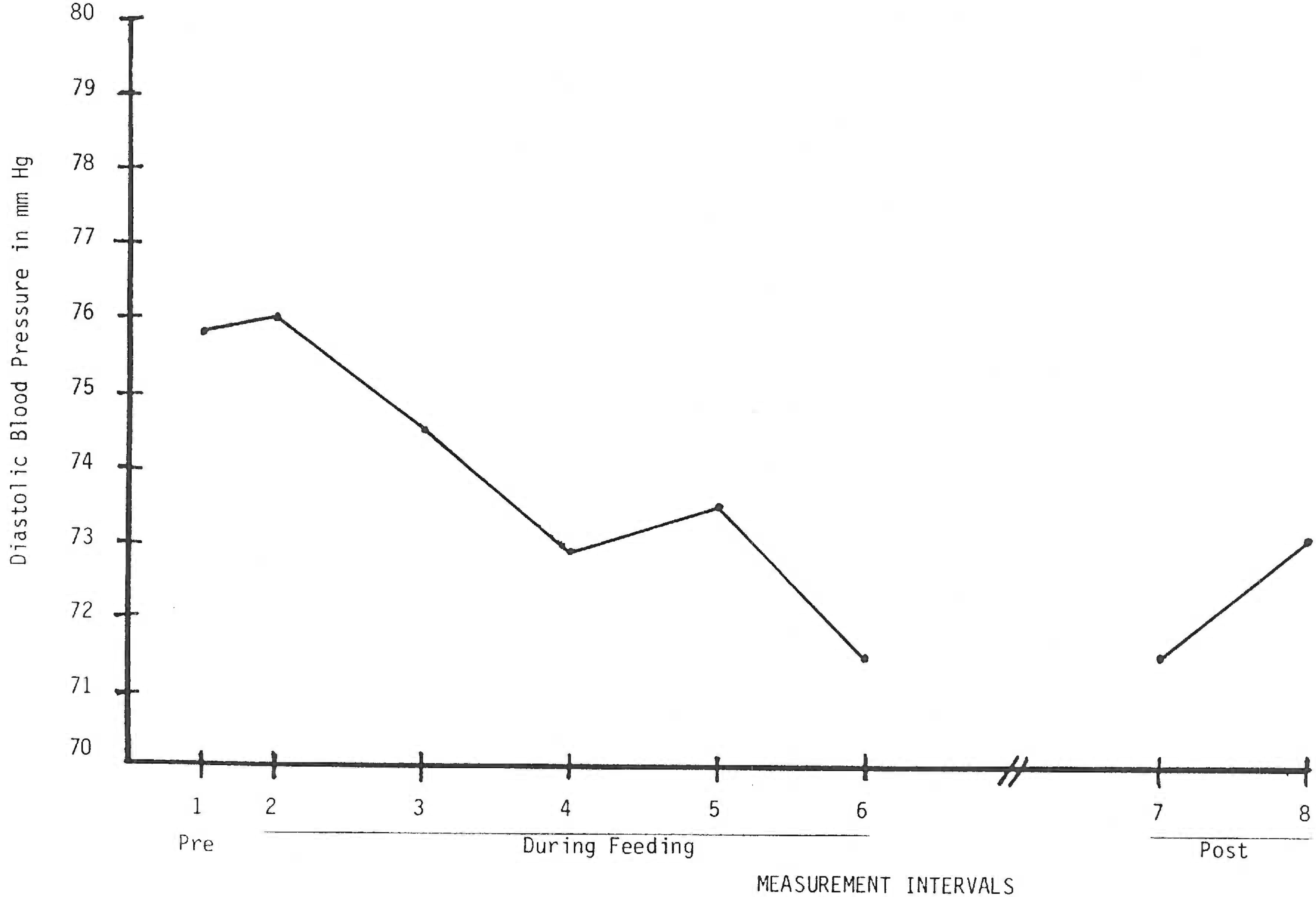

Figure 2. Diastolic blood pressure; group mean over time.

Table 8

ANOVA Summary Table for Heart Rate

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Probability
Between People	9626.232	9	1069.581		
Within People	954.854	70	13.641		
Time	35.797	7	5.114	0.351	0.927
Residual	919.057	63	14.588		

Note. Number of cases = 10, number of intervals = 8.

Pearson correlation and Kendall's Tau values for heart rate between pairs of time intervals were very high, with only three values failing to reach the $p<.01$ level of significance (see Table 9). The Pearson correlations ranged from .623 to .995 with a median value of .935.

A graph of mean values for heart rate over time appears in Figure 3. No further analyses were done.

Pearson correlations between heart rate and systolic blood pressure ranged from -.346 to .356 with a median of -.153. Pearson correlations between diastolic blood pressure and heart rate ranged from -.360 to .360 with a median of -.076.

Table 9

Correlational Stability of Repeated Measures of Heart Rate

	HR1	HR2	HR3	HR4	HR5	HR6	HR7	HR8
HR1		0.841**	0.783**	0.742**	0.677*	0.701*	0.623*	0.828**
HR2	0.764**		0.934**	0.935**	0.896**	0.915**	0.851**	0.912**
HR3	0.705**	0.854**		0.993**	0.979**	0.990**	0.962**	0.979**
HR4	0.614**	0.764**	0.886**		0.986**	0.995**	0.974**	0.968**
HR5	0.628**	0.782**	0.931**	0.907**		0.990**	0.970**	0.956**
HR6	0.659**	0.861**	0.942**	0.965**	0.940**		0.981**	0.963**
HR7	0.598**	0.796**	0.874**	0.920**	0.965**	0.953**		0.920**
HR8	0.659**	0.809**	0.841**	0.932**	0.907**	0.918**	0.920**	

Note. Pearson correlation above diagonal, Kendall's Tau below diagonal.
Number of cases = 10, number of intervals = 8.
$^{*}p < .05$. $^{**}p < .01$.

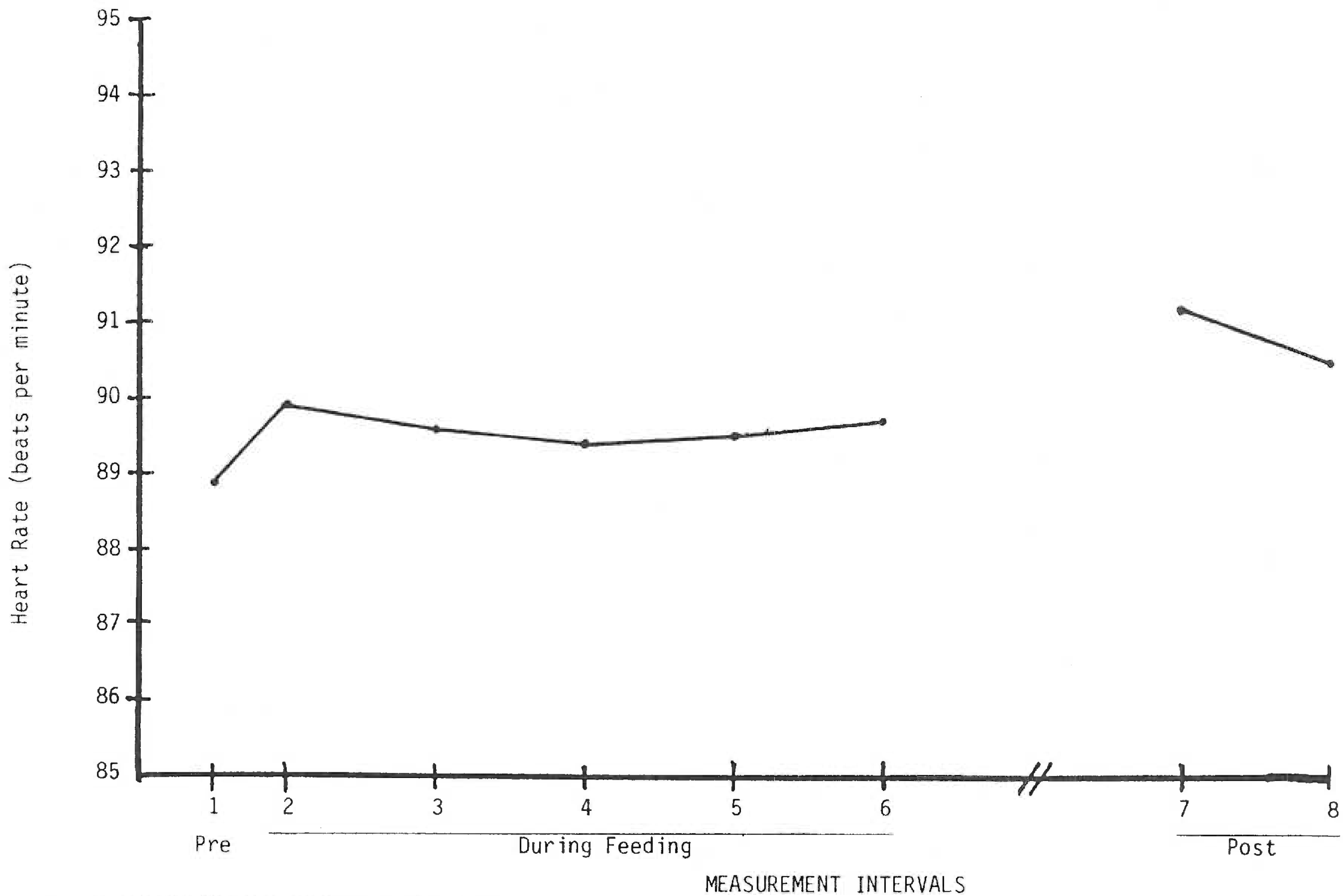

Figure 3. Heart rate; group mean over time.

CHAPTER IV

DISCUSSION

The results of this exploratory study regarding changes in blood pressure and heart rate during infant feeding suggest that the systolic blood pressure of breast feeding mothers declines during the feeding period although heart rate remains remarkably stable. Although the decline in diastolic blood pressure was not statistically significant, the pattern of decline is similar to that of the systolic pressure. The following discussion addresses the meaning of these finding and presents alternative explanations for their occurrence.

There are several possible reasons for the drop in systolic blood pressure during nursing. One is that the blood pressure at Time 1 was elevated due to anticipation of feeding, infant crying, or positioning the baby. All three of these factors occurred at Time 1, and yet the Time 1 systolic blood pressure was not significantly different from the baseline systolic measurement taken to determine eligibility for the study ($\underline{M}$ = 127.4).

The consistently decreasing blood pressure is very different from the pattern of oxytocin release which, if it had any effect on blood pressure, would likely begin the decrease before feeding began and produce a rising and falling blood pressure in response to its pulsatile secretion.

It is also unlikely that the falling blood pressure is due to prolactin secretion alone since in McNeilly et al., prolactin secretion began 1-4 minutes after the onset of suckling and continued to rise after the cessation of nursing. If it were lowering blood pressure, the measurements at Time 7 and 8 should be even lower than Time 6, unless other factors such as increased maternal movement and speech were involved in the post-nursing period. If rising prolactin levels caused blood pressure to rise as well, that could account for the rising blood pressure at Times 7 and 8, but not for the initial fall.

The incidence of maternal speech during each interval follows a curve similar to that of mean systolic blood pressure (see Figure 4), the most speech occurring with the highest blood pressures. This is not unlike the results of other interaction studies, in which blood pressure rises were associated with speech. The difference is that systolic blood pressure showed greater variation than diastolic, and that heart rate did not follow a similar pattern of response.

The incidence of maternal movement also parallels the blood pressure curve and could thus be a factor in the higher pressures pre- and post-feeding (Figure 5). The incongruity is again the absence of variation in heart rate which is expected to occur with movement.

The direction of blood pressure change is the same as in interaction studies using touch rather than speech as the

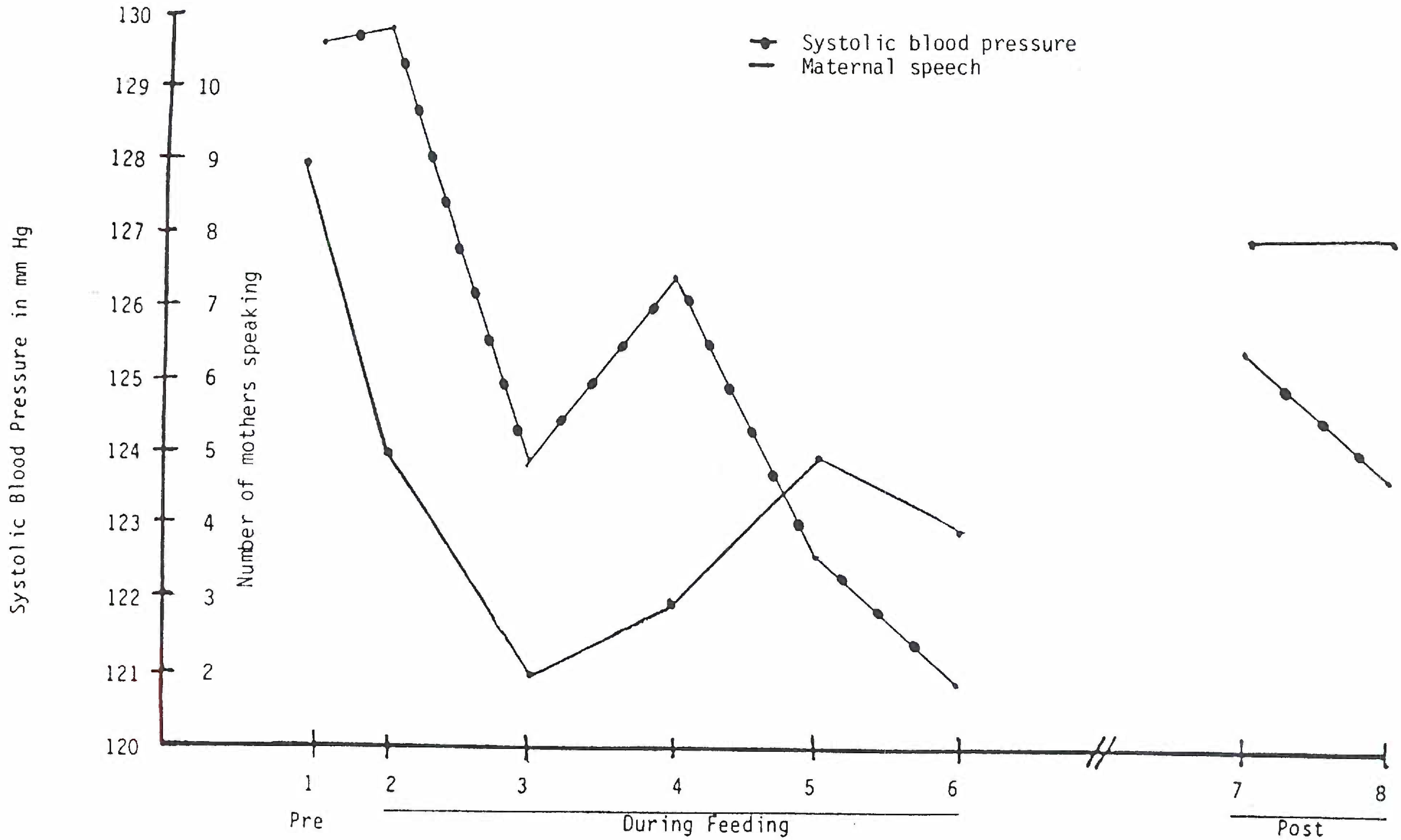

Figure 4. Systolic blood pressure and incidence of maternal speech; group mean over time.

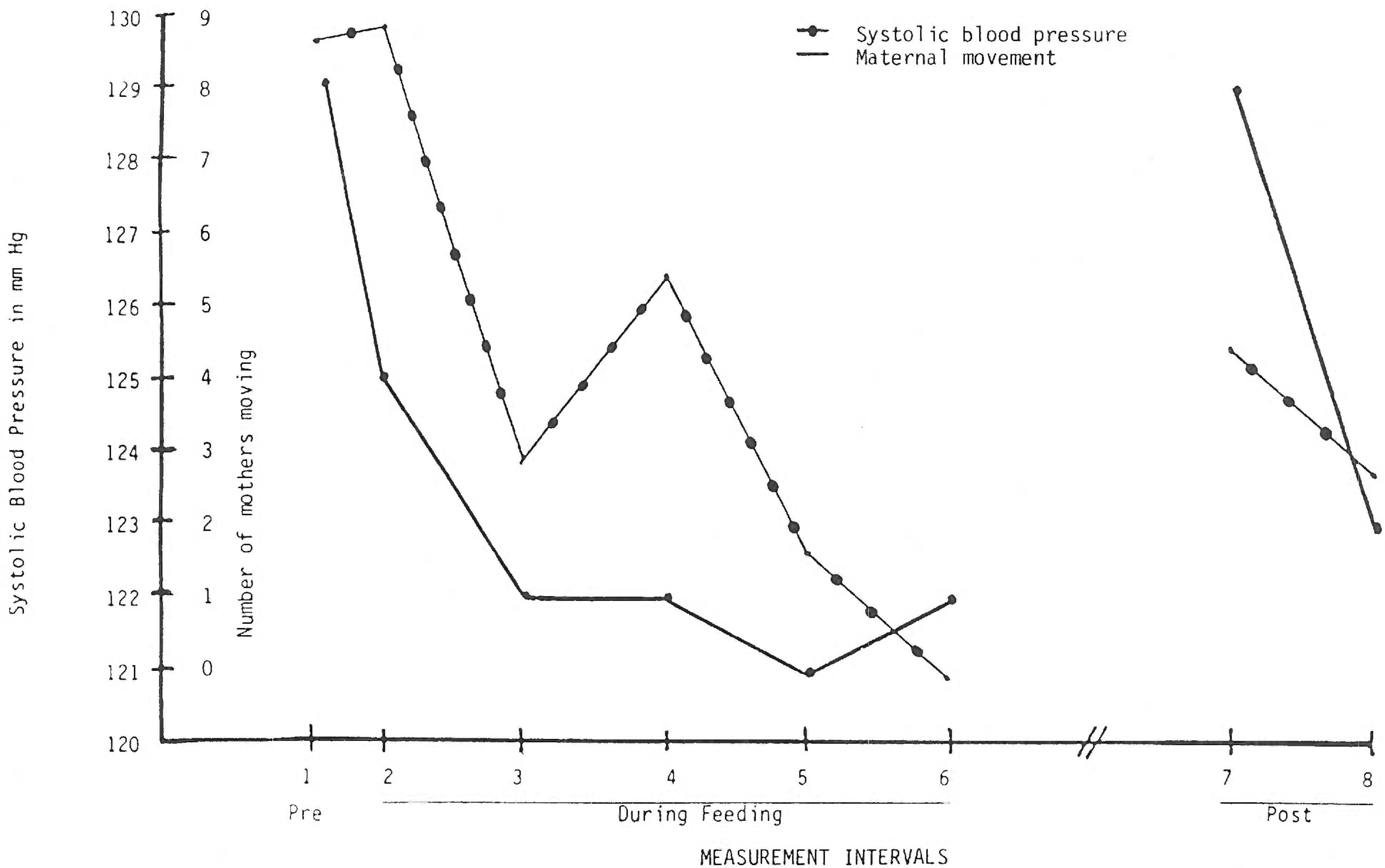

Figure 5. Systolic blood pressure and incidence of maternal movement; group mean over time.

independent variable. It is possible that the incidence of maternal speech and movement in the pre- and post-feeding periods obscures the effects of the physical contact between mother and infant. During the actual nursing periods speech and movement are decreased, perhaps allowing touch to have a greater influence on maternal physiology. Most of the mothers volunteered that they felt relaxed during the feeding and no one expressed surprise that their blood pressure had decreased.

Most of the cases, when examined individually, followed a similar pattern as that seen in Figure 1, with the systolic pressure falling fairly consistently throughout nursing. Because the systolic mean at Time 4 rises, individual cases were examined for increases and decreases between Time 3 and Time 4, and the activities preceding the Time 4 measurement. In the six cases where blood pressure rose, four had resting babies, while only one of the falling group had a resting baby.

Cell sizes are too small for statistical analysis on maternal and infant activities during the actual nursing period, but in summary, thirty of the fifty measurement intervals involved falling pressures. Those observation periods had less infant resting and maternal position changes than in the intervals where pressures rose. There was only a slight difference in maternal speech and no difference in interruptions. It may be that the mothers whose infants were resting felt anxious about the baby not nursing well and this caused a rise in blood pressure. All three of the mothers whose systolic blood pressure fell during rest periods had breastfed another child; of the five whose systolic pressure rose during rest periods, two had previously breastfed another child and three had not. Therefore parity may be an important factor.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study is to examine the relationship between maternal-infant interaction and maternal physiology during breastfeeding. The study describes a pattern of physiologic response in women in the early postpartum period as they breastfeed their babies. It also describes behaviors exhibited by the mothers and infants during nursing.

The current investigation is conceptually related to other studies which examine physiologic responses to human interaction. It also draws on our understanding of the physiology of human lactation and the cardiovascular effects of lactational hormones (prolactin and oxytocin).

The major finding in this study is that systolic blood pressure drops significantly during breastfeeding periods. Diastolic blood pressure follows a similar pattern to a lesser degree. Heart rate shows little variation over the same period, which is somewhat surprising, given that it generally varies with blood pressure.

Direct observations were made of maternal and infant behaviors during nursing which support the assumption that interaction occurs during breastfeeding.

A number of hypotheses can be advanced to explain these findings. One is the possible cardiovascular effects of prolactin and/or oxytocin. Because the study did not measure hormone levels directly, the relationship between lactational hormones and blood pressure can only be hypothesized. Maternal movement during the nursing period may be significant in that smaller numbers of movements were associated with the lower mean blood pressures. The same association existed between maternal speech and blood pressure. Additionally, the pattern of falling blood pressures during nursing may be an effect of touch. In all probability, the results are due to a combination of the above factors.

Limitations and Suggestions for Further Research

Several limitations existed for this study. A larger sample size would have increased the number of observations made of maternal and infant activity so that statistical analysis could be done on the relationship between maternal and infant activity and blood pressure change. In addition, it is possible that a larger sample size would bring the diastolic blood pressure pattern to a statistically significant level.

No control group was used in this study, which could have been made up of the same group of mothers during another activity such as reading. The comparison between those mothers engaged in a non-feeding activity and engaged in breastfeeding could strengthen the study.

It was not possible to use a bottle feeding control group for this study, which would help distinguish the physiologic effects of breastfeeding from the effects of other variables.

Both primiparous and multiparous women were included in this sample. It is possible that controlling for parity or previous breastfeeding experience could have an effect on the findings.

Convenience sampling, such as was used in this study, always limits the generalization of findings.

Implications for Nursing

The most direct application of these findings relates to our current treatment of women with pregnancy induced hypertension (PIH). Those women are often separated from their infants in the first hours and days after birth. Sometimes this is because the infant needs increased levels of nursing or medical care, and sometimes because it is believed that decreasing the enviromental stimuli is important for these women until their blood pressure stabilizes. If a study of this kind were done with a group of mothers with PIH and had similar findings, we could begin to promote breasfeeding and early contact for these mothers. The establishment of a good nursing pattern in the first 24-48 hours is important to the overall success of breastfeeding, and early contact promotes a feeling of normalcy in what may have been a difficult labor and delivery situation.

In a more general sense, this study is relevent to nursing because of its focus on human interaction, a process of central concern in nursing research and practice. It utilized the measurements of blood pressure and heart rate, which are among the most common nursing assessments used, to explore the physiology of interaction.

Blood pressure and heart rate are commonly used by nurses to assess physiologic status in a general way, most often as related to a pathologic condition. The notion that blood pressure and pulse may be measures sensitive to human interaction brings a different light to their potential use in nursing practice.

The major contribution of this study is in its relationship to our growing understanding of human physiology. Simple cause-effect relationships between human interaction and physiologic variables will probably never be identified. The human organism is exceedingly complex, and as our understanding of that grows, all aspects of human functioning become increasingly related.

REFERENCES

Biswas, S., & Rodeck, C. (1976). Plasma prolactin levels during pregnancy. British Journal of Obstetrics and Gynecology, 83, 683-687.

Borell, V., Fernstrom, I., Ohlson, L., & Wiquist, N. (1964). Effect of uterine contractions on the human uteroplacental blood circulation. American Journal of Obstetrics and Gynecology, 89, 881-890.

Caldeyro-Barcia, R. (1960). Oxytocin in pregnancy and labor. Acta Endocrinologica, 34 (Supp. 50), 41-49.

Coleman, R., Greenblatt, M., & Solomon, H. (1956). Physiological evidence of rapport during psychotherapeutic interviews. Diseases of the Nervous System, 17, 71-77.

Delvoye, P., Demaegd, M., Delogne-Desnoeck, J., & Robyn, C. (1977). The influence of the frequency of nursing and of previous lactation experience on serum prolactin in lactating mothers. Journal of Biosocial Science, 9, 447-451.

Goldberg, L. (1A78). Vascular dopamine receptors as a model for other dopamine receptors. Advances in Biochemical Psychopharmacology, 19, 119-129.

Hendricks, C., & Brenner, W. (1970). Cardiovascular effects of oxytocic drugs used post partum. American Journal of Obstetrics and Gynecology, 108, 751-760.

Holland, O., & Gomez-Sanchez, C. (1977). Prolactin in hypertension. The Lancet, 2, 1033.

Hull, C., & Nie, N. (1981). SPSS update 7-9: New procedures and facilities for releases 7-9. New York: McGraw-Hill Book Company.

Innes, G., Millar, W., & Valentine, M. (1959). Emotion and blood pressure. Journal of Mental Science, 105, 840-851.

Jenkins, D., & Perry, L. (1978). Plasma prolactin in pregnancy induced hypertension. British Journal of Obstetrics and Gynecology, 85, 754-757.

Jenkins, D., & Soltan, M. (1980). Plasma prolactin and puerperal blood pressure. British Journal of Obstetrics and Gynecology, 87, 597-599.

Lynch, J., Flaherty, L., Emrich, C., Mills, M., & Katcher, A. (1974). Effects of human contact on the heart activity of curarized patients in a shock-trauma unit. American Heart Journal, 88, 160-169.

Lynch, J., Thomas, S., Long, J., Malinow, K., Chickadonz, G., & Katcher, A. (1980). Human speech and blood pressure. The Journal of Nervous and Mental Disease, 168, 526-534.

Lynch, J., Thomas, S., Mills, M., Malinow, K., & Katcher, A. (1974). The effects of human contact on cardiac arrhythmia in coronary patients. The Journal of Nervous and Mental Disease, 158, 88-99.

McNeilly, A., Robinson, I., Houston, M., & Howie, P. (1983). Release of oxytocin in response to suckling. British Medical Journal, 286, 257-259.

Meares, R., & Horvath, T. (1974). A physiological approach to the study of attachment: the mother's attention and her infant's heart rate. New Zealand Journal of Psychiatry, 8, 3-7.

Millar-Craig, M., Bishop, C., & Raftery, E. (1978). Circadian variation of blood pressure. The Lancet, 1, 795-797.

Mitchell, P., Parlin, R., & Blackburn, H. (1964). Effect of vertical displacement of the arm on indirect blood pressure measurement. The New England Journal of Medicine, 271, 72-74.

Nakano, J. (1973). Cardiovascular actions of oxytocin. Obstetrical and Gynecological Survey, 28, 75-92.

Nakano, J., & Fisher, R. (1963). Studies on the cardiovalcular effects of synthetic oxytocin. Journal of Pharmacology and Experimental Therapeutics, 142, 206-214.

Nie, N., Hull, C., Jenkins, J., Steinbrenner, K., & Bent, D. (1975). SPSS: Statistical package for the social sciences (2nd ed.). New York: McGraw-Hill Book Company.

Noel, G., Suh, H., & Frantz, A. (1974). Prolactin release during nursing and breast stimulation in postpartum and nonpostpartum subjects. Journal of Clinical and Endocrinologic Metabolism, 38, 413-423.

Redman, C., Bonnar, J., Beilin, L., & McNeilly, A. (1975). Prolactin in hypertensive pregnancy. British Medical Journal, 1, 304-306.

Secher, N., Arnsbo, P., & Wallin, L. (1978). Haemodynamic effects of oxytocin (Syntocinon) and methyl ergometrine (Methergin) on the systemic and pulmonary circulations of pregnant anaesthesized women. Acta Obstetricia Gynecologica Scandinavia, 57, 97-103.

Stumpe, K., Kolloch, R., Higuchi, M., Kruck, F., & Vetter, H. (1977). Hyperprolactinaemia and antihypertensive effect of bromocryptine in essential hypertension. The Lancet, 1, 211-214.

Tepperman, J. (1980). Metabolic and endocrine physiology. Chicago: Year Book Medical Publishers, Inc.

Thomas, S., Lynch, J., & Mills, M. (1975). Psychosocial influences on heart rhythm in the coronary-care unit. Heart and Lung, 4, 746-750.

Thompson, D. (1981). Recording patients blood pressure: A review. Journal of Advanced Nursing, 6, 283-290.

Tyson, A., Hwang, P., Guyda, H., & Friesen, H. (1972). Studies of prolactin secretion in human pregnancy. American Journal of Obstetrics and Gynecology, 113, 14-20.

Vuorenkoski, V., Wasz-Hockert, O., Koivisto, M., Lind, J. (1969). The effect of the cry stimulus on the temperature of the lactating breasts of primiparae. Experientia, 25, 1286-1287.

Weiner, H., Singer, S., & Reiser, M. (1962). Cardiovascular responses and their psychological correlates: A study in healthy young adults and patients with peptic ulcer and hypertension. Psychosomatic Medicine, 24, 477-498.

Williams, R., Kimball, C., & Williard, H. (1972). The influence of interpersonal interaction on diastolic blood pressure. Psychosomatic Medicine, 34, 194-198.

Woodruff, G. (1978). Biochemical and pharmacologic studies on dopamine receptors. Advances in Biochemical Psychopharmacology, 19, 89-118.

Yuen, B., Cannon, W., Wooley, S., & Charles, E. (1978). Maternal plasma and amniotic fluid prolactin levels in normal and hypertensive pregnancy. British Journal of Obstetrics and Gynecology, 85, 293-298.

APPENDICES

APPENDIX A

Demographic Information Record

Demographic Data

ID______

AGE______(years)

RACE___(1)Asian (2)Black (3)Caucasian

PARITY___# full term infants

PARITY___# preterm infants

PARITY___# abortions(all)

PARITY___# living children

FEEDING METHOD___(1)breast (2)bottle

BIRTH WEIGHT____________grams

INITIAL STUDY SYSTOLE_________(90-130)

INITIAL STUDY DIASTOLE________(60-90)

INITIAL STUDY HEART RATE_________

INITIAL MEAN ARTERIAL PRESSURE_________

PREVIOUS FEEDING METHOD___(1)has used current method before

(2)has not used current method before

APPENDIX B

Observation Tool

Data Collection Tool

MA1A ____ Maternal activity:
MA1B ____

IA1A ____ Infant activity:
IA1B ____

OA1A ____ Other activity:
OA1B ____

MA2A ____ Maternal activity:
MA2B ____

IA2A ____ Infant activity:
IA2B ____

OA2A ____ Other activity:
OA2B ____

MA3A ____ Maternal activity:
MA3B ____

IA3A ____ Infant activity:
IA3B ____

OA3A ____ Other activity:
OA3B ____

MA4A ____ Maternal activity:
MA4B ____

IA4A ____ Infant activity:
IA4B ____

OA4A ____ Other activity:
OA4B ____

MA5A ____ Maternal activity:
MA5B ____

IA5A ____ Infant activity:
IA5B ____

OA5A ____ Other activity:
OA5B ____

Data Collection Tool (continued)

MA6A	____	Maternal activity:
MA6B	____	
IA6A	____	Infant activity:
IA6B	____	
OA6A	____	Other activity:
OA6B	____	
MA7A	____	Maternal activity:
MA7B	____	
IA7A	____	Infant activity:
IA7B	____	
OA7A	____	Other activity:
OA7B	____	
MA8A	____	Maternal activity:
MA8B	____	
IA8A	____	Infant activity:
IA8B	____	
OA8A	____	Other activity:
OA8B	____	

APPENDIX C

Procedure for Obtaining Subjects

Procedure for Obtaining Subjects and Consent to Participate

1. Each mother admitted to the postpartum unit was considered for participation according to the guidelines for inclusion. Preliminary information on route of delivery, complications, and infant gestational age and health status was obtained from the information board on the unit, and the patient chart if necessary.

2. Patients meeting the study guidelines was approached in the following manner and invited to participate.

> "Hello, my name is Lisa Chickadonz, and I am a nurse and a graduate student at this university. I am doing a research project on blood pressure and heart rate in new mothers and would like to have you participate. I am interested in what happens to blood pressure and pulse as women are feeding their babies. If you agree to participate in the study, I will be taking your blood pressure and pulse using an automatic blood pressure cuff during one or two of your baby's feeding periods. It will not be harmful to you or your baby in any way. Would you like to participate?"

3. Patients expressing an interest in the study were given a detailed explanation of the procedure involved and were shown the automated sphygmomanometer. Any questions they had were answered. They were then asked if they were willing to participate. If so, the consent form was given to them and explained. After any other questions were

answered, they were asked to sign the consent form. At that time, the patient's blood pressure was taken to determine if they fell within the limits set for the study.

4. If a woman met all the criteria and gave her consent to be included, arrangements were made regarding which feeding would be most appropriate for study. Consideration was given to the time constraints set in the study, as well as the infant's feeding schedule, and the mother's activity and rest plans. Visiting hours for friends and relatives were avoided.

APPENDIX D

INFORMED CONSENT

THE OREGON HEALTH SCIENCES UNIVERSITY

School of Nursing 3181 S.W. Sam Jackson Park Road Portland, Oregon 97201 (503) 225-7793

Consent Form

I agree to participate in a research study, "Maternal Blood Pressure and Heart Rate Variation During Infant Feeding," conducted by Lisa Chickadonz, R.N. The purpose of this study is to learn more about blood pressure and heart rate in healthy women as they are feeding their newborns.

My participation will be confidential; neither my identity nor my name will be used for publicity or publication purposes. My participation involves having my blood pressure and heart rate taken approximately ten times on one or two occasions while I am feeding my baby. The procedure will take about fifteen minutes of my time. The procedure has been explained to me and I understand that it will not be harmful to myself or my baby. In addition, I understand that a limited amount of information will be obtained from my chart, such as age, health status, and due date.

While I may not benefit directly from participation in this study, I will be contributing to scientific knowledge.

This research is under the supervision of Dr. Barbara Stewart, Ph.D. If there are any questions, please call Lisa Chickadonz or Dr. Stewart at 225-7796.

I understand that I may refuse to participate, or withdraw from this study at any time without affecting my relationship with, or treatment at, the Oregon Health Sciences University and Woodland Park Hospital.

I understand what will be required of me and agree to participate in this study as described above.

Date ______________________ Signature ________________________________

AN ABSTRACT OF THE THESIS OF

Lisa J. Chickadonz

For the MASTER OF NURSING

Date of Receiving this Degree: June 8, 1984

Title: MATERNAL BLOOD PRESURE AND HEART RATE VARIATION DURING INFANT FEEDING: A PHYSIOLOGIC APPROACH TO THE STUDY OF HUMAN INTERACTION

Approved: [redacted]

Barbara J. Stewart, PhD., Thesis Advisor

Human interaction is a process rich for scientific study, and of great importance in clinical practice. This study builds on others which have explored interaction from a physiologic perspective, on the assumption that psychologic processes impact physiology. Previous studies have found the cardiovascular system to be responsive to both touch and speech, reflected in changes in blood pressure and heart rate.

Interaction between mothers and their newborn infants is an area of recent research interest, particularly with a behavioral approach. This study used measurement of blood pressure and heart rate to explore the physiologic dimension of maternal-infant interaction. Breastfeeding periods were

used for measurement, on the assumption that breastfeeding is an interactive process.

This descriptive study consisted of a convenience sample of ten breastfeeding mothers and their infants. The mothers' blood pressures and heart rates were taken at eight intervals before, during, and after nursing using an automated sphygmomanometer to reduce error from observer bias and allow the mothers to speak whenever they chose.

A significant drop in systolic blood presure occurred between the onset of nursing and the last measurement made during nursing period, nine minutes later. Diastolic blood pressure followed a similar pattern but was not significant. Heart rate was not well correlated with blood pressure and showed remarkable stability over time.

The possible explanations of these findings are numerous. Both of the hormones involved with lactation have been shown to affect the vascular system and could produce changes in blood pressure. The mothers movement during feeding is a confounding variable which may be causing some of the variation. Patterns of maternal speech and infant resting during the nursing period may be associated with blood pressure, along with effects of touch and relaxation.