# PROGRAMMATIC GUIDANCE BRIEF ON USE OF MICRONUTRIENT POWDERS (MNP) FOR HOME FORTIFICATION

HF-TAG Home Fortification Technical Advisory Group

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Prepared for HF-TAG implementation guidelines by:-

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## Home fortification with MNP: purpose and rationale

Home fortification is an innovation aimed at improving the diet quality of nutritionally vulnerable groups, such as young children. The term Micronutrient Powders (MNP) refers to sachets containing dry powder with micronutrients that can be added to any semi-solid or solid food that is ready for consumption. Home fortification with MNP aims to ensure that the diet, i.e. complementary foods and breast milk combined, meets the nutrient needs of young children[1].

Home fortification is recommended where complementary foods do not provide enough essential nutrients. This occurs where one or more of the following apply:

a) dietary diversity is low (due to limited availability or affordability);

b) complementary foods prepared for the small child have insufficient nutrient content and density (for example, watery porridges and foods with too low micronutrient content);

c) the bioavailability of micronutrients is poor due to absorption inhibitors in the diet (fibre, phytate, tannin), which is especially the case in plant-source based meals.

These conditions are widespread in developing countries where the diet is predominantly based on staple foods, contains few animal-source and fortified foods, and where tea consumption is common.

Home fortification increases micronutrient intake, which leads to an improvement of micronutrient status, and can therefore improve child health, including reduced morbidity and mortality, improved growth, cognition, appetite and other functional outcomes.

Other commodities for home fortification include small-quantity Lipid-based Nutrient Supplements (LNS)(<20 g/d, equivalent to ≤120 kcal/d) and other complementary food supplements, such as soy-flour with micronutrients, or malt powder with micronutrients, essential amino acids and enzymes. These commodities provide some other essential nutrients in addition to micronutrients, such as macro minerals (calcium, magnesium, potassium, phosphorus), essential fatty acids and essential amino acids. As these products are undergoing further development and as there is less programmatic experience with their use, this document focuses on MNP.

## History of MNP development

MNP was originally developed to provide iron and other nutrients required for treating nutritional anemia. This is because iron and folic acid tablets cannot be swallowed by young children and syrups had not been an effective intervention, likely due to poor acceptability related to a strong metallic taste, staining of teeth, bulky packaging, and the potential for over-dosing. For this reason, the efficacy of MNP was evaluated regarding its impact on anemia and iron deficiency. The product was formulated with three to five micronutrients, known to be necessary for treating nutritional anemia. The efficacy of MNP to treat anemia has been confirmed[2,3]. This means that the MNP mixture of bioavailable micronutrients was effective to treat anemia, and that the mode of administration, i.e. a powder that is to be mixed with food, was feasible.

While this research was ongoing, the potential of MNP as a means of also preventing other micronutrient deficiencies became apparent. Based on the knowledge that complementary feeding diets are often low in many micronutrients, formulations containing a much higher number of micronutrients, typically 15, were developed for preventing micronutrient deficiencies in general[4].

The concept of using MNP for home, or point-of-use, fortification to fill gaps in the diets of particularly infants and young children, is now widely accepted. This brief focuses on that purpose, i.e. using MNP to prevent micronutrient deficiencies in general, whereas the recent WHO guideline[2] is based on studies that focused on treating nutritional anemia.

## Formulation of MNP

Currently, most countries use an MNP formulation containing 15 micronutrients, which is designed to provide one Recommended Nutrient Intake (RNI) of each micronutrient per dose for children 6-59 months

old (see Table 1)[5]. WFP and UNICEF, as the main procurers of MNP, almost exclusively procure the 15 micronutrient formulation. However, where specific information is available that warrants adjusting the formulation, this could be done.

## Target groups

The target group should be those who are at risk of having an inadequate intake of micronutrients; evidence from multiple countries suggests that the period of highest vulnerability is six to 23 months of age when food variety and quantity are limited. Children 24 to 59 months of age may also be at high risk of inadequate dietary intake of some nutrients. When home fortification is being introduced in a population for a period of several years, children aged 24-59 months will have been exposed to MNP when they were 6-23 months of age. In that case, prioritizing the age range of 6-23 months may be a good choice. However, when the problem of micronutrient deficiencies is widespread, or the program will be implemented for a limited period of time, it might be better to target a wider age range.

