ORIGINAL ARTICLE

Mother Milk and the Indonesian Economy: A Major National Resource

by

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Abstract

While a myriad of health and nutritional considerations have proven that mother milk is the ideal infant food, national policy makers have failed to recognize the great value of human milk to the economy of developing countries. Today in Indonesia, mothers produce over one billion liters of milk annually with a conservatively estimated net market value of over Rp. 252 milyard or US $ 400 million. Additional monetary savings in health and fertility reduction directly attributable to lactation add a further Rp. 75.6 milyard or US $ 120 million to the economy.

Mothermilk is one of Indonesia's most precious natural resources, exceeding tin and coffee in gross monetary value and approaching that of rubber.) Its value exceeds twice the annual national budget for health and roughly equals the cost of imported rice, for which Indonesia has become, unenviably, the world's largest buyer. This great resource is not only renewable, but also equitably distributed, benefits consumer and producer alike and gives far ranging nonmonetery benefits to society. Positive governmental action is urgently needed to curtail private industry, professional groups and international assistance whose actions in providing and promoting milk of various kinds are insidiously depriving Indonesia of one of its greatest natural resources — Indonesian mother milk.

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Introduction

The economic wealth of a nation is calculated in terms of a wide variety of assets ranging from raw materials to capital goods to the value added to natural resource through industrial processing. Human labor is a major economic resource valued for its role in producing wealth through work, such as farming, extraction of raw materials or manufacturing. The lactating mother is an exceptional resource, for not only does she process coarse cheap foods to produce a unique and valuable infant food, but also the production process (lactation) provides measurable benefits to health and contributes to nationally declared goals of fertility reduction. In contrast to virtually all processing industries, the lactating woman requires no capital outlays and the direct benefits are enjoyed uniqeuely and fully by the producer and her child. Mother milk production is the ultimate in economic equity, with "right-to work" enjoyed by all, direct and immediate value to the producer, and far reaching benefits affecting all of society.

In this paper I estimate the economic value of mother milk to the Indonesian economy by calculating its direct net food value plus the savings in national expenditures consequent to its use plus the cost of equivalent fertility reduction by clinical contraceptive means. As I make no effort to monitize the considerable contribution of breast feeding to intellectual and psychosocial development of the infant, nor its proven benefit to overal nutritional status, these calculations grossly underestimate the full value of mother milk to Indonesia,. Yet even then, lactating Indonesian mothers currently contribute a value of Rp. 327,6 milyard/$ 520 millions annually to the economy, a figure fully 10% of 1978 exports, 3.5% of the total national budget for 1980/81 and roughly 1.5% of the GNP.

How does Indonesia treat this valuable resource? Rather than protect and increase its production, diverse influences are acting to undermine and reduce maternal lactation threatening great social and economic losses to the country and incurring far greater expenses in imported infant food substitutes, need for health services, increased fertility and immeasurable costs in intellectual and physical development of future generations. Strong affirmative action by the government is needed now to avoid further loss of one of Indonesia's great natural resources: mother milk.

Mother Milk and its Value

How much milk do mothers make? Studies of lactating women from countries throughout the world have been published in several books (Jelliffe and Jelliffe, 1978), articles (Jelliffe and Jelliffe, 1978 summarized in table 1). There is remarkable uniformity between countries, with women producing over ½ liter perday in the first year, 1/3 liter daily in the second year and 200 cc (one glass) even beyond two years of lactation (Blankhar, 1968). Reports from a number of universities and nutrition

research units show Indonesian mothers are entirely comparable in lactation ability with women the world around (Blankhart, 1968; Rohde, 1974). Thus the estimated daily milk production shown in table 1, taken as the low end of the normal range, is a minimum figure for Indonesia. By this estimate a lactating mother produce 180 liters of milk for her baby in the first year and 110 liters in the second.

Interestingly, women interned in Japanese prison camps during World War II were able to nourish their infants adequately in spite of their own increasing severe malnutrition(William, 1973). Whereas adult malnutrition is completely reversible with refeeding, it is known that babies will suffer irreversible brain damage if severely undernourished. Thus, lactation is a remarkable nutritional resource protecting the baby during his most vulnerable period, even if his mother is not ideally nourished. Studies from the Academy of Nutrition in Bogor (now Puslitbang GIZI) among women of varying nutritional status showed milk production was normal in all women studied and volume was not affected by mothers diet or nutritional status (Blankhart, 1968). Growth standards of Indonesian children fed breast milk for the first 4 - 6 months are above international standards, offering further proof of the adequacy of lactation among Indonesian women (Rohde, 1974).

Interestingly, the oft heard complaint of inadequate milk production is found only in urban settings, usually in clinics where bottle milk is offered as an alternative. Numerous studies in rural areas have documented the inate ability of Indonesian mothers to lactate. Indeed, lactation failure is a rare finding in the village. A prospective study of 510 mothers in a poor Central Javanese village as recently as 1977 - -1979 showed not a single case of lactation failure (Hull, 1977).

Is the quality of Indonesian mother milk adequate? Numerous studies of milk protein, fat and carbohydrates show that not only do Indonesian mothers produce milk of the highest nutritional value (table 2), but perhaps of even more importance, this high quality is preserved even in mothers who are themselves undernourished. Studies on milk composition in Indonesia have shown no correlation between maternal nutrition and protein or sugar content of mother milk which remains normal regardless of maternal diet (Boediman et al., 1979) The mother is able to produce the best food for her infant during his most critical stages of growth, even if she herself has suffered from inaquate nutrition.

How long do Indonesian mothers lactate?

The age specific prevalence of lactation from several studies in rural and urban Indonesia are shown in Table 3. It is clear that most infants enjoy the benefits of mother milk well into the second year of life with weaning age often close to or beyond two years (Singarimbun and Manning, 1974; Popu-

lation Institute, 1980; Hull, 1975; Tan et al., 1970; Kardjati et al., 1978). The urban data, though indicating far better lactation than most countries, shows a disturbing trend to earlier weaning. (UNICEF/Ministry of health, 1979; Hull et al., 1976; Iman et al., 1979; Djumadias and Enoch, 1978). Furthermore, a substantial proportion of urban infants are only partially fed on mother milk, receiving bottle milk from an early age. It is well known that bottle milk does not supplement breast but rather replaces it: for each additional bottle feed given there is proportionally less breast milk produced (Jellife and Jellife, 1978). These mothers are therefore spending money on infant formula, reducing their own milk supply, exposing the child to the known dangers of bottle feeding including substantial increased risk of infectious and allergic disorders.

Thus, the rural Indonesian child receives mother milk for roughly twice as long as his urban peer. Due to the wide use of mixed feeding in urban areas (breast plus bottle) it appears that the urban child receives not only less duration of mother milk, but also substantially less quantity of milk during his limited time at the breast. The enormous economic and health costs of this seemingly minor social change are enumerated below.

What is the total value of mothermilk in Indonesia?

Total milk production in Indonesia is calculated from average daily milk volume and duration of lactation (tables 1 and 3) as shown in table 4. Annual milk production, if all Indonesian mothers follow the rural feeding pattern is 1,315 million liters. If all mothers are "modernized" to the urban pattern, production would drop to 582 million liters, or less than half. Taking 20% of Indonesia as urban we can reliably estimate the present 1980 mother milk production as 1,168 million liters or roughly fifteen times the milk produced by the entire milk cattle industry of Indonesia (Indonesian Central Bureau Statistics, 1980).

The gross value of this vast resource is estimated in table 5 by comparing prices of equivalent amounts of various milk products. Even if given only the value of dried skim milk, a byproduct of cheese and butter manufactured and used widely in the West as animal feed, Indonesian mothers produce a product worth roughly 150 million US dollars. Valued more appropriately at the price of infant formula (although no infant formula has as high nutritious or health promoting value as mother milk) the gross value of mother milk is some million US dollars or more.

What is the cost of production of mother milk?

The cost of production must be deducted to derive a net value to the economy. Physiologic studies show a 90% efficiency of coarse food calories to milk calories and a 50 — 60% efficiency for protein (Rohde, 1974).

In table 6 is shown the food costs of producing one liter of mother milk from

a diet of rice and tempe: roughly Rp. 55 per liter ($0.09). While the opportunity cost, or value of the time taken to breast feed, might be charged as a production cost as well, it has been shown that the cost of bottle feeding are far greater, including time to shop, prepare bottle milk, feed it to the infant and clean utensils. In addition, by breast feeding a mother can save inevitable costs of not only the milk itself, but also the expense of bottles, teats, cooking fuel, refrigeration and spoilage which contribute substantially to the cost of bottle feeding (Cameron and Hofvander, 1976; Greiner et al., 1979). Therefore, in calculating costs of breast milk I have attributed no time costs, considering that the opportunity and related costs of alternative feeding methods are even more expensive and therefore further enhance the relative value of mother milk.

The net value of mother milk calculated as its retail values less production costs is roughly Rp. 252 milyard ($ 400 million). In table 7 this approximate commercial value of mother milk is compared to other more standard economic figures such as government budget or items of international trade. Mother milk is worth roughly twice the entire 1980/81 Indonesian health budget, with a value to the economy close to that of exported rubber or coffee, or imported textiles or rice in 1978. Clearly mother milk ranks as a major national economic resource. Were the country to "modernize" to the extent of Jakarta or other major cities, reducing the weaning age accordingly, the loss to the economy would be over Rp. 126 milyard ($ 200 million), a figure that would have to be made up, to a large degree by imported milk.

The real values of mother milk

How great are the health benefits of mother milk?

The true value of mother milk far exceeds its commercial value, for it contains a myriad of immunologically active factors protecting the infant from infections, allergies, asthma and even death. Only 50 years ago in America the death rate among bottle fed babies was 9.5 times higher than among those breast fed, and that at a time when safe running water and electricity already served most homes (Wray, 1978). Recently in Chile (GNP $ 1200:1970-75) death rates were shown to be 2 - 3 times as high in bottle over breast fed babies, even in spite of the fact that bottle fed babies tended to come from wealthier families (Plank and Milanesi, 1973). Death rates among infants in Latin America in 1970 were 6 - 14 times higher in babies breast fed less than six months compared to those receiving mother milk beyond six months (Wray 1978). In a 1959 study in Punjab India, while 12% of breast fed infants died in the first year, 95% of bottle fed infants died (Wyon and Gordon, 1971). Clearly, the bottle is a dangerous instrument.

Studies throughout the world demonstrate far higher infection rates in bottle fed babies (Wray, 1978; Larsen and Horner, 1978; Cunningham, 1979). This is

true not only for developing countries where environmental hygiene is relatively poor, but even in the sterile environment of middle class America (Table 8).

Looking at diarrhea alone, fully $^1/_3$ of pediatric admissions to the largest pediatric unit in Jakarta, Rumah Sakit Cipto Mangunkusumo, are for diarrhea (Rohde and Northrup, 1976). Breast feeding among diarrhea cases age 4 - 12 months is only 8 - 16% (Gunn et al., 1979) while 65 — 80% of the Jakarta population of the same age are receiving breast milk (UNICEF/Ministry of Health, 1979; Djumadias and Enoch, 1978). (Table 9). Thus, the relative risk for diarrhea among bottle feeders is about 5 - 8 times those enjoying breast milk*. A decline in breast feeding would predictably lead to an increase of diarrhea by as much as five times, virtually overwhelming the health service. The Department of Health currently estimates that young children suffer 50 - 60 million episodes of diarrhea annually, 20 - 30 million occurring among infants age 0-2 years (Rohde and Northrup, 1976).

A reduction in numer of mothers breast feeding by only 25% could lead to a doubling of the total cases of diarrhea. A conservative estimate of the cost of treatment of a single case of infantile diarrhea is $ 1.5 (Rp. 1,000)**. The added cost to the health system could conservatively exceed 25,2 milyard (40 million dollars) or roughly 20% of the total Department of Health budget. This discounts entirely the costs of the inevitable deaths and the immeasurable cost of resulting malnutrition***. As breast feeding has been known to protect from respiratory illness (pneumonia, ear infection), food allergies, iron deficiency anemia, infantile obesity, asthma and other chronic ailments the estimable health benefits far exceed even those calculated above for diarrhea (Jelliffe and Jelliffe, 1978).

*This particularly high risk of diarrhea seen in bottle fed babies the world over is due to :

1) The deprivation of the bottle fed child of immunologically active agents in mother milk including : specific anti-diarrhea antibodies, viable cells that kill diarrhea germs and special factors that prevent germs from growing (lactoferrin, lysozyme);

2) The invariable contamination of milk feeding bottles with bacteria or other germs one recent study in Yogyakarta clinics showed over 80% of bottles being fed to babies contained thousands of bacteria in each drop of milk, (Suryono et al, 1980).

**This ranges from a Health Centre visit at Rp. 150 to hospital costs exceeding Rp. 100,000.

***This death rate from diarrhea is variously estimated between 0.5% and 2% depending upon both severity and access to treatment facilities. The Department of Health currently estimates over 500,000 diarrhea deaths among children aged 0-5 years annually in Indonesia. A doubling of diarrhea rates could double this figure. Numerous studies from Indonesia and abroad have proved that diarrhea has a major detrimental effect on nutrition, a child's growth being adversely affected in direct proportion to the frequency and duration of diarrhea. Indonesian health and nutrition authorities consider

diarrhea a major contributor to the existing high level of malnutrition still prevalent in the country indeed diarrhea is the only disease directly included in the National Family Nutrition Program, UPGK A rise in bottle feeding with subsequent rise in diarrhea would predictably exacerbate the level of malnutrition, already considered a major national health priority.

How great is the fertility reduction due to lactation in Indonesia?

Because traditional culture in many parts of Indonesia (e.g. Java) urges sexual abstinence throughout lactation, the fertility reduction attendant upon prolonged lactation, has been shown to be substantial (Singarimbun and Manning, 1974; Hull, 1975). However, let us consider the physiologic reduction in fertility alone, assuming no adherence to such traditional practices. This will give a conservative estimate of the fertility reduction associated with lactation -the real figure is surely higher.

Lactational amenorrhea and duration of lactation are shown in table 10. (About 5% of women will conceive before resuming menstruation but the vast majority, >90%, remain infertile until return of menses). In general a woman is protected for roughly 50 - 75% as long as she lactates, especially if lactation is frequent and bottle substitutes are not used. Since the average duration of lactation in rural areas is 16 - 26 months and average duration of amenorrhea is 13 - 19 months we can estimate a mean increase in protection from pregnancy of at least 12 months beyond the usual 6 - 8 week period of infecundity seen in non-lactating postpartum women.

In table 11 can be seen the net effect on fertility attributable to lactation. The current breast feeding patterns accounts for roughly 4,5 million couple years of contraception annually, roughly equivalent to the entire National Family Planning program which at the beginning of 1980 counted 5.5 million current users of all contraceptive methods country wide. This makes lactational amenorrhea the number one contraceptive in Indonesia ahead of the pill which is used by about 3.6 million. The cost per couple-protected-year of the BKKBN program is about Rp. 9450 or $ 15 (Hull et al., 1977). At this same rate, lactational amenorrhea contributes over Rp. 50,4 milyard or $ 80 million to the national economy in fertility reduction alone.

These are only some of the quantifiable benefits of mother milk. What price can be set on the death of a child? What is the cost of malnutrition and lifelong deprivation of full potential physical and intelectual growth? Proven psychological benefits of maternal-infant bonding associated with lactation, which appear to account for less juvenile delinquency and other social problems, cannot be expressed in economic terms. Indeed the estimated net value of mother milk of Rp. 327,6 milyard ($ 520 million) to the Indonesian economy (table 12), over 1%

of total GNP, is a conservatively low estimate.

Conservation of national resources : mother milk.

In spite of the obvious economic, social and health benefits of mother milk, Indonesia has done little to protect this valuable resource. Milk imports have more than doubled during the past five years alone to over 60.000 tons at a cost in foreign exchange in of Rp. 31,5 milyard ($ 50 million). The boom in the infant feeding industry is not a response to decline in breast feeding but rather a direct cause if it. Large budgets promote infant formula feeding as "modern", "health", "advised by your doctor" and most damaging, "the best thing for your baby if your own milk fails", insidiously undermining the self-confidence of Indonesian mothers. The decline in breast feeding is not physiological it is psychosocial, a clear result of modern marketing strategy by a profit-making industry.

While multinational firms have played a major role in the decline of breast feeding in many developing nations, Indonesia is unique in that its own national industry is the major promotor of infant formula. Paradoxically, this makes these companies relatively immune to the international pressures that have forced the multinationals to abide by a new strict code of ethics in marketing of infant foods. The Secretary of the UNPAG informed the author that the major Indonesian milk producer even declined the invitation of the UNPAG to join the meeting of industry, UN agencies, medical professionals and government officials held in Singapore in 1974 during which substantial protections for consumers were formulated (WHO/UNICEF, 1979). Honestly in advertising, no direct promotion to the public, package labelling standards and other issues were discussed. Although Indonesia sent a delegation to the meeting, the national infant food industry was not represented. To this day, promotion direct to the public, hospital and clinic free samples and use of government health clinics as retail outlets continues throughout much of Indonesia.

Perhaps even more shocking is the role of the medical profession in their acquiescence to the marketing strategy of milk companies. While patients depend upon health workers for objective unbiased advise and guidance, these same professionals often receive a commission for promoting or selling infant milk. The industry makes substantial monetary contributions to hospitals, clinics and some departments of pediatrics and provides extensive direct support for meetings and social gatherings. Given the unquestioned benefits of breast feeding for personal health it is hard to overlook the ethical conflict of interest of this industry — health professional relationship.

While WHO and Unicef have spearheaded international efforts to control marketing and distribution of infant milks, the World Food Program (WFP)

continues to supply dried milk in various forms for distribution through government MCH clinics throughout Indonesia. Envisoned as a food supplement and an incentive to bring mothers to these underutilized facilities, field observations show that these milk products often contribute to the decline in breastfeeding by replacing mother milk. While industry products are at least reliably packaged in tins, containing mixing instructions in Bahasa Indonesia and providing a standard measuring scoop, WFP milk products are dispensed in plastic sacs, closed by an elastic band without a single word or diagram explaining proper mixing and with no measuring instrument mixing and with no measuring intrument provided. The result is predictable: improperly mixed often heavily contaminated bottle feeds, a reduction in lactation, and a new level of dependency upon the health services for infant food supplies. As supplies are usually and often unreliable, the mother who depends upon such "free" milk is placing her child in severe jeopardy.

"What can we do? Its free" explained a high level government official who is personally aware and concerned about this problem. "How can I advise the government to refuse food when we are attempting to obtain far greater foreign government resources for our own nutrition programs? The policy makers don't understand, and furthermore, free milk increases clinic attendance so it looks good on the records. Against such odds, what chance has the mother, quietly following the wisdom and guidance or her own mother and mothers before her, to nourish her own child with the milk of her body?

Much can and should be done immediately to halt this erosion and loss of a major national resource. The establishment of the Commitee to Promote Breast-feeding, PP-ASI in 1977 and its expansion to eight branches throughout the country has done much to alert the medical profession to the values of breast milk and their role in its promotion. This organization, with UNICEF assistance, spearheaded the media campaign in Jakarta using TV, radio, newspapers and public posters to explain in lay terms the outstanding advantages of mother milk over infant formulas. Unfortunately this crash campaign is already past, once again leaving the infant milk industry an unfettered field for its continued marketing persistance. One stroke of the pen, one simple decision could change all this: in the words of the Joint WHO-UNICEF Meeting on Infant and Young Child Feeding, attended by representatives from all major infant formula companies in the world, "There should be no sales promotion including promotional advertising (i.e., mass media, personal visits) to the public of products to be used as breastmilk substitutes or bottlefed supplements and feeding bottles" (WHO/UNICEF, 1979) Such a regulation is in the best interest of the health and economy of Indonesia.

While Health Center waiting-rooms throught the land display new colorful

posters of attractive mothers suckling their infants, women still dutifully wait their turn to receive a free sachet of WFP milk or purchase a tin of infant formula at "special low price" inside the clinic, where calenders portraying the happy formula-fed baby stare down in approbation. Again, the WHO/UNICEF recommendations are clear: "Facilities of the Health Care System should never be used for the promotion of artificial feeding (WHO/UNICEF, 1979) A single directive by the Minister of Health should suffice.

Not only private industry but also foreign-aid should be subjected to the same regulations: "Artificial feeding should not be openly demonstrated in health facilities they (infant foods) should be labelled to indicate proper and safe home preparation". World Food Program officials have told me they have no budget to package or label their milk products, much less provide measuring devices: "That is up to the Indonesian government" they add. Why should a UN Agency providing "free" aid be immune from the controls guiding industry? After all, regulations are designed for the protection of the consumer and it is likely that the poor unsophisticated rural population, the target of WFP assistance, is in greater need of such protection than the urban middle class.

Some countries have taken it a step further: Papua New Guinea has made the sale of feeding bottles legal only with doctors/nurses prescription, highlighting the inherent danger of this instrument. Algeria has controlled the sale of infant formula like other pharmaceuticals it is potentially very dangerous to health and its use requires professional guidance. While these specific measures may be neither practical nor acceptable in Indonesia they illustrate the type of action urgently required in the best interests of the country.

A further area for immediate action is amongst the health professionals :

1. Ignorance and misinformation about breast milk could be overcome by a crash campaign re-educating everyone in the government health services about the unique importance of breast milk and the dangers of bottle feeding. They should actively promote breast and discourage bottle feeding. All schools of medicine and related training should have detailed curricula on lactation and promotion of breast feeding.

2. All obstetric units should immediately conform to WHO recommendations that "in order to facilitate breastfeeding, mothers should be permitted and encouraged to keep their infants with them in the same room or close to them and to practice on-demand feeding" (Wyon and Gordon, 1971). The outmoded system of newborn nurseries for normal infants should be eliminated in favor of the proven values of health to mother and child of "rooming-in".

3. Ethical committees of all professional societies should review current

practices of accepting support from infant formula companies examining the conflict-interest inherent therein. Support for meetings, parties, private vacations and other benefits place the professional in a compromised position. The cost of such promotion is passed on directly to the consumer, his patient. The normal leadership of the Philippine Pediatric Society in declining all industry support for its annual meeting should be lauded and copied in Indonesia. The added cost to the professional is small, the gain in moral stature and independence immeasurable.

Public promotion of breast feeding should be continuous, treating the lactating mother, the family planning acceptor, as a "Pahlawan Negara" (national hero).. Particular emphasis on teaching the merits of lactation to school children, both boys and girls, will help offset the perceived trend to modernity of the feeding bottle. Indeed the "trendy" Western woman is returning to breast feeding at a rate almost equal to the decline of lactation in the developing world.

Conclusions

While lactation is indeed a highly personal and human function, requiring no more justification than the direct benefits to mother, child and family welfare, it can also be viewed as well as a major national resource contributing to the economy, to the national goals of equity, health, good nutrition, small families and freedom from economic dependence on imports. Like other valuable resources, lactation will be threatened by diverse conflicting interests often at odds with national welfare. It is the right and responsibility of the nation to protect and promote this resource in the nation today and for generations to come.

TABLE 1 : *Daily Volume of Mother Milk (ml) by age of child (in months).*

	1 — 6	7 — 12	13 — 24	*25 above*
Western Countries (Jelliffe and Jelliffe, 1978a).	*750*			
Asian Countries (Jelliffe and Jelliffe, 1978b).	*500 — 700*	*400 — 600*	*300 — 500*	*200 — 450*
Bogor (Blankhart, 1968).	*400 — 820*	*360 — 520*	*190 — 460*	
Estiimate for Indonesia (Rohde , 1974).	*600*	*400*	*300*	*200*

TABLE 2 : Composition of Mother Milk (gm %)

	Protein	Lactose	Fat
Western Countries (Jelliffe and Jelliffe, 1978a).	1.2 — 1.4	6.8 — 7.1	3.9 — 4.5
Asian Countries (Jelliffe and Jellie, 1978b).	1.0 — 1.4	7.1 — 7.3	2.5 — 3.9
Indonesia (Boediman et al., 1979).	1.2 — 1.6	7.1 — 7.2	3.3 — 3.6

TABLE 3 : *Duration of Lactation in Rural and Urban Areas of Indonesia.*

		Percent Receiving Mother Milk							
RURAL	Age of Chlid (mos)	1 — 6	7 — 12	13 — 18	19 — 24	25 above	N*	Duration of lactation	
Mojolama (Singarimbun and Manning 1979).		100	98	87	74	25	2195	25.6	(mean)
Ngaglik (Population Institute, 1980).		98	96	80	60	51	472	26	(median)
Maguwoharjo (Hull, 1975).					46		3868	16.3	(mean)
Rural Indonesia (Tan et al., 1970)			90 — 99		40 — 75	15 — 50	450	18 — 24	(median)
Eeast Java (Kardjati et al., 1978).		99	93	84	74	30	2339	24 — 30	(median)
URBAN									
Jakarta Survey (UNICEF/Ministry of Health, 1979).		89	72	44	20	5	1253	14	(median)
UGM Women		65	21	3			297	7.5	(mean)
Yogyakarta Clinic (Iman et al., 1979).		44 — 75	8 — 32	6 — 10	0 — 2			7	(median)
Jakarta Survey (Djumadias and Enoch, 1978).		75	65				595	12	(median)
RURAL AVERAGE	%	99	95	85	65	35		24	
URBAN AVERAGE	%	75	60	25	10	0		12	

*N — number of children in study

TABLE 4 : *Annual Breast Milk Production by Indonesian women with Comparison of Rural and Urban Weaning Patterns*

	0 — 6	7 — 12	13 — 18	19 — 24	25 up
Rural (if all Indonesian Women follow Rural Pattern)					
Mothers with babies (millions)	5.250	4.935	4.738	4.688	4.643
Deaths during this age (millions)	315	197	050	045	069
Breast Feed (percent)	99	95	85	65	35
Breast feeding (millions)	4.885	4.500	3.985	3.000	1.600
Estimated daily production (ml)	600	400	300	300	200
Production over period (liters per mother)	110	72	54	54	48
Total Indonesia-wide Production (millions of liters)	537	324	225	162	77
TOTAL ANNUAL PRODUCTION million liters					1,315
Urban (if all Indonesian women follow Urban Pattern)					
Breast feed (percent)	75	60	25	10	0
Breast Feeding (millions)	3.700	2.842	1.172	464	
Estimated daily production (ml)**	500	350	250	200	
Production over period (liters per mother)	90	63	45	36	
	333	179	53	17	0
TOTAL ANNUAL PRODUCTION million liters					582

*Assumed Average duration of this group is 8 months

**Less than rural due to use of bottle milk

TABLE 5 : *Annual Gross Value of Mother Milk — 1980.*

Rural production	1,052 million liters
Urban production	116 million liters
Total annual milk	1,168 million liters
Equivalent to	140 million gm dried milk
Gross Market Value at Various Prices :	
At price of	Value in milyard of Rp or Million of US $
Dried Skim Milk $ 1000/ton (World Market)	88.2 (140)
Fresh cow milk @ $ 0.30/liter Infant Formula (local retail)	207.9 (330)
SGM $ 3.25/Kgm	283.5 (450)
Nestle $ 4.00/Kgm	355.95 (565)

TABLE 6 : *Nutritional Cost of Production of One Liter Human milk.*

	Calories	Protein	Rp. cost*
185 gm rice	665	14	37
45 gm tempe (fermented soy cake)	66	8	18
Efficiency of Conversion	0.9	0.55	
Human Milk	660 cal.	12 gm	Rp. 55 or $ 0.09

*US$1 = Rp. 620

TABLE 7 : *Net Value of Indonesian Mother Milk 1980 and Comparison with Indonesian Government Budget and Trade .*

	Rp. cost	US $ cost
Total liters produced 1,168 millions		
Total Cost of Production @ $0.09/liter	66,8 milyard	($ 106 million)
Net Value if priced as Infant Milk (SGM)	216,7 milyard	($ 344 million)
Net Value if priced as Nestle	289,2 milyard	($ 459 million)
Total Government of Indonesia Budget : 1980/81	7,200 milyard	($ 14,605 million)
Department of Health 1980/81 Routine plus Development	138,6 milyard	($ 220 million)
Exports 1978 : Rubber	451 milyard	($ 716 million)
Coffee	309,3 milyard	($ 491 million)
Tin	103,2 milyard	($ 286 million)
Import 1978 : Vehicles (125,000 cars/trucks 250,000 motor cycles)	436 milyard	($ 692 million)
Rice (2.6 tons)	425,2 milyard	($ 675 million)
Milk (35.000 tons)	37,2 milyard	($ 59 million)
Medicines	7,5 milyard	($ 12 million)
Mother Milk Production (net value)	252,2 milyard	($ 400 million)

TABLE 8 : *Relative Rates of Infection in Breast and Bottle Fed Babies*

	Relative Risk* of Bottle
U.S.A. : Diarrhea 1978 (Larsen & Homer)	13.6
Otitis Media 1979 (Cunningham, 1979)	2.5
Pneumonia 1979 (Cunningham, 1979)	5.1
Bahrain : Cholera 1979 (Cunn et al., 1978)	9.0
U.K. : Gastroenteritis 1936 - 1942 (Wray, 1978)	12.9
Respiratory (Wray)	1.7

TABLE 9 : *Risk of Diarrhea among bottle fed Jakarta babies compared to Jakarta breast fed babies*

	0 — 3	4 — 6	7 — 9	10 — 12
Percent of diarrhea cases receiving Mother Milk (Rumondang et al., 1979)	66	16	9	8
Percent of all children in Jakarta receiving Mother Milk (Unicef, 1979; Djumadias & Enoch, 1978)	90	80	75	65
Relative Risk Associated with Bottle	1.4	5.0	8.3	8.1

TABLE 10 : *Lactation amenorrhea in Indonesia-the time of physiologic reduced fertility resulting from lactation. Social patterns further reducing fertility are not included here.*

Rural :	Mean duration of Amenorrhea months	Mean duration of Lactation-months
Mojolama (Singarimbun and Manning, 1974)	18.7	25.6
Maguwoharjo (Hull, 1975).	12.9	16.3
Ngaglik (Population Institute, 1980).	12+	26
Urban :		
Yogyakarta (Hull et al., 1976).	3.5	7.5

*Relative risk is the number of cases appearng in 100 bottle-fed babies divided by the number of cases in breast fed babies from the same socio-economic environment over the same time period.

TABLE : 11 *Fertility Reduction in Indonesia attributable to lactation and comparison with Modern Contraceptives*

	Rural	Urban
Mean duration lactation (months)	24	12
Mean duration amenorrhea (months)	14	8
Mean protection increase* (months)	12	6
Mean number of women annually** (million)	3 95	0.99
Protection years (Population: 80% rural, 20% urban)	3.95	495
Total Protection Years From Lactation		4.5 million

Current users of Modern Contraceptives :	(millions of couple years)
IUD	1.6
Pill	3.4
Other methods	0.5

Source : National Family Planning Board - 1980

TABLE 12 : *Total Economic Value of Mother Milk — Indonesia 1980*

	Rp milyard	($ Millions)
Net Value of milk	252	(400)
Value of Health Service (diarrhe only)	25,2	(40)
Value in fertility reduction	50.4	(80)
T o t a l	Rp. 327.6 milyard	($ 520 million)

* Calculated as duration of amenorrhea minus two months, the normal post partum amenorrhea in non-lacating-women

** 5,250 — 315 (infant deaths) = 4935 women with surviving babies.

REFERENCES

1. BLANKHART D.M. : Measured food intakes of young Indonesian children. J. Trop. Pediatr. 8 : 18 - 21 (1968).
2. BOEDIMAN D, ISMAIL D, IMAN S, ISMANGOEN, ISMADI S.D. : Composition of breast milk beyond one year. J. Trop Pediatr. 25 : 107 - 110 (1979).
3. CAMERON M, HOFVANDER Y : Manual on feeding infants and young children-UNPAG 2nd ed. 103 (1976).
4. CUNNINGHAM A.S. : Morbidity in breastfed and artificially fed infants. II. J. Pediatr 95 : 685 - 689 (1979).
5. DJUMADIAS A, ENOCH M. : Comparison of breast feeding, weaning and nutritional status of infants in urban and peri-urban Jakarta. (in Indonesian) Proceedings of National Pediatric Congress, KONIKA IV Yogyakarta; 55 - 77 (1978).
6. GREINER T, ALMOTH S, LATHAM M.C. : The Economic Value of Breastfeeding. Cornell International Nutrition Monograph Number 9, 1979.
7. GUNN R.A. KIMBAL A.M. et al., Bottle feeding as a risk factor for cholera in infants. Lancet ii : 730 - 732 (1979).
8. HULL, T.H., HUL V.J., SINGARIMBUN M. : Indonesia's family planning story: success and challenge. Population Bulletin 32 :6 (1977).
9. HULL V.J. : Women, doctors and family health care : Some lessons from rural Java. Studies in Fam Plan 10 : 315 -325 (1979).
10. HULL V.J. : Fertility, socioeconomic status and the position of women in a Javanese village - Ph. D. Thesis; Australian National University 1975.
11. HULL V.J. KORDIRAN, SINGARIMBUN I : Family formation in the University Community. Population Institute Gajah Mada University 1976.
12. IMAN S, SADJIMAN T, BUDIMAN D, ISMANGOEN : Breast milk, weaning and child growth in: Breast Feeding; the Biological Option (Indonesian edition), eds. Soeharyono and Ebrahim. Yayasan Essentia Medica, Yogyakarta 1979; p. 109.
13. Indonesian Central Bureau of Statistis 1980. Jakarta.
14. JELLIFFE, D.B. and JELLIFFE, E.F.P. : Human Milk in the Modern World. (Oxford University Press, New York 1978a).
15. JELLIFFE D.B. and JELLIFFE E.F.P. : The volume and composition of human milk in poorly nourished communities. A review. Am J clin Nutr 31 : 492 - 215 (1978).
16. KARDJATI, KUSIN J.A. DeWITT C, SUDIGBIA I.K. : Feeding practices, nutritional status and mortality in preschool children. Trop. Geogr. Med 30 : 359 - 317 (1978).
17. LARSEN S.A., HOMER D.R. F : Relation of breast versus bottle feeding to hospitalization for gastroenteritis in a middleclass US population. J. Pediatr. 92 : 417 - 418 (1978).
18. PLANK S, MILANESI L : Infant feeding and infant mortality in rural Chile. Bull WHO 48 : 203 - 210 (1973).
19. POPULATION INSTITUTE : Unpublished analysis. Ngaglik rural study. Gajah Mada University, Yogyakarta 1980.
20. ROHDE J.E. : Human milk in the second year : Nutritional and economic considerations for Indonesia. Pediatr. Indones. 14 : 198 - 207 (1974).
21. ROHDE J.E. NORTHRUP, R.S. : Taking science where the diarrhea is in: Acute Diarrhea in Childhood, CIBA Foundation Symposium 42, 339 - 366 (Elsevier/Excerpta Medica/Nerth Holland, 1976).

22. RUMONDANG et al : Mother milk and diarrhea in: Breast Feeding — the Biological Option — Iman S, Sadjimin T, Boediman D, Ismangoen, Breast milk, weaning and child growth in: Breast Feeding the Biological Option (Indonesian editon) eds. Soeharyono and Ebrahim. Yayasan Essentia Media, Yogyakarta 1979; p. 102.

23. SINGARIMBUN M, MANNING C Fertility and family planning in Mojolama. Population Institute, Gajah Mada University, Yogyakarta 1974.

24. SURYONO D, ISMAIL S.D. SUWADJI, ROHDE, J.E. : Bacterial contamination and dilution of milk in infant feeding bottles. J. Trop. Pediatr. 26 : 58 (1980).

25. TAN M.G., DJUMADIAS et al., Social and cultural aspects of food patterns and food babies in five rural areas in Indonesia. National Institute of Economics and Social Research, 1970.

26. UNICEF/Ministry of Health. Communication and breastfeeding behavior in Jakarta. UNICEF 1979 (preliminary analysis).

27. UN protein Calorie Advisory Group Recommendations on policies and practices in infant and young child feeding and proposals for action to implement them. PAG Bull 5 : 1 - 24 (1975).

28. WHO/UNICEF : Joint WHO/UNICEF meeting in infant and young child feeding. WHO Geneva, 1979.

29. WILLIAMS C.D. : Nutritional condiition among women and children in internment in the civilian camp at Singapore. Proceedings of the Nutrition Society 5 : 127 (1946). Reprinted in Nutr Rev 31 : 539 - 361 (1973).

30. WRAY J.D. : Maternal nutrition, breastfeeding and infant survival. In Mosley WH ed. Nutrition and Human Reproduction, Plenum 1978; 197 - 229.

31. WYON J.B. GORDON J.E. : The Khanna Study. Harvard University Press 1971.