A Strategy for Acceleration of Progress in Combating Vitamin A Deficiency

Consensus of an Informal Technical Consultation

Convened by the United Nations Children's Fund (UNICEF) in association with:
The Micronutrient Initiative (MI)
The World Health Organization (WHO)
The Canadian International Development Agency (CIDA)
The United States Agency for International Development (USAID)
New York, 18–19 December 1997

Vitamin A GLOBAL INITIATIVE

Participants

Dr. Alfred Sommer (Chairman)
Johns Hopkins University School of Public Health, Baltimore

Mr. David Alnwick
Health Section, UNICEF, New York

Dr. Paul Arthur
VAST Project, Ghana, and London School of Tropical Medicine and Hygiene

Dr. Martin Bloem
Helen Keller International, Jakarta

Dr. Joanne Csete
Nutrition Section, UNICEF, New York

Ms. Nita Dalmiya
Nutrition Section, UNICEF, New York

Dr. Frances Davidson
Center for Population, Health and Nutrition, USAID, Washington, DC

Dr. Bruno de Benoist, Nutrition Unit, WHO, Geneva

Ms. Archana Dwivedi
Food Aid Centre, CIDA, Ottawa

Ms. Joyce Greene
Nutrition Section, UNICEF, New York

Ms. Dawn Liberi
Center for Population, Health and Nutrition, USAID, Washington, DC

Mr. Ernest Loevinsohn
Food Aid Centre, CIDA, Ottawa

Mr. Venkatesh Mannar
The Micronutrient Initiative, Ottawa

Dr. Meera Shekar
UNICEF, Manila

Dr. Clive E. West
Wageningen Agricultural University, The Netherlands

Dr. Keith P. West, Jr.
Johns Hopkins University School of Public Health, Baltimore

Dr. Olivia Yambi
UNICEF Eastern and Southern Africa Regional Office, Nairobi

CONTENTS

Summary

Vitamin A deficiency is a major contributor to child mortality. There is increasing evidence that it also raises significantly the risk of maternal death. Elimination of vitamin A deficiency as a public health problem must be a principal element of child survival and maternal survival programmes where the problem exists. The central place and stature of vitamin A programmes in maternal and child health and survival efforts need to be elevated beyond that of vitamin A for prevention of blindness alone.

There has been progress in many countries in combating vitamin A deficiency, but urgent action is needed to accelerate progress and to increase rapidly the number of countries that are bringing this potentially lethal disorder under control. Assessment of the problem can be a key to this acceleration in some countries. This report suggests some key assessment indicators and strategies to update earlier recommendations.

Vitamin A supplementation is a very reliable and effective way to combat vitamin A deficiency and is the programme strategy that can most rapidly be implemented on a national scale. Supplementation programmes enable rapid progress to be made against vitamin A deficiency but should not be regarded necessarily as short-term measures. They are best understood to have a minimum 5-10-year life — indeed, many developing countries have carried on vitamin A supplementation programmes for decades. Vitamin A supplementation of deficient children has been demonstrated beyond any doubt to be effective in reducing their mortality and illness. Supplementation protocols are well developed. Reaching children at the age of about 6 months in supplementation programmes is important for mortality and morbidity reduction.

Vitamin A fortification is a central strategy for vitamin A deficiency reduction in many countries and holds great promise for more extensive use in the near future. Breastfeeding support is a key element of reducing vitamin A deficiency among young children. Horticultural approaches have not frequently been shown to be rapid or cost-effective in achieving reduction of vitamin A deficiency but may be useful in the longer term as a complement to supplementation and fortification or for income generation.

About 30 countries are likely to meet the World Summit for Children goal of elimination of vitamin A deficiency as a public health problem by end 2000. The many other countries affected by this lethal public health problem should, at a minimum, by the year 2000 establish realistic plans of action and allocate resources to implement them. They should begin putting vitamin A programmes in place as soon as possible. Donor countries must be mobilised to put a high priority on support for programmes to combat vitamin A deficiency.