Another target group for MNP can be school children, in particular those who receive school meals that have limited micronutrient content because they consist largely of staple foods, and protein and fat sources. The micronutrient content of MNP for school feeding should be age group appropriate. Preliminary experience from WFP with adding MNP to school meals by kitchen staff is that it is easy to implement and acceptance by pupils and staff is good. Sachets of MNP used for school feeding typically contain 10 or 20 dosages, which are cheaper per dosage compared to sachets containing one dose, due to lower packaging costs.

If increasing the micronutrient intake of pregnant and lactating women is desirable, this may best be done in the form of a capsule, rather than as MNP, because the relatively high dose of micronutrients that is required is more likely to change the taste of the food that it is added to, and limited programming experience shows that women may prefer swallowing a capsule instead of adding something to their food. The same may apply to adolescents.

TABLE 1. RECOMMENDED NUTRIENT INTAKE (RNI) OF EACH MICRONUTRIENT PER DOSE FOR CHILDREN 6-59 MONTHS OLD

| Micronutrients | Children (6-59 months) |
|---|---|
| Vitamin A µg RE | 400 |
| Vitamin D µg | 5 |
| Vitamin E mg | 5 |
| Vitamin C mg | 30 |
| Thiamine (vitamin B1) mg | 0.5 |
| Riboflavin (vitamin B2) mg | 0.5 |
| Niacin (vitamin B3) mg | 6 |
| Vitamin B6 (pyridoxine) mg | 0.5 |
| Vitamin B12 (cobalamine) µg | 0.9 |
| Folate µg[6] | 150.0 |
| Iron mg | 10.0 |
| Zinc mg | 4.1 |
| Copper mg | 0.56 |
| Selenium µg | 17.0 |
| Iodine µg | 90.0 |

## Frequency and duration of taking MNP

In principle, the frequency and duration of using MNP should be such that it contributes enough of required micronutrients so that the combination of the diet and the MNP meets the RNI (i.e. the daily recommended nutrient intake) for all micronutrients. When the sachets contain one RNI for each micronutrient, giving 90 sachets for a six month period (providing on average 15 per month, i.e. 3-4 per week) would result in an average dose of 50% of the RNI/d, 60 sachets for a six month period (10 per month, i.e. 2-3 per week) would be equivalent to 33% of the RNI/d, and 120 sachets for a six month period (20 per month, i.e. 4-5 per week) would provide 67% of RNI/d.

It is important to keep in mind that, for some micronutrients, the typical diet may contain 80% of the RNI, whereas for others, it may only contain 20-40%. In particular, the intake of vitamins and minerals that are most abundant in animal source foods

(vitamin B6, vitamin B12, zinc, iron) may be relatively low when these foods are consumed infrequently and in small amounts. The RNI has also been established for normal, healthy children, whereas children with micronutrient deficiencies or frequent illness may require a higher intake, above maintenance levels, in order to correct deficiencies and recover from illness[7]. And, finally, some minerals and vitamins are stored by the body, whereas for others, when intake exceeds needs, the excess is excreted rather than stored for periods when needs exceed intake. For nutrients that are not stored in the body, additional intake should be on an ongoing basis.

Since it will often not be possible to get a good estimate of the actual intake of specific micronutrients, and because this differs widely among micronutrients, among individuals, between seasons, and for other reasons, proxy indicators can be used to determine whether a population is likely to have micronutrient deficiency problems. Such proxy indicators can include the following: anemia prevalence (or, if available, prevalence of iron deficiency), which is also an indicator of micronutrient deficiencies more broadly; stunting prevalence; frequent infections; night blindness during previous pregnancy; lack of dietary diversity, in particular the consumption of animal source foods and fortified foods; inadequate nutrient density of typical complementary foods (this is common when young children eat from the family pot and do not receive foods specially prepared for them); and food insecurity.

As the upper tolerable intake level (upper limit, UL) for most micronutrients is well above the RNI, it is considered safe to consume an additional full RNI (as specified for the specific target group), i.e. one individual dose, every day (for more details, see Q&A section below)[8]. Therefore, the needs of the beneficiaries with the lowest intake should guide the decision on how many sachets to give for a period of time.

A target of, for example, 90 sachets per six months period, i.e. 180 sachets per year, can be distributed at different frequencies (e.g. 90 at once every six months, 30 every other month, 60 every four months). The choice should be guided by programmatic feasibility, such as integration with twice yearly high-dose vitamin A capsule distribution, or monthly growth monitoring. It is important to note that more frequent contact with beneficiaries increases understanding and acceptance (see section on behaviour change communication below), but such contacts do not necessarily have to be linked to the actual distribution of the MNP.

The message that is given about frequency of consumption can also vary. For example, in the case of 90 sachets every six months, the instruction can be to consume 3-4 per week and no more than one per day, or specific days of the week can be designated to be 'MNP consumption days'.

Furthermore, to spend resources most effectively, it is important to give priority to those individuals with the highest needs (i.e. at the greatest risk of micronutrient deficiencies). This can, for example, be done through geographic targeting to areas with the highest prevalence of anemia or stunting or the greatest food insecurity, or by linking the distribution, of MNP for young children to a social safety net program that targets the poorest. In this context, for those that are not targeted by the social safety net program but are also at risk of micronutrient deficiencies, MNP could be available through sales at a subsidized or commercial price. This combination of distribution strategies will reduce the burden on public delivery systems, while generating volumes of demand that can bring down the price of MNP for all.

In conclusion: Sachets should be made available throughout the year for the target groups, and should be no less than 60 / 6 months and no more than 180 / 6 months (no more than one sachet per day). A target of 90 sachets per six months period (equivalent to 15 per month, or 3-4 per week), which thus provides an additional intake of 50% RNI/d for each micronutrient, is likely to be reasonable for most situations.

Ultimately, the decision on which groups to target with how many sachets, over what period of time, and using which distribution strategies, should be based on the risk of micronutrient deficiencies, estimated micronutrient needs and available funds.

With regard to cost, even though product costs would increase with the provision of more sachets (e.g. by 50% when providing 90 instead of 60 sachets per six months period), it is important to note that the other program costs do not increase much when the number of

distribution contacts is the same, and that training, promotion and program monitoring and evaluation are unchanged.

## Key program components

Any program requires inputs, so that the activities needed to produce the expected outputs and outcomes can be implemented. For home food fortification with MNP, the following program components need to be in place: policies, packaging/labelling, production and/or supply, delivery system, quality control and behaviour change communication/demand creation. The expected coverage (reaching all eligible children) and adherence (using the MNP as promoted, e.g., by adding to foods just before consumption, appropriate frequency of use) will be achieved if effective activities are implemented in each of these components.

These aspects are discussed in detail in the Home Fortification Manual of the Home Fortification Technical Advisory Group, which will come out in 2012, but some specific aspects, as well as Q&A for frequently asked questions, are described below.

## Delivery system

It is also important to note that home fortification is best introduced as part of an infant and young child feeding strategy, because the primary aim is to improve nutrient intake from complementary foods by children as of six months of age. Thus, by providing guidance and counselling on exclusive breastfeeding for the first six months of life, and continued breastfeeding thereafter, together with complementary feeding combined with MNP, messages are best coordinated. Providing MNP can be an incentive to come to information sessions about infant and young child feeding. For this reason, contact points with the health care sector or community-based services that bring caretakers together to discuss health, breastfeeding and complementary feeding of young children are more appropriate channels for distribution and information dissemination about MNP than other points of contact with the family that do not include this focus, for example, the distribution of food rations or cash transfers for families.

## Behaviour change communication (BCC)

As with any new product, a number of barriers may exist to its acceptance and utilization by the target population. This may be particularly true for child feeding, where habits and traditions may strongly dictate what is acceptable and appropriate to provide to small children. The regular and appropriate utilization of MNP by families for their children requires them to be knowledgeable about why they should do so and that they know how to use the product. It also must be clear for whom in the family the MNP is intended, and families must be motivated to use it.

Successful communication requires the development of a strategy intended to change behaviour related to child feeding in the target population that takes into account factors that might impede or facilitate appropriate utilization (i.e., local contextual and cultural knowledge). This knowledge should be taken into consideration in all aspects of program design and implementation, including the local name selected for the product and package specifications, selection and training of those who will be responsible for delivery of the MNP and any promotional materials that will be used. Experience suggests that utilization of the principles of social marketing can increase the effectiveness of BCC campaigns. The BCC campaign should ensure that information sources are available and easily accessible so that questions and concerns related to MNP can be easily addressed. Public messaging, social marketing, and where relevant, commercial marketing should be harmonised to ensure that beneficiaries of MNP programs are not confused.

Training the media is also very important, so that they know what MNP is, who should use it, how it should be used and other aspects of MNP, so that they can write informative and accurate articles and support the messages of the BCC campaign.

## Monitoring and evaluation

It is important, to assess provision, coverage, and adherence, changes of Infant and Young Child Feeding (IYCF) practices and impact on micronutrient intake (dietary diversity and MNP), status and function. Information on provision, coverage, and adherence

should be collected regularly and, in particular, simultaneously with program initiation so that any issues that arise can be tackled immediately. Issues related to successful implementation, coverage and adherence should be resolved before assessing program effectiