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BREAST MILK CONSUMPTION IN RURAL COSTA RICA

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SUMMARY

Breast milk consumption was measured in 20 breast-feeding infants, aged two days to six months. This was achieved by test-weighing infants before and after every feeding over a 24-hour period. Infant length, weight, number of breast-feedings, and time spent sucking were also measured. The mean consumption among 10 full breast-feeders (no supplementation) was 639 ± 214 ml/day at a mean age of 42 ± 36 days, and 396 ± 249 ml/day at a mean age of 95 ± 53 days for ten breast-feeders receiving supplements (partial breast-feeders). Significant correlations were found between the number of feedings per day and breast milk consumption (ml/day) when examining all twenty infants ($r = 0.788$, $p < 0.01$) and the ten partial breast-feeders ($r = 0.903$, $p < 0.01$), but not the ten full breast-feeders ($r = 0.431$). Correlations between the time sucking per day (min/day), and breast milk consumption (ml/day), were again significant for all twenty infants ($r = 0.576$,

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$p < 0.01$) and partial breast-feeders ($r = 0.728$, $p < 0.02$), but not for full breast-feeders ($r = 0.357$). The weight-for-length ratio for full breast-feeders ranged from 94 to 135% of the 50th percentile of the National Center for Health Statistics (NCHS) curves, while for partial breast-feeders it ranged from 103 to 141%. Both groups show adequate growth in this poor, rural area of Costa Rica.

INTRODUCTION

There has been renewed concern over the adequacy of the quantity of breast milk consumed by infants of poor mothers in developing countries (1, 2). However, bottle-feeding and early introduction of supplemental foods in impoverished environments is well associated with increased morbidity and mortality due to a higher risk of infection and malnutrition (3-5). It is the objective of this study to examine the breast milk consumption and anthropometric status of rural Costa Rican infants.

METHODS

Population

Six communities in the area of Puriscal, Costa Rica, were studied. All localities are within 48 kilometers of Santiago, municipal seat of Puriscal; Santiago is 1,105 meters above sea level, but some localities were about 350 m in altitude. Dwellings are generally dispersed and accessible by dirt roads or trails.

The socioeconomic status of Puriscal residents is low and representative of many rural areas of the country. Men usually work in agriculture (corn, beans, coffee, and tobacco), and women in domestic chores. Most homes have latrines, some of which may not be sufficiently distant from the water supply —stream, well, or piped water system. Cooking is generally done over an elevated firewood hearth. Although the sleeping arrangements varied, parents and infant often slept in one bed and other children in another bed or on the floor.

Twenty breast-fed infants less than six months of age were studied between February and October 1978. These infants represent all but three of all breast-fed infants of this age range in the study area at the time of our investigation. We estimate that

there were 35 other infants less than six months of age who were not breast-feeding. Two mothers chose not to participate and another one was not visited due to hospitalization of the infant. Ten of the 20 infants were fully breast-fed (no water, breast milk substitute, juice, or other foodstuff) and 10 received a partial breast milk diet. This partial diet varied considerably from infant to infant, irrespective of age, and daily supplementary foods varied from one bottle of sugared instant milk to multiple portions of soup, bread, and fruit. (A food scale, accurate to one gram, was used to measure the weights of infant foods consumed, but results are rough due to small intakes and home-made foods. Thus, no caloric estimates were made).

Technique

All measurements were made in duplicate by the same worker (R. N.). Milk consumption was measured by test-weighing over a period of 24 hours. Disposable diapers were worn by the infant at all times and identical clothing was worn at weighings before and after breast-feeding. The difference of the two weighings was assumed to be the amount of milk consumed. Infants were weighed nude (or with a cotton undershirt) on one occasion for anthropometric analyses. A Detecto Infant gram scale was used for all weighings, measuring to one gram. Length was measured to the half centimeter with an infant meter and the assistance of the mother.

RESULTS

Breast Milk Consumption

Fully breast-fed infants consumed considerably more breast milk than partially breast-fed infants (Table 1), 639 ± 214 ml/day at 42 ± 36 days and 396 ± 249 ml/day at 95 ± 53 days, respectively. Infants were fed on demand day and night and were kept at the breast as long as they were sucking. Fully breast-fed infants fed more often and for a longer time than partially breast-fed infants (9 ± 2 feedings/day for 76 ± 31 min/day and 6 ± 3 feedings/day for 66 ± 45 min/day, respectively). The number of feedings per day was significantly correlated with breast milk consumption (ml/day) when examining all 20 infants and the 10 partial breast-

TABLE 1

MILK CONSUMPTION BY BREAST-FED INFANTS 0-6 MONTHS OF AGE. PURISCAL, COSTA RICA, 1978

Case	Age, days	Feedings per day	Time sucking min per day	Milk consumption, ml per day
Fully breast-fed				
1	2	8	20	206
2	11	10	77	721
3	13	11	93	1043
4	14	9	120	434
5	14	8	70	727
8	44	13	130	657
10	45	8	68	608
12	72	8	78	711
15	101	6	51	494
16	103	9	55	789
Mixed-fed				
6	26	9	103	567
7	43	7	62	593
9	44	9	175	756
11	51	3	37	84
13	75	4	62	172
14	93	4	30	103
17	125	4	42	457
18	134	7	66	485
19	170	3	21	73
20	184	10	61	665
Mean ± Standard Deviation				
Fully breast-fed	42 ± 36	9 ± 2	76 ± 31	639 ± 214
Mixed-fed	95 ± 53	6 ± 3	66 ± 45	396 ± 249

feeders, but not the ten full breast-feeders (Table 2). The same pattern was found when correlating the time sucking per day and breast milk consumption (ml/day). Significant correlations were found for all 20 infants, and the 10 partially breast-fed infants, but not for the ten fully breast-fed infants. Nine of the ten mixed-fed infants were receiving reconstituted, whole, powdered milk by bottle (the exception was case 20). Milk was provided gratis as part of the national food distribution program, and was generally prepared with sugar and extra water from that indicated on the package.

TABLE 2

CORRELATIONS OF NUMBER OF BREAST-FEEDINGS, TIME SUCKING, AND BREAST MILK CONSUMPTION OF INFANTS 0-6 MONTHS OF AGE (PURISCAL, COSTA RICA, 1978)

Correlation	Type breast-feeding	No. of infants, N	Correlation coefficient, r	Significance level (6), $p <$
Number of feedings/day and breast milk consumption (ml/day)	Full and partial	20	0.788	0.01
	Full only	10	0.431	not significant
	Partial only	10	0.903	0.01
Time Sucking (min/day) and breast milk consumption (ml/day)	Full and partial	20	0.576	0.01
	Full only	10	0.357	not significant
	Partial only	10	0.728	0.02

Infant Anthropometry

Full and partial breast-feeders showed comparable rankings on the NCHS growth curves, although fully breast-fed infants were

younger (Table 3). The per cent of weight-for-age values were always greater than 86, length-for-age values were greater than 91o/o, and weight-for-age values were greater than 94o/o of the standard.

DISCUSSION

Breast-feeding appears to be adequate in the first six months as analyzed by the anthropometric measurements of weight-for-age, length-for-age, and weight-for-length. An adequate growth status was being maintained with a consumption of 639 ± 214 ml/day at 42 ± 36 days of age for fully breast-fed infants, the oldest of which was 3.5 months (Table 1).

It is possible that the presence of the field worker may have interfered with the emotionally-sensitive let-down reflex of the mother, thus decreasing breast milk output (8). The study, however, began with three-day test-weighings and an average variation in breast milk consumption of only 22 ml/day over the three days (9). This stable volume suggests that the one-day measurement is characteristic. Furthermore, the field worker had all personal needs cared for, inflicting as little extra work on the mother as possible, and the 24-hour stay insured that no feedings were missed.

Circumstances of maternal undernutrition have been associated with decreased breast milk output, usually after three months (10). The 639 ml/day volume consumed by fully breast-fed infants was at a mean age of 42 ± 36 days, compared to the recommended 850 ml/day determined by feeding infants pasteurized breast milk from a bottle (11, 12). This determination differs from breast-feeding in two major ways. First, the milk no longer changes composition during the feed; the high fat content of the last milk in a feed (the hind milk) is thought to be important in curbing appetite and limiting the feed (3). Second, it is much easier to obtain milk from a bottle than the breast (3). Both of these factors could increase the intake, thus the recommendation, above the need.

The significance of the correlations between the number of feedings, time sucking and breast milk consumption are unclear. One would expect a linear increase of breast milk consumption with time at the breast as milk is produced by a hormonal process which is initiated by the sucking stimulus. Nevertheless, it appears

TABLE 3

ANTHROPOMETRIC CHARACTERISTICS OF 20 INFANTS
0—6 MONTHS OF AGE
Puriscal, Costa Rica, 1978

Case	Age, days	Sex	Weight, g	Length, cm	Weight /age	Length /age	Weight /length
					Per cent of standard[a]		
1	2	f	3134	49.1	94	100	94
2	11	m	4300	53.0	116	100	113
3	13	m	4408	51.2	116	96	126
4	14	f	3135	49.0	86	94	94
5	14	m	3478	49.4	92	93	109
8	44	f	5168	55.2	121	100	121
10	45	f	4605	50.3	107	91	135
12	72	f	5792	59.5	121	104	107
15	101	f	6063	61.0	109	100	105
16	103	f	6972	61.4	123	100	117
Mixed-fed							
6	26	m	3657	50.4	88	91	112
7	43	f	4431	52.5	102	96	119
9[b]	44	m	3555	49.2	77	88	113
11	51	f	5400	57.4	120	102	113
13	75	f	5580	56.8	114	98	119
14	93	f	5512	59.0	102	98	104
17	125	m	7480	62.7	112	98	121
18	134	m	8190	60.6	121	94	141
19	170	m	8038	66.5	113	100	105
20	184	f	7839	67.9	107	103	103

[a] National Center for Health Statistics, 50th percentile (7).
[b] A preterm infant.

that other factors are involved, perhaps the intensity of sucking, the let-down reflex, or the maternal nutritional status, as correlations for full breast-feeders were not significant, although in the

expected direction.

As the supplemental milk was usually obtained from the Costa Rican food distribution program, and was generally prepared differently from the directions, the program might consider pictorial directions or demonstrations of milk preparation at the health posts.

More research on maternal nutritional status during full breast-feeding must be undertaken to determine the adequacy of breast-feeding for mother and infant. In circumstances of maternal undernutrition, it would be logical to supplement the mother rather than the infant to minimize cost and avoid the health risks of infant supplementation (3-5).

Although the sample studied is small, it represents practically all breast-fed infants in the localities studied within a six-month span. Since this study was conducted, an intervention at the hospital (skin-to-skin interaction and partial rooming-in) has resulted in a significant increase as well as a greater duration of breast-feeding. Preliminary analysis revealed that most infants fully breast-fed exhibit adequate growth velocity by six months of age (13).

Rural Costa Rica is changing culturally and nutritionally (14). Evidence from various studies suggest that breast-feeding in the first six months is important to insure the adequate growth seen in this poor rural population (3-5).

RESUMEN

CONSUMO DE LECHE MATERNA EN EL MEDIO RURAL DE COSTA RICA

Se evaluó el consumo de leche materna en 20 lactantes cuyas edades fluctuaban entre dos días y seis meses. El procedimiento utilizado se basó en pesar a los niños antes y después de cada mamada por un período de 24 horas. El peso, la talla, el número de mamadas, y la duración de cada mamada, también fueron evaluados. La media de consumo entre los 10 lactantes cuya alimentación consistió únicamente de leche materna (lactancia exclusiva) fue de 639 ± 214 ml/día con la media de edad de 42 ± 36 días, y 396 ± 249 ml/día con la media de edad de 95 ± 53 días en los 10 niños que recibieron una dieta mixta (alimentos además de la leche materna).

Se encontraron correlaciones significativas entre el número de mamadas por día y el consumo de leche materna (ml/día) en los 20 lactantes

(r = 0.788, p $<$ 0.01) y en los 10 lactantes con dieta mixta (r = 0.903, p $<$ 0.01) pero no así (r = 0.431) en los 10 lactantes exclusivos. La correlación entre la duración de las mamadas (min/día) y el consumo de leche materna (ml/día) también fue significativa en los 20 lactantes (r = 0.576, p $<$0.01) y en los 10 lactantes con dieta mixta (r = 0.728, p $<$0.02), pero no así en el caso de los 10 lactantes exclusivos (r = 0.357). En relación al peso para la talla, los niños que recibieron lactancia exclusiva tuvieron un porcentaje entre 94-135 de peso para talla tomando como referencia el percentil 50 de las curvas utilizadas por el Centro Nacional de Estadísticas Sobre Salud (National Center for Health Statistics), mientras que los valores encontrados en los niños que recibieron una dieta mixta fueron de 103 a 141%. Ambos grupos acusaron un crecimiento adecuado, no obstante que los niños bajo estudio pertenecen a una zona rural pobre en Costa Rica.

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