I. Introduction

Vitamin A is essential for the functioning of the immune system. Improving the vitamin A status of deficient children has been shown repeatedly to enhance their disease resistance capacity and thus reduce their mortality and illness from infectious disease significantly and at low cost. The elimination of vitamin A deficiency as a public health problem is a central element of improving the survival, growth and development of children and the well-being of children and their families. All persons have a right to good vitamin A intake.

Programme activities to reduce vitamin A deficiency are still often limited institutionally to blindness prevention programmes, and vitamin A deficiency is too readily regarded largely as a cause of ocular impairment. The ability to resist illness is reduced — and thus the risk of death increased — long before ocular problems occur in the vitamin A-deficient person. It is urgent that vitamin A deficiency take on a new "image" — that it be understood as a potentially lethal disorder and its reduction as an **essential element of child survival programmes**.

In part because of this underestimation of vitamin A deficiency as a contributor to mortality, the tools available to policy-makers and programme managers to reduce vitamin A deficiency and thus to improve child survival and well-being are underutilised and inadequately recognised. The goal of elimination of vitamin A deficiency as a public health problem by the year 2000 — adopted by heads of state and other high-level policy makers at the World Summit for Children in 1990 and reiterated at the International Conference on Nutrition in 1992 — is likely to be met in far too few countries.

The purpose of the informal consultation from which this statement emerged was:

- To articulate a clear consensus on a number of technical issues where lack of agreement may impede programme progress in combating vitamin A deficiency;
- To develop a strategy for acceleration of progress toward the elimination of vitamin A deficiency as a public health problem.

II. Benefits of adequate vitamin A consumption

A detailed accounting of the benefits of adequate vitamin A consumption and good vitamin A status is beyond the scope of this statement (see also, e.g., Sommer and West, 1996). It is useful, nonetheless, to note a brief summary of these benefits:

- Improving the vitamin A status of deficient children aged 6 months to 6 years dramatically increases their chances of survival. Risk of mortality from measles is reduced by about 50%, from diarrhoea by about 40% and overall mortality by 25-35%. Vitamin A is thus **at least as effective as immunization or oral rehydration in mortality prevention.** (The two are not, of course, mutually exclusive.)
- Improving vitamin A status of deficient children reduces the severity of infectious illness, especially measles and chronic diarrhoea, that they may suffer. Good vitamin A status is associated with reduction in the rate of hospital admissions and reduced need for out-patient services at clinics and therefore lower overall cost of health services.
- Recent studies suggest that preventing vitamin A deficiency of women during and before pregnancy greatly reduces their risk of mortality and morbidity around the time of childbirth, probably through increasing resistance to infection and lowering levels of anaemia.
- Vitamin A deficiency contributes to anaemia. Children and pregnant women whose vitamin A status is improved through fortification or supplementation have been shown to experience increases in haemoglobin concentration. Vitamin A deficiency impairs iron utilisation.

Improving the vitamin A status of deficient children has been shown repeatedly to enhance their disease resistance capacity and thus reduce their mortality and illness from infectious disease significantly and at low cost.

- Vitamin A is essential for normal vision and ocular function. Deficiency results in night blindness and other manifestations of xerophthalmia, including corneal destruction (keratomalacia) and blindness.
- Evidence is growing that adequate vitamin A consumption may result in other benefits, even in industrialized countries, including improved response to immunizations, reduction in birth defects, and prevention of epithelial and perhaps other types of cancer.

The elimination of vitamin A deficiency as a public health problem is a central element of improving the survival, growth and development of children and the well-being of children and their families.

Thus, increasing the vitamin A intake of children through diet or supplementation is **an essential component of a comprehensive child survival and development strategy** for populations where deficiency is likely, and ensuring adequate vitamin A intake of pregnant women should be seen as an essential **element of maternal health and survival programmes** where deficiency is likely.

III. Assessment of vitamin A deficiency

Many assessment criteria have been applied to the determination of whether VAD is a public health problem for a given population. In the last few years, it has become clear that some assessment criteria previously suggested (see WHO, 1996, e.g.) are difficult to apply or interpret on a population level or give results that are less precise or reliable than desired. It has also become apparent that vitamin A deficiency is widespread in developing countries, particularly those sharing similar environments. The informal consultation reviewed assessment criteria for vitamin A deficiency and made the following recommendations:

A. Ocular indicators: Ocular signs of vitamin A deficiency are associated with advanced stages of the condition. They are rare compared to the very vast problem of sub-clinical deficiency. The indicators already identified with clear cut-off points (WHO, 1996) — that is, conjunctival xerosis with Bitot's spots; corneal xerosis, ulceration or keratomalacia; and corneal scars — are useful. Another indicator that should be added to these is **night blindness in the last pregnancy,** with 5% proposed as a cut-off point for determining whether vitamin A deficiency is a public health problem, using a locally familiar term for night blindness where one exists. This is an indicator of vitamin A deficiency not only among women but also among young children in a given population. A recall of night blindness during the last pregnancy provides a low-cost, widely adaptable, non-invasive way to assess risk of maternal vitamin A deficiency that does not require highly trained technical staff. Recall of maternal night blindness can be added easily to a multi-purpose household survey, once the appropriate local term(s) for the condition are identified. In a population-based study in Nepal, women with XN during pregnancy had a mean serum retinol concentration (SD) of 0.72 (0.41) µmol/L compared to a level of 1.03 (0.39) µmol/L among non-night blind pregnant women ($p<<0.001$) (Christian et al., 1998). As this is an indicator without a long record of use in women, a history of maternal XN should continue to be used, where possible, with serum retinol and other biochemical or functional indices of vitamin A status in the community.

The central place and stature of vitamin A programmes in maternal and child health and survival efforts need to be elevated beyond that of vitamin A for prevention of blindness alone.

B. Biochemical indicators: The indicator of choice is less than 0.7 µmol/litre serum retinol; a public health problem exists when more than 20% of the population has serum retinol below this cut-off. Children **6-36 months** are a key group to evaluate against this criterion.

C. Dark adaptometry: Dark adaptometry is a useful approach for non-invasive assessment of early stages of vitamin A deficiency by objective physical criteria, and it merits more attention. There is an urgent need to accelerate research on and dissemination of this tool for population-level assessment of vitamin A status.

IV.
Evidence needed to trigger action

The expert consultation recognised that many countries do not have up-to-date national-level assessments of the prevalence of vitamin A deficiency and are unlikely to have them in the near future. The participants therefore considered the question of whether some proxy for national-level prevalence assessment of vitamin A deficiency could be used to trigger action where the deficiency is likely. A long list of "indirect indicators" was developed by WHO (WHO, 1996), including information on PEM, food consumption, morbidity, low birth-weight, immunization coverage, access to health services and socio-economic indicators.

Recommendation: A high infant mortality or under-five mortality rate (U5MR) — U5MR > 70 was proposed by WHO (1996) as a possible cut-off point — should be taken as an indicator of a likely vitamin A deficiency problem of public health importance. High mortality, preferably taken in conjunction with another indirect indicator of vitamin A deficiency (WHO, 1996), should lead governments and their partners to put in place a programme for control of vitamin A deficiency, including assessment of the problem, as part of a comprehensive strategy to reduce child mortality.

V.
Interventions to combat vitamin A deficiency rapidly and effectively

In view of the remarkable benefits of vitamin A and the savings that accrue from a reduced burden on health services associated with improved vitamin A status, policy makers and programme managers should focus on proven, rapid and effective strategies to combat vitamin A deficiency (see also West and Hautvast, 1997). The following conclusions were drawn about vitamin A strategies:

V. a) Supplementation

Supplementation as a strategy: Supplementation is a low-cost, highly effective means of improving vitamin A status of children and other population groups and is the quickest intervention to implement on a national scale. Countries wanting to make rapid progress in reducing vitamin A deficiency, particularly where the feasibility of fortification is low, should make vitamin A supplementation the centerpiece of their efforts. Studies that have demonstrated the effects of vitamin A on reduction of child death and illness are mostly based on supplementation of deficient children.

