AMERICAN JOURNAL OF HUMAN BIOLOGY 6:551–562 (1994)

Suckling Patterns: Lack of Concordance Between Maternal Recall and Observational Data

VIRGINIA J. VITZTHUM
Department of Anthropology, University of California, Riverside, California 92521-0418

ABSTRACT During the last decade, an increased awareness of the importance of breastfeeding patterns in determining maternal fecundity and infant health has led to a dramatic rise in surveys that query mothers on suckling duration and frequency. However, with few exceptions, observational studies have not been undertaken, and the accuracy of the recalled information is not known. This analysis ascertained the concordance of maternal recall and observational data collected for a single sample of Andean women practicing on-demand nursing. Interviews of 30 women were conducted in their native language; for 10 mother-infant pairs, breastfeeding behavior was precisely timed during the course of normal daily activities for a total of 86 hours. There is virtually no agreement of recall and observational data, either for each individual or for sample statistics. Rounding is the rule; suckling duration is reported in 5-minute units when, in fact, women often nurse for only 2–3 minutes. Overestimation is also very common; suckling durations of 30 minutes are frequently reported but almost never observed. These reporting patterns obscure the considerable actual variation in suckling duration—exposed by observation—and bring into serious question the conclusions of studies based on mothers' recall. In particular, given that analyses of these observational data indicate otherwise, the claim that suckling duration is unimportant in the regulation of maternal fecundity should be re-examined. Further, the design, implementation, and evaluation of breastfeeding promotional programs intended to increase child spacing requires data of greater accuracy than that obtainable from maternal recall.

An increased awareness of the importance of breastfeeding patterns in determining maternal fecundity and infant health has led to a dramatic rise in surveys that query mothers on daily suckling duration and frequency. Considerable expense and effort, involving large samples and sophisticated statistical techniques, typify these studies. Often the goal is to develop breastfeeding guidelines that increase birth spacing. Hence, recommendations resulting from surveys of recalled information can have a direct impact on women and children.

However, with few exceptions (Konner and Worthman, 1980; Huffman et al., 1980, 1987; Wood et al., 1985; Vitzthum, 1986, 1989; Panter-Brick, 1991; Gray, 1993), observational studies of breastfeeding have not been undertaken. Prospective data may also be obtained from records kept by mothers, but this method is not feasible in many populations (see Vitzthum, 1994). Moreover, other than the present study, none have evaluated the agreement between precisely timed observations and mothers' recollections of breastfeeding behavior. In all retrospective surveys, the accuracy of recalled suckling patterns is not known.

This analysis ascertained the concordance of retrospective data derived from maternal responses to interview questions and prospective data based on direct observations, collected for a single sample of Andean women practicing on-demand breastfeeding.

Received May 20, 1993; accepted March 9, 1994.
Address reprint requests to V.J. Vitzthum.

MATERIALS AND METHODS

Research setting: The community

Bisected by a shallow river and bordered by mountains, Nuñoa, at an altitude of 4,000 m, is among the more remote communities of the southern Peruvian Andes. A single dirt road links the town of 4,500 people to the nearest rail station, which is at least 2 hours away by truck. The harsh *altiplano* terrain is treeless, cold, and seasonally arid; the main crops are potatoes and native cereals (*quinoa—Chenopodium quinoa* and *cañihua—Chenopodium pallidicaule*), but agricultural output is poor (Thomas and Winterhalder, 1976). Llama, alpaca, cattle, and sheep are herded. However, nearly all slaughtered animals are sold outside the town where a better price is obtained. In recent years the weekly market, boasting several varieties of fresh fruits and vegetables, has grown, and there has been increased importation of commercial foods in local stores. Nonetheless, although there is markedly greater diversity in the goods and foods available (Escobar, 1976; Luerssen and Markowitz, 1986), most are relatively expensive, requiring cash payment, and thus are unavailable to most Nuñoans. Quechua speakers, distinguished in addition to language by dress, house construction, and a reliance on agropastoralism, make up the majority of the population (Mishkin, 1946; Escobar, 1976).

Infant feeding styles

Nuñoa infants are typically breastfed on demand (i.e., without regard to a pre-determined nursing schedule) from a few hours after birth until 2 years of age or more. Feeding casual sips of tea and broth by spoon or cup begins in early infancy. As a substitute for breastfeeding, bottlefeeding is uncommon; if used, bottlefeeding of various liquids is initiated at ~5 months of age. Among the poorest families, bottles usually contain only teas and herbal infusions; less poor women also bottlefeed canned milk or fruit juice. Rather than specially prepared foods, growing infants are given "the foods of the house." Mothers reported that solid, if soft, foods are purposefully introduced at ~1 year of age. In addition to *chuño* (Andean freeze-dried potato), bread, and potatoes, commonly fed to all infants, less poor women also occasionally feed eggs, meat broth, and chicken. These various foods, both liquid and solid, are treated as complements, not alternatives, to nursing. Thus, rather than an abrupt event, weaning is an extended process of continually modified feeding routines primarily based upon a mother's perception of her infant's development and constrained by household resources (for a detailed consideration of infant feeding practices in Nuñoa, see Vitzthum, 1988, 1992).

Study sample

During August 1985, 30 Nuñoa women were interviewed in their native language on their reproductive histories and infant feeding practices. Twenty-two of these women had taken part in the recently completed project, *Responses to Illness Among Andean Peasants*, which had endeavored to sample the community randomly; details of household sampling are found in Thomas et al. (1988). The remaining eight women were acquainted with some project member and recruited to increase sample size. Participants were *not* selected because of a specific infant feeding practice; maternal age, health, marital status, or occupation; or family's economic status. A participant was selected if she currently had a child <3 years old. Hence, the sample did not include those women who had not had a child in the previous 3 years nor those whose infants had died during that time.

As part of a general inquiry into current infant feeding practices for her youngest child, each mother was asked, "How many times during the day do you give this child the breast?" and "For how much time at each occasion?" (Wording of these questions is exactly the same as that found in many surveys, a listing of which is available from the author.) Although most of the Nuñoa women were not literate, time and numerical computations were familiar aspects of daily life. Women were asked for their best estimate, but not constrained to give a single numerical response as this practice tends to give a false sense of precision. Inquiries about night suckling were kept separate.

Also in August 1985, a subset of 10 currently nursing mother-infant pairs were observed by the author during the course of normal daily routines (see Vitzthum, 1989 for details and analyses). All 10 women reported an absence of either traditional or modern contraceptive use and no resumption of post-partum menses (during the

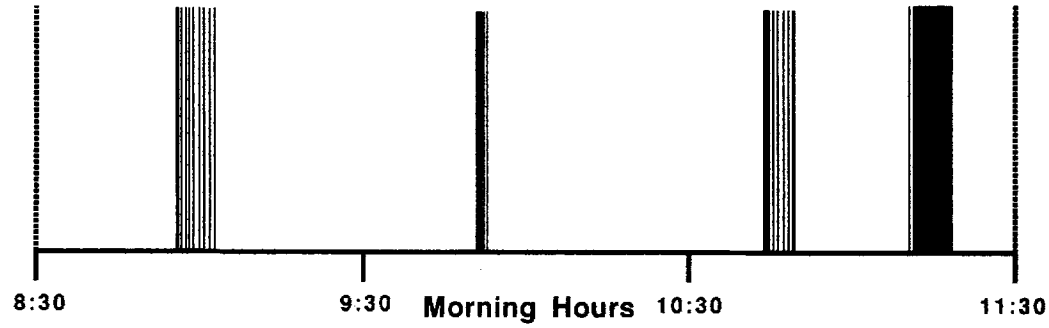

Fig. 1. Timed observations of nursing behavior for a single mother-infant pair during one morning. Each dark vertical bar represents a suckling episode comprising one or more suckling events; several episodes, each separated by <1 minute, are clustered to form a nursing session.

study one woman noted her first post-partum bleeding). Their ages ranged from 20 to 44 years and infants' ages from 3 to 21 months.

Accurate and complete observations were possible because almost all of a woman's activities took place in the confines of the courtyard and rooms of her home during this post-harvest season. While nursing, a woman preferred to sit and did not cover her infant's head or her own breasts. Most of the women had been previously observed as part of a separate time allocation study and were comfortable with observers, having too many other things to do to be distracted by the investigator. Nonetheless, to evaluate the possibility that observer presence (ideally resembling "a fly on the wall") inadvertently affected breastfeeding behavior, the reasons for the initiation and termination of nursing were noted. In 98% of the cases, it was begun as the result of a child's cries (however, this does not imply that an infant is breastfed every time he or she cries); the remaining 2% were initiated by the mother without a clear provocation by the child but in nearly every instance appeared to be an act of nurturing by the mother, often undertaken in a playful moment. Nursing continued until the infant was satiated, fell asleep, or in a few instances, another task demanded the mother's attention. In one case the woman never acclimated to observer presence and hence was not subsequently included in any analyses, here or elsewhere.

Reflecting the characteristics of each field setting, observational protocols vary somewhat among studies (Vitzthum, 1994). For !Kung women, nursing was recorded to the nearest 30 seconds during three 2-hour sessions on separate days, from 8:30–10:30 a.m., 12:30–2.30 p.m., and 4:30–6:30 p.m. (Konner and Worthman, 1980). In Bangladesh Muslim women, timed observations were made from ~9:00 a.m.–5:00 p.m., at monthly intervals for up to 1.5 years; suckling was analyzed to the nearest minute (Huffman et al., 1987). In the Gainj of Papua New Guinea (Wood et al., 1985), nursing was timed to the nearest second on a single day from ~8:00–4:00 p.m.

In the Nuñoa sample, suckling was timed by the author to the nearest second using an electronic watch and prepared recording sheets. All other activities of the mother, infant, and any other family members present were timed to the nearest minute. Observations generally began around 9:00 a.m. or 2:00 p.m. and usually lasted 3–4 hours. Seven women were observed during the morning, nine in the afternoon, six during both periods, for a total of ~86 observation hours. Figure 1 represents the timed observations of a single mother-infant pair during one morning.

Analytical variables

Nursing activity can be partitioned at its simplest level into periods of suckling separated by periods of rest. Rest intervals may extend from a few seconds, as when the infant is swallowing, to several hours, as when the infant sleeps. In most studies it is unclear whether the stated nursing duration includes none, some, or all of the short swallowing and fussing intervals that commonly punctuate a session of feeding.

The following definitions apply (Vitzthum, 1986, 1989): a nursing *event* is the exact period when the nipple is in infant's mouth; a nursing *episode* consists of one or more events separated by <5 seconds; a nursing *session* consists of one or more episodes separated by <1 minute; *intersession* refers to the intervals between sessions. Event, a fundamental unit of suckling behavior, displays little intra- or interindividual variation and appears to reflect physiological or morphological factors such as mouth fluid capacity, swallowing frequency, and respiratory rate (Vitzthum, 1986, 1989). Episode is as defined by Wood et al. (1985) to ensure comparability with that study. Session was newly defined by Vitzthum (1986, 1989) and arises from the statistically verified observation that episodes are not randomly distributed throughout the observation period but are clustered together (Fig. 1); the distribution of the number of episodes per hour departs significantly ($P < 0.01$) from a Poisson distribution. A previous lack of specificity has made comparisons among studies difficult, but more recent investigations (Panter-Brick 1991; Gray, 1993) have adopted these definitions of variables.

RESULTS

Analyses of timed observations

A thorough consideration of the analyses of these observational data is given in Vitzthum (1989). The most significant findings are summarized here for comparison with analyses of the recall data.

Diurnal variation. There is significant diurnal variation in daily breastfeeding, the greatest magnitude being during the morning (Table 1). Session duration tends to be longer and intersession interval duration shorter (i.e., sessions are more frequent) in the morning than in the afternoon (paired t-test, two-tailed, df = 5; session duration: $t = 2.07$, $P < 0.10$; intersession interval duration: $t = 3.12$, $P < 0.05$). This finding is consistent with a long hiatus in feeding during the sleeping hours. However, there is no significant correlation between morning and afternoon nursing magnitude; hence these analyses treated the two periods separately.

Morning suckling patterns. The mean duration of a morning nursing session is negatively associated ($r^2 = 0.76$, $P < 0.01$) with infant's age (Table 1; Fig. 2, upper panel). This is consistent with the expectation that older children receive less of their nutritional needs from breast milk than from other sources and corresponds to the decreasing proportion of amenorrheic mothers with time postpartum. In contrast, intersession interval duration does not vary with infant's age.

TABLE 1. Observed magnitude of daily breastfeeding

ID #	Infant age (days)	Mother age (years)	Mean session duration (minutes)	Mean intersession duration (minutes)
Morning (ordered by infant age)				
14	201	20	6.91	55.39
31	295	25	6.39	41.29
07	331	36	3.94	31.40
19	521	36	4.85	56.77
13	558	37	2.22	43.33
08	611	27	1.55	54.73
15	622	22	2.77	26.11
Afternoon (ordered by mother age)				
14	201	20	3.02	94.36
15	628	22	0.75	49.50
31	301	25	1.61	91.75
25	88	27	1.87	32.09
27	353	31	5.30	72.35
07	325	36	3.69	37.67
19	535	36	3.80	134.05
13	553	37	4.55	53.06
12	492	44	5.06	30.35

Afternoon suckling patterns. The mean duration of an afternoon nursing session is positively associated ($r^2 = 0.56$, $P < 0.02$) with mother's age (Table 1; Fig. 2, lower panel). Older women may have a decreased ability to produce as much milk as younger mothers; hence an infant must suckle longer to acquire the same (or perhaps still less) milk. In addition, older women, more likely than younger women to have an adolescent daughter, may be able to make greater use of surrogate caretakers during the afternoon when girls are not attending school. Thus nursing sessions may tend to be longer than for a younger woman who typically keeps her infant wrapped in a shawl and slung on her back, easily accessible for quick feeds. As in the morning, intersession interval duration does not vary with infant's age or mother's age.

Analyses of maternal recollections

Of the 30 women interviewed, 26 reported the frequency and duration of current daily breastfeeding behavior. Responses are

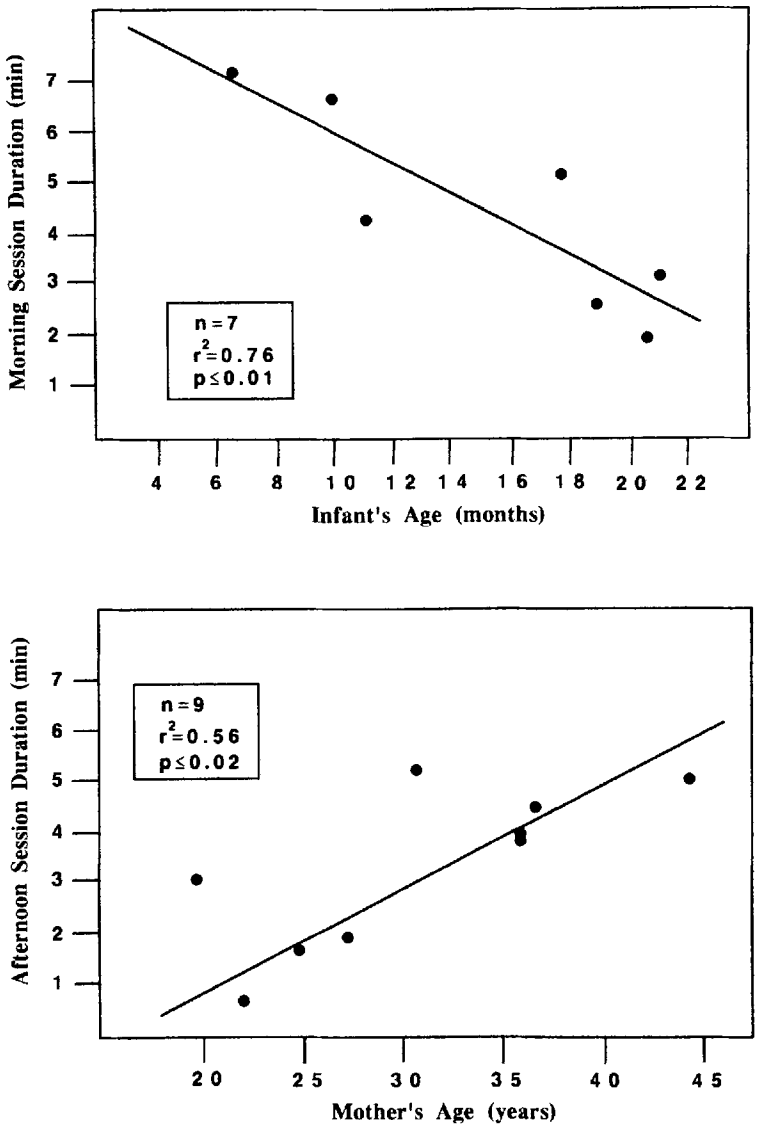

Fig. 2. Significant association of session duration in morning with infant's age and in afternoon with mother's age.

listed in Table 2 and illustrated in Figure 3 in order of increasing infant age.

Daily frequency. As is readily apparent, there is no relationship ($P > 0.10$) between infant age and reported daily frequency of nursing. In this respect, this lack of association is similar to the findings based on the observational data.

Feeding duration. Column 4 (Table 2) gives the reported duration for individual feedings and column 5 the daily total suckling duration (the product of frequency and individual duration). In contrast to the findings based on the observational data, reported duration (either for single feedings or daily total) has no relationship ($P > 0.10$) to in-

TABLE 2. Reported magnitude of daily breastfeeding

ID #	Infant age (days)	Daily frequency	Single feed duration (minutes)	Total duration minutes
25	88	4	5	20
21	179	4	15	60
28	183	7	5–10	35–70
14	200	7	50–60	350–420
26	227	5	10–20	50–100
09	279	7–8	5–10–15	35–120
07	333	6	15	90
05	339	8	15–20	120–160
24	356	10	10	100
03	366	5–8	15–20–30	75–240
27	368	3	30	90
17	402	4	15–20	60–80
01	409	5–6	20–30–40	100–240
12	493	6–7	15	90–105
16	503	5–7	5–15	25–105
19	540	10	10–15–20–30	100–300
13	555	6	25–30	150–180
22	584	6	15–20	90–120
30	591	3	15–20	45–60
08	607	6	5–10	30–60
29	609	3–4	10–15	30–60
15	622	5	30	150
11	746	6	10	60
10	797	10	15–20	150–200
23	865	5–6	15–30	75–180
02	930	6–7	5–10–15	30–75

fant age or any other variable. Duration is reported in 5-minute units; 15 minutes is the most commonly reported duration.

Comparison of recall and observational data

The accuracy of recalled breastfeeding behavior was evaluated by comparison to data derived from timed observations. Accuracy commonly refers to both validity and reliability. Validity is the correspondence between a measurement and that which is being measured. Reliability is reproducibility of the measurement for independent trials. A measurement that is either invalid or unreliable cannot be considered accurate (McNabb, 1990); informants may reliably report invalid, and hence inaccurate, information (Bernard et al., 1984). For a thorough consideration of these issues, see Muir (1977) and Cook and Campbell (1979).

Table 3 lists the reported and observed magnitude of daily breastfeeding for those nine women for which both kinds of data are available. Reported data are as given in Table 2. Observed single feeding durations are the values for mean session durations (Table 1); session was defined by Vitzthum (1986, 1989) as a behaviorally meaningful unit of analysis, based on the statistically verified ($P < 0.01$) observation that nursing episodes are clustered into nursing sessions. The values for observed daily frequency and observed daily total suckling duration are extrapolated from the observed mean times for session and intersession durations, based on a 12-hour day (the approximate time of at least some daylight in this locale at this time of year). The mother-infant pairs are ordered by increasing observed daily total suckling duration.

Daily frequency. With a single exception (ID# 19), all women underreported the frequency of daily nursing; observed values are as much as five times greater than reported values. In addition, there is no correlation between reported and observed values (Spearman's rank order correlation, $r_s = -0.27$); the woman reporting the greatest frequency (and the most accurate value) was, in fact, the least frequent nurser.

Feeding duration. Women dramatically overreported the duration of individual feedings, but not in any consistent manner (Spearman's rank order correlation of observed and reported values, $r_s = 0.42$). Fifteen minutes is the most commonly reported duration; 30 minutes was frequently reported. Yet, timed observations revealed that virtually all sessions are <10 minutes duration, and most are far shorter.

Total suckling duration. The underreporting of daily frequency and overreporting of individual feeding duration might be expected to counter each other and thereby yield a reasonably accurate estimate of daily total suckling duration. Unfortunately, this is not the case. Generally, total suckling duration values based on recall are much greater than those based on observed data. Moreover, there is no correlation between the reported and observed values; even rank ordering of the two data sets are not in agreement (Spearman's rank order correlation, $r_s = 0.20$).

DISCUSSION

The lack of substantial concordance between maternal recall and observational data on breastfeeding activity is not surprising; how many of us could remember how frequently we drink water each day, or how long it takes to do so? But the magnitude of the disparity is disappointing, particularly since timed observation is a very demanding method and interviews more easily yield larger samples. Nonetheless, although a

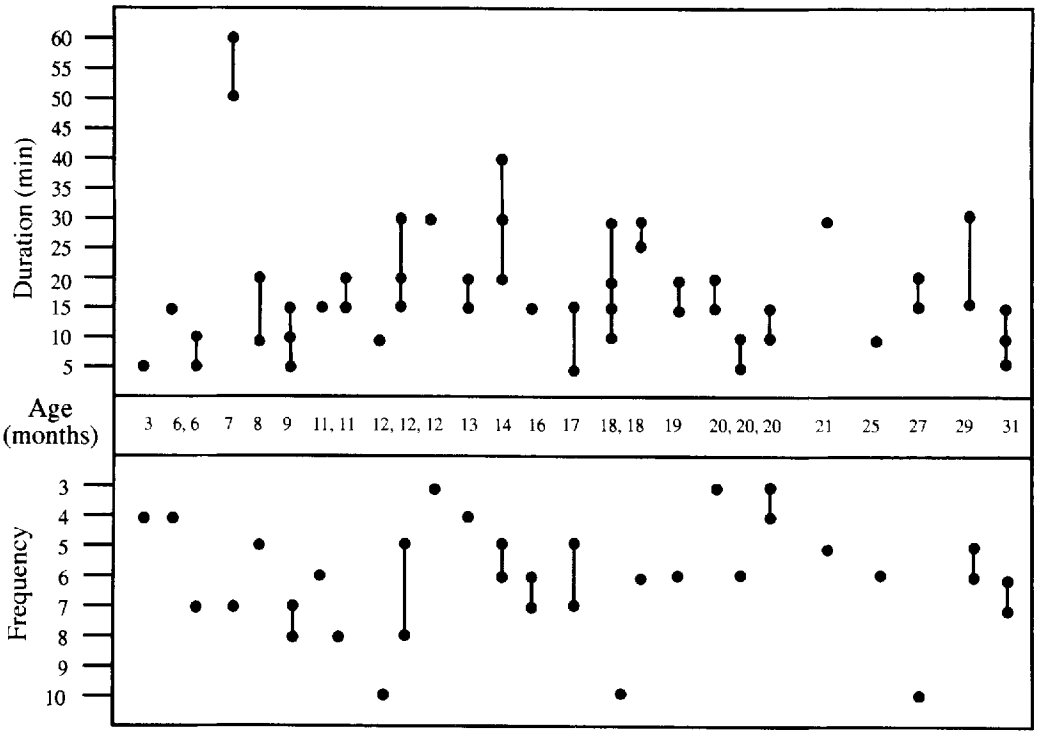

Fig. 3. Reported nursing duration and frequency ordered by infant's age in months (n = 26).