Vitamin A supplementation is a very reliable and effective way to combat vitamin A deficiency and is the programme strategy that can most rapidly be implemented on a national scale.

The idea that vitamin A supplementation is a short-term strategy that is appropriate until more sustainable approaches can be implemented is widely held and reflected in some policy statements but must be rethought. Vitamin A supplementation is a low-cost, sustainable strategy that has been in place and effective for decades in some developing countries. Policy-makers should be advised that vitamin A supplementation is not necessarily a short-term measure and may be a sustainable approach to vitamin A deficiency control. Supplementation should be integrated with existing programmes to the greatest degree possible. The integration of vitamin A supplementation with both routine and campaign-based immunisation has taken place in many countries.

Vitamin A supplementation should also not be regarded as a programme exclusively for resource-poor or remote populations. Daily vitamin supplementation of young children is widely practised in industrialised countries,

for example. Nonetheless, supplementation programmes must find ways to include the neediest groups who are less likely to have regular contact with health facilities and other services.

Supplementation protocols: The ideal vitamin A supplementation protocol would call for frequent low-dose supplements. The reality in many countries is that contact opportunities with young children and other vulnerable groups may be infrequent. The supplementation guidelines prepared by WHO, UNICEF and IVACG and recently issued by WHO (WHO, 1997) take this reality into account and are appropriate. That is, preventive supplementation with higher doses of vitamin A can follow this schedule:

Infants < 6 mo of age only if not breastfed (Breastfed children in this group should be protected by post-partum supplementation of their mothers.)	50,000 IU orally
Infants 6-12 mo of age	100,000 IU orally, every 4-6 mo
Children > 12 mo of age	200,000 IU orally, every 4-6 mo
Mothers (post-partum, lactating)	200,000 IU orally within 8 wks of delivery

The importance of beginning supplementation at the age of about 6 months deserves greater emphasis as many existing supplementation programmes report lower coverage for children under 12 months of age. **The mortality and morbidity reduction potential of vitamin A is very high beginning at about 6 months of age.** In some countries there appear to be lingering concerns about the safety of high-dose supplements for infants. Some transient side effects may be reported in this age group, but the mortality reduction impact of supplementation will far outweigh them. Thus, it is **recommended that vitamin A supplementation programmes for children include a contact opportunity at age 6 months,** when 100,000 IU should be administered, perhaps through existing immunization activities if their timing can be so adjusted. Such a contact would also provide an opportunity for other interventions, such as counseling and support for good complementary feeding.

In view of the remarkable benefits of vitamin A and the savings that accrue from a reduced burden on health services associated with improved vitamin A status, policy makers and programme managers should focus on proven, rapid and effective strategies to combat vitamin A deficiency.

Post-partum vitamin A supplementation of women has been adopted in many countries in recent years and is an efficacious, cost-effective and practical way of improving and protecting the vitamin A status of women after childbirth and young children. WHO has estimated the safe interval for high-dose supplementation of **breastfeeding** women to be 8 weeks from the time of childbirth.

More frequent low-dose supplementation should be a goal where feasible. Low-dose vitamin A does not need to be administered under supervision of the health system. Initial experiences with distribution through community-based institutions and very decentralised commercial outlets have shown promise and should be replicated. The introduction or expansion of daily (5,000 to 10,000 IU) or weekly (25,000 IU) supplementation of pregnant women with vitamins and minerals in many countries may provide another occasion for testing modes of more frequent vitamin A supplementation.

Toxicity of vitamin A: Toxicity from excessive ingestion of vitamin A is an extremely minor concern compared to the devastating effects of vitamin A deficiency. For children age 1-6 years, Bauernfeind (1980) estimated that prophylactic doses under 6,000-10,000 IU given each day over a period of months pose a negligible risk of toxicity. A single oral dose of 200,000 IU poses no significant risk for children over the age of about 6 months; for adults, a single dose of about 400,000 IU per day is generally well tolerated.

Children over age 6 months can receive two high-dose (200,000 IU) capsules separated by at least one month with virtually no risk, and IMCI and other programme guidelines should reflect this fact. Doses as low as 25,000 IU given to children under 6 months along with DPT vaccines have been shown to result in an increase in bulging fontanelle in up to 10% of children, but this condition resolves itself rapidly and has not been found to be associated with any undesirable long-term effects.

For men and non-pregnant women, a daily dose of up to 25,000-30,000 IU over several months carries negligible risk. For prophylaxis in pregnant women, the WHO/UNICEF/IVACG Task Force recommended doses not exceeding 10,000 IU daily or 25,000 IU weekly (WHO, 1997). Regular consumption of vitamin A-fortified foods does not usually provide more than 1000-1500 IU per day and thus fortification plus supplementation according to existing recommendations is not associated with risk of toxicity.

In conclusion, the doses of vitamin A recommended in this document, given together with EPI antigens, will not result in any significant increase in adverse reactions or side effects over and above those normally associated with child immunisation. Even in the situation in which a child is inadvertently given twice the recommended dose of vitamin A within a short period of time, any side effects which may occur will be minor, will resolve themselves without specific treatment, and will not have long-term consequences. Steps must be taken to reduce to an absolute minimum any risk that a young child would receive three or more successive high doses of vitamin A, which would be expected to pose a health risk.

V. b) Dietary approaches

V. b) 1. Breastfeeding promotion, protection and support

In much of the developing world, breastmilk is the most important food for children in the first year of life, though it is adequate alone to meet children's nutrition needs for about the first six months. The vitamin A content of breastmilk depends on the vitamin A status of the breastfeeding woman. Promotion, protection and support of breastfeeding, including through the Baby-Friendly Hospital Initiative, are important child survival measures independent of vitamin A, but are also essential components of vitamin A deficiency reduction programmes. Post-partum vitamin A supplementation is now known to be useful for women whether or not they breastfeed their infants, but successful and well supported breastfeeding extends this usefulness to the infant as well. Where women have adequate vitamin A consumption without post-partum supplementation, breastfeeding support is similarly essential for prevention of the deficiency among young children. **Support to breastfeeding is an essential component of vitamin A deficiency reduction programmes for young children.**

V. b) 2. Fortification

Fortification of margarine and products consumed by infants and young children has been the approach used in most industrialised countries for the last 70 years to prevent vitamin A deficiency. On average, for example, some 20-50% of the vitamin A supply in Europe comes from vitamin A added as a fortificant to food. Prior to the introduction of fortification, vitamin A deficiency was common. There is now growing experience with vitamin A fortification in developing countries following the long-running programme of sugar fortification in Central America. The success of salt iodisation in controlling iodine deficiency disorders has provided an impetus for vitamin A fortification in some countries. Fortification of maize with vitamin A is proving successful in Zimbabwe, and the first sugar fortification experience in sub-Saharan Africa is moving forward in Zambia.

Vitamin A fortification is a central strategy for vitamin A deficiency reduction in many countries and holds great promise for more extensive use in the near future.

Fortification is thus an effective and sustainable strategy to combat vitamin A deficiency and increasingly feasible in developing countries. Vitamin A fortification can now be accelerated more quickly from planning to implementation than was the case even in the relatively recent past. **The possibilities for vitamin A fortification should be more widely understood and exploited.** Public health and public nutrition authorities should work with the food industry to maximise the nutritional benefit of vitamin A fortification.

Ideally, a food consumed by all the population should be chosen as a vehicle for vitamin A fortification. That is why sugar fortification in Central America has been so effective. Sugar fortification is a promising approach in about 20 countries where vitamin A deficiency is a public health problem. Fortification of oils and flour can also cover large parts of the population in many countries. Fortification of milk processed in urban dairies is an option in some countries. In the absence of universally consumed, centrally processed staples, maximising the nutritional benefit of vitamin A fortification may entail focusing on foods for high-risk groups — such as complementary foods for young children — and additional measures to ensure access to these foods for the neediest families. Like supplementation, fortification should be designed to include high-risk groups to the greatest degree possible.

Some fortification experiences have blurred the distinction between dietary and supplementation approaches. Low-cost vitamin A-fortified powdered drink mixes have been tried with promising results in developing countries and exemplify a product that can be "delivered" through market mechanisms or in more targeted ways through health facilities or other service institutions. Innovation in fortification strategies to improve the access of fortified products to the poor should be supported.

V. b) 3. Other dietary approaches

Home gardens, particularly those based on dark green leafy vegetables, have been promoted as part of vitamin deficiency control strategies in many countries. In many parts of the world, including the Indian sub-continent, a very high percentage of vitamin A in the diet comes from horticultural crops. Relatively few of these home garden experiences have been evaluated as to their impact on vitamin A status, and only a few of these have demonstrated a positive impact. This is not surprising as it has now been shown that the bioconversion of pro-vitamin A in dark green leafy vegetables is less than one quarter of that previously thought (Castemiller and West, 1998). Home gardens may nonetheless be a useful complement to supplementation and fortification as part of a longer-term strategy for some populations and may be useful for income generation, but more intensive support to supplementation and fortification is needed to ensure acceleration of progress toward the year 2000 and beyond.

There has been progress in many countries in combating vitamin A deficiency, but urgent action is needed to accelerate progress and to increase rapidly the number of countries that are bringing this potentially lethal disorder under control.

A recent experience in Indonesia (HKI, 1997) included the promotion of egg consumption by children to improve vitamin A status and had very promising results. This may be a useful strategy in countries or regions where vitamin A-rich animal products or oils are affordable and accessible to families likely to be affected by vitamin A deficiency.

VI. Monitoring and evaluation

Strategies for monitoring and evaluating the impact of any kind of vitamin A activity should be planned and built into programmes from the earliest stages of programme design and implementation. Ideally, the impact of vitamin A activities, especially supplementation, on infant and child mortality should be evaluated, though this requires more effective and rigorous monitoring systems than those in place in many countries. Support should be given to countries to enable them to appreciate the morbidity and mortality impact of vitamin A supplementation and fortification, preferably through the strengthening of existing information systems.

Also at the **country level,** process indicators such as supplementation coverage or household-level purchases of fortified food products should be established and followed regularly. Guides to process indicators and their use in vitamin A programmes have been prepared (see, e.g.,

Micronutrient Initiative, in press). Supplementation coverage data have been very unreliable in many countries. Efforts should be made to introduce simple tools such as vitamin A supplementation records on immunization and other health cards or otherwise to improve the functioning of regular health information systems to improve the reliability and verifiability of coverage data. Sentinel site approaches may also be useful.

Serum surveys cannot be repeated frequently but are necessary in addition to coverage data and process indicators to ensure that activities are having an impact on VAD. Countries that have had activities in support of the goal of elimination of VAD as a public health problem by end-2000 should plan serum surveys for the year 2000 or 2001 to assess progress toward that goal. Regional centres of excellence for analysis of data from these surveys should be identified and supported.

Monitoring activities should include a focus on the highest-risk and hardest-to-reach groups. Surveys should over-represent these groups.

At the **global level,** there is a need for a dynamic score card on progress across countries and for regular reporting of some simple indicators of elimination of vitamin A deficiency as a public health problem. Indicators such as supplement coverage and percentage of the population regularly consuming vitamin A-fortified foods should be reported annually in regular publications such as *Progress of Nations* or *State of the World's Children* and perhaps more frequently in data bases made available on the Internet. Donor governments should support efforts to maintain a global data base and to implement innovative ways to disseminate this information and use it for effective advocacy.

VII. Revisiting goals

It was estimated in 1995 that about 17 countries were "on track" to reach the World Summit for Children goal of elimination of vitamin A deficiency as a public health problem by the year 2000 (UN and UNICEF, 1995). It is a mark of some good progress in a short period that a 1997 re-estimate of that figure came up with a total of 30 countries that have a high probability of meeting that goal (based on criteria such as >50% supplement coverage, at least twice yearly, among children or widespread access to fortified food; see Sethuraman et al., 1997), and those countries are to be congratulated. Nonetheless, there are many countries where vitamin A deficiency is a serious public health problem where no assessment of the problem has even taken place and/or there is no coherent plan of action to address it.

It is useful, therefore, to establish some benchmarks for the year 2000 and beyond for countries that will have difficulty reaching the original goal.

Recommended minimum targets:

By end 2000: All countries where populations are affected by vitamin A deficiency or likely to be affected (based on infant and child mortality criteria) should at a minimum have a detailed plan of action for elimination of vitamin A deficiency as a public health problem, with a resource mobilisation and allocation plan to support actions. Actions should be undertaken as soon as possible after plans of action are agreed to.

By mid-year 2002: All of these countries should have activities and monitoring systems in place and should have data on process indicators corresponding to key programme strategies.

By end 2005: All affected countries should have assessed or re-assessed vitamin A deficiency through nationally representative surveys using serum retinol or other more convenient criteria that may be better established by that time.

In addition, there are currently several divergent estimates of global prevalence of vitamin A deficiency (see, e.g., Sethuraman et al., 1997, and WHO and UNICEF, 1995). For purposes of establishing a global figure against which progress can be judged into the new century, it would be useful for WHO and UNICEF and other interested parties to examine the differing estimates and the methods by which they have been derived and to propose a consensus figure and a replicable assessment method for this purpose.

References

Bauernfeind J.C. The safe use of vitamin A: A report of IVACG. Washington, DC: IVACG, 1980.

Castenmiller J.J.M. and West C.E., 1998. Bioavailability and bioconversion of carotenoids. Annual Reviews of Nutrition 18:19-38.

Christian P., West K.P. Jr., Khatry S.K., Katz J., Shrestha S.R., Pradhan E.K., LeClerq S., Pokhrel R.P., 1998. Night blindness of pregnancy in rural Nepal — nutritional and health risks. International Journal of Epidemiology Apr;27(2):231-237.

Helen Keller International (Indonesia), 1997. The Central Java Project: Maternal postpartum vitamin A supplementation, increased intake of vitaminA-rich foods, and early childhood survival in Central Java. Jakarta: HKI Special Report series.

Sethuraman K., Dalmiya N., Mason J., Lotfi M., and Alnwick D., 1997. Progress in controlling vitamin A deficiency. UNICEF, Micronutrient Initiative, and Tulane University.

Sommer A. and West K.P. Jr., 1996. Vitamin A deficiency: Health, survival and vision. New York: Oxford University Press.

UNICEF, 1997. State of the World's Children 1998. New York: Oxford University Press.

United Nations and United Nations Children's Fund, 1995. Promise and progress: Achieving goals for children (report to the Secretary General on progress toward the achievement of the goals of the World Summit for Children). New York: United Nations.

West C.E. and Hautvast J.G.A.J., 1997. From 'whither' to 'wither' micronutrient malnutrition? The Lancet 350(supp 111):15.

WHO, 1996. Indicators for assessing vitamin A deficiency and their application in monitoring and evaluating intervention programmes. WHO/NUT/96.10, Geneva.

WHO, 1997. Vitamin A supplements: A guide to their use in the treatment and prevention of vitamin A deficiency and xerophthalmia, 2d edition (prepared by a WHO/UNICEF/IVACG Task Force). Geneva: WHO.

WHO and UNICEF, 1995. Global prevalence of vitamin A deficiency (WHO Micronutrient Deficiency Information System working paper no. 2 — WHO/NUT/95.3). Geneva: WHO.

Printed on recycled paper