TABLE 3. Comparison of reported and observed magnitude of daily breastfeeding

	Daily frequency		Single feed duration (minutes)		Total duration (minutes)		Rank order (total)	
ID#	R	O	R	O	R	O	R	O
08	6	13	5–10	1.55	30–60	20	2	1
19	10	9	10–15–20–30	4.33	100–300	41	8	2
25	4	22	5	1.87	20	42	1	3
15	5	21	30	1.76	150	44	6	4
13	6	15	25–30	3.39	150–180	49	7	5
27	3	10	30	5.30	90	53	3.5	6
14	7	10	50–60	4.97	350–420	56	9	7
07	6	21	15	3.82	90	80	3.5	8
12	6–7	24	15	5.06	90–105	120	5	9

precise quantitative agreement between observations and recall had not been expected, even simple rankings of daily total suckling duration do not agree.

Even when there is no desire to deceive, informant accuracy is disturbingly poor for a wide variety of activities (see Bernard et al., 1984). When behavior is self-monitored and has occurred fairly recently, informants are still often inaccurate. Furthermore, the seeming importance of time markers in a given setting does not ensure accurate recall. Quandt (1987) requested that mothers in Lansing, Michigan, record the dietary intake of their newborns every 8 days for 6 months at which time a final interview asked the infant's age at weaning, at first consumption of formula, and at first consumption of solid foods. Inaccuracy rate for age at weaning was 39%, rising to 59% for age at first solid foods.

Discovering that informants are "inaccu-

rate" with respect to some piece of information is not a value judgment about the informant; rather, it is a statement about methodological limitations in the study of human behavior. For some behaviors in some settings, the difficulties of informant accuracy can be reduced by redesigning the instrument, reorienting the research issue (e.g., from a concern with actual behavior to an investigation of "typical" behavior or cognitive processes), or using multiple approaches (cf. Sudman and Bradburn, 1974; Schuman and Presser, 1981; Bernard et al., 1984; Freeman et al., 1987; Bernard, 1988; McNabb, 1990; Frankfort-Nachmias and Nachmias, 1992).

However, the style of child care in Nuñoa, typical of many places worldwide, is not amenable to accurate reporting of breastfeeding behavior. A Nuñoa infant is commonly carried in a blanket on her mother's back and easily swung forward for nursing. Women breastfeed casually while socializing, working in the marketplace, or attending to cooking and other household tasks. Hence, frequent short nursing sessions (cf. Fig. 1) are hardly noticed and rarely remembered; they are simply part of the daily flow of activities. Thus it is the very nature of breastfeeding behavior (brief, unscheduled, repetitive, and casual) and the nature of recall, rather than the nature of the question, that makes it exceedingly difficult to obtain sufficiently accurate data from retrospective questionnaires. Similar conclusions have been reached by others regarding the ability of informants to recall other types of "non-eventful" behavior (cf. D'Andrade, 1974; Hawkins and Tedford, 1976; Nisbett and Ross, 1980; Fraisse, 1984; Bernard, 1988; Valdez and Coltrane, 1993).

For retrospective data to be of use, there need not be numerical equivalency to observational data. For some analytical purposes, categorical groupings or rankings are sufficient. Nonetheless, the recall data must bear some reasonable relationship to the actual behavior. A large sample, although making it easier to obtain statistical significance, does not correct for inaccurate data. In Nuñoa, mothers were asked open-ended questions, as are typically found in many surveys, by a single interviewer (thereby eliminating one source of error, a practice not feasible in most studies). Leaving aside the specific values, if the women's responses had been qualitatively accurate (i.e., relative to one another), then rank orderings should have shown reasonable agreement—they do not.

Breastfeeding behavior as seen in Nuñoa is similar to that of many, perhaps most, populations worldwide, particularly in non-industrialized settings. Unfortunately, but most certainly, data derived from maternal recall are not an adequate basis for analyses of suckling activity in these locales. This methodological flaw has very significant consequences for understanding the effects of suckling patterns on fecundity. Having firmly established during the previous decade that lactation prolongs post-partum amenorrhea (e.g., Delgado et al., 1978; Howie et al., 1981; Dobbing, 1985; for reviews see Vitzthum, 1994; Wood, 1994), much attention is now focused on investigating the finer details of breastfeeding behavior. With an eye toward promoting natural fertility regulation, a primary goal is to determine the suckling variables and/or schedule that might have the greatest suppressive effect on fecundity.

However, the comparisons made here attest that maternal recall obscures significant variation in suckling activity. Of particular importance is the tendency to report suckling duration in 5-minute increments, thereby obliterating differences in suckling duration between women and changes in suckling duration over time. The seeming constancy of suckling duration throughout the entire duration of nursing, as reported by some survey studies (cf. Jones, 1989), may actually be an artifact of maternal reporting biases. In addition, at least in Nuñoa, daily total suckling duration is typically substantially overestimated, in some cases by as much as seven times the observed value (Table 3). This overestimation is not orderly, such that women who breastfeed less report relatively lower values than those who breastfeed more.

Maternal recollections are also very apt to yield an erroneous *schedule* of daily suckling activities, particularly when breastfeeding is on demand. Pre-determined nursing schedules may enhance recall of nursing frequency and duration, in much the same way that set mealtimes are easier to remember than day-long nibbling. In Nuñoa, and very likely in many other populations practicing on-demand breastfeeding, recall data are characterized by an underreporting of frequency and an overreporting of individual

feeding duration. In addition, diurnal variation in suckling activity is not detectable by typical questioning and appears to have gone unrecognized previous to these timed observations (Vitzthum, 1986, 1989). Yet the presence of diurnal variation and its underlying causes could have important implications for promoting breastfeeding, particularly in some work settings.

In addition to the negative consequences for designing effective recommendations for promoting birth spacing, the inaccuracy of maternal recall data prevents a thorough understanding of the role of lactation in suppressing fecundity. The evidence that lactation prolongs postpartum amenorrhea is overwhelming; nonetheless, women of seemingly comparable breastfeeding magnitude display considerable unexplained heterogeneity in the time to resumption of postpartum menses (Jones, 1989; Vitzthum, 1990, 1994). However, observational studies have revealed substantial intra- and interindividual variation in the structure of daily breastfeeding regimes (Huffman et al., 1987; Vitzthum, 1989), even when the daily total suckling duration is similar. For example, the daily total suckling duration for mother-infant pair 19 (Table 3) is 41 minutes, that of pair 25 is 42 minutes. But these nearly identical values are achieved by very different patterns. Pair 25 nurses twice as often as 19 (22 vs. 9 times/day) yet, on average, for only about half as long (1.87 vs. 4.33 minutes). Unfortunately, it is impossible to adequately characterize or quantify this structure on the basis of maternal recall data.

This structural variation is likely to be pivotal in elucidating the biobehavioral links between lactation and fecundity. Rather than one aspect of suckling magnitude (e.g., daily total duration, mean duration per session, daily frequency) being of singular significance in regulating fecundity, it is the patterned interaction of suckling duration and suckling frequency that more fully explains variation in duration of postpartum amenorrhea (Howie and McNeilly, 1982; Jones, 1989; Vitzthum, 1989, Fig. 3).

Suckling activities are neither randomly scattered through the day nor adequately approximated by a Poisson distribution (e.g., Wood et al., 1985). Rather, events are clustered into sessions of varying duration and frequency. The length and scheduling of these sessions are likely to depend upon a variety of cultural and biological factors (Vitzthum, 1989), including maternal work schedules (Panter-Brick, 1991; Gray, 1993), maternal milk output (Prentice, 1986; Vitzthum, 1989), presence of surrogate caretakers (Vitzthum, 1989), supplemental feeding patterns (Howie et al., 1981; Panter-Brick, 1991; Gray, 1993; Wood, 1994), and maternal-infant co-sleeping (Howie and McNeilly, 1982; Jones, 1989). Evidence suggests that night nursing is a significant factor in prolonging postpartum amenorrhea (Howie and McNeilly, 1982; Elias et al., 1986), and the diurnal variation in suckling activity observed in Nuñoa may be of similar import.

It is to be expected that such factors will vary within and between populations. Because of populational variation in these factors, different studies are likely to reach disparate conclusions regarding the relative importance of suckling duration and frequency. Where factors affecting suckling frequency are paramount, measures of fecundity will correlate with suckling frequency; similarly, factors affecting suckling duration may be of greater importance in other settings. One can envision a wide range of differing combinations and interactions (Vitzthum, 1989).

Clinical evidence suggests that suckling duration is important when frequency is low but less critical when suckling occurs 10–20 times per day (McNeilly et al., 1985). Swidden agriculturalists (the Gainj in Papua New Guinea; Wood et al., 1985), pastoralists (the Turkana in East Africa; Gray, 1993), and intensive agropastoralists (the Quechua in highland Peru; Vitzthum, 1989) all have very different work demands and schedules. Even within a single village, two castes may have less dramatically dissimilar work patterns that differentially affect nursing patterns and hence fecundity (Nepal; Panter-Brick, 1991). Maternal-infant co-sleeping patterns, and hence night suckling patterns, span the entire range from complete separation shortly after birth (often but not necessarily accompanied by a near absence of night feeding) to co-sleeping until 4 years of age.

In addition to variation in breastfeeding structure, differences in maternal nutrition and workload may also contribute to heterogeneity in the duration of postpartum amenorrhea (Frisch, 1978, 1988; Bentley, 1985; Ellison, 1990; Vitzthum, 1990). Although the role of energetics in human fecundity

remains controversial (Delgado et al., 1978; Huffman et al., 1978; Bongaarts, 1980; Dobbing, 1985; Bentley et al., 1993; Wood, 1994), it would be extraordinary if a mammalian reproductive system did *not* respond to nutritional factors (Bronson, 1989; Vitzthum, 1990). In any case, because energetics is, at most, secondary to lactation in prolonging postpartum amenorrhea (Bentley, 1985), clarifying the effects of energy balance on fecundity will remain troublesome as long as the data on suckling patterns are inadequate. Maternal recall data are neither sufficiently accurate nor detailed to thoroughly delimit the role of lactation, thereby hampering a satisfactory understanding of the potential involvement of maternal nutrition and workload in human fecundity.

Aside from these theoretical issues and the problems of developing effective breastfeeding recommendations for increasing child spacing, the limitations of maternal recall have important implications for implementing and evaluating breastfeeding promotional programs. The first difficulty lies in knowing just how much a given woman is nursing her infant and then counseling her accordingly. Nearly all the Nuñoa women substantially overestimated the actual total duration of daily nursing; given a similarly erroneous "guesstimation," a health worker might not suggest increasing breastfeeding when, in fact, such an increase is necessary if fecundity is to be suppressed. Since there is no simple relationship between actual and reported magnitude (Table 3), the reported value cannot be used to estimate the actual breastfeeding magnitude.

A second difficulty is the tendency of informants to report behavior that is in accord with recommendations by authorities; this often unconscious predilection has been observed for a wide variety of informants, data, and settings (Bernard et al., 1984; Quandt, 1987). Thus whatever the accuracy of a mother's initial recall of suckling behavior, over time it is likely she will report (and possibly believe) that she is conforming to instructions, even if this is not the case. If these recommendations are known to her before the initial interview (as a result of conversations with neighbors or promotional advertisements), her initial recall is likely to be similarly biased. This bias toward expected behavior will give the appearance that women are conforming to program guidelines when they may not be, thereby leading to client dissatisfaction and program failure despite the best of efforts on everyone's part.

Given the myriad difficulties and negative consequences of relying on maternal recall for generating accurate data on suckling patterns, one might be tempted to abandon altogether the endeavor to thoroughly elucidate the biobehavioral links between breastfeeding and fecundity. But the situation is, perhaps, not quite that dire. Certainly, if breastfeeding is to be promoted as a means of childspacing, we must go beyond "more is better." Such a simplistic recommendation may not be tenable in some settings and even unnecessary in others; further, there may be unintended negative consequences, for example, where maternal nutritional status is at risk or essential employment is jeopardized.

Although inquiries regarding daily suckling duration and frequency are of little use when breastfeeding is brief and/or casual, other methods of determining suckling patterns (e.g., maternal record keeping) may yield sufficiently accurate data, depending upon the goals and setting of the investigation (Vitzthum, 1994). However, it is inescapable that for addressing some issues in some locales, there is no satisfactory alternative to directly timed observations. This is particularly true when we are concerned with subtle but significant differences amongst women.

As discussed above, in Nuñoa the brevity of suckling coupled with the tendency to report in 5-minute increments obscures significant variation in suckling duration and thus the importance of suckling duration in regulating fecundity. Observational data from Nuñoa indicate that mean suckling duration decreases as an infant ages and increases as a woman ages (Vitzthum, 1986, 1989). In light of this finding, claims based on recall data that suckling duration is unimportant in the regulation of maternal fecundity should be re-examined.

If maternal recall is to be used, informant accuracy must be evaluated before undertaking extensive data collection (Bernard et al., 1984). In Central Java, women were asked to recall the average number of suckling episodes and suckling duration once each month over 2 years (Jones, 1989). Accu-

racy was evaluated by comparison to a 24-hour, self-recorded survey and a 24-hour recall survey conducted by enumerators; relatively frequent breastfeeders in one survey were found to be relatively frequent breastfeeders on the others (Hull, 1984, cited by Jones, 1989). Thus for the purposes of the study, the data may have been sufficiently accurate. However, without comparison to observational data, it is impossible to know the inaccuracy of any of the three survey methods. Caution is warranted, despite the appearance of accuracy, because for the recalled data "the breastfeeding variables remained relatively constant over time" (Jones, 1989). From all that is understood of nursing behavior, it is extraordinarily unlikely that a 2-year old will be suckling at the same level as when he or she was a newborn. Further, it is difficult to reconcile the increasing proportion of women experiencing postpartum menses over these 2 years with an absence of change in breastfeeding.

In all studies of any kind, "a measurement whose accuracy is completely unknown has no use whatever" (Wilson, 1952). No matter what the reason for the inquiry or the population studied, it *cannot* be assumed that informants are sufficiently accurate for the purpose. Rather, the accuracy of maternal recall data must be assessed before it is used to construct recommendations, untangle theoretical controversies, or evaluate promotional programs.

ACKNOWLEDGMENTS

My deepest gratitude is extended to the women of Nuñoa, and especially to Maria Olinda Cala Mar for her indispensable role as Quechua translator. Data collection was conducted under the auspices of R.B. Thomas (P.I. of a larger project supported by NSF Grant BNS 8306-186). Financial support was provided by a Rackham School of Graduate Studies Research Grant and NICHD (T32-HD07339). Many thanks to Gillian Bentley, Alan Fix, and the anonymous reviewers for their thoughtful commentary.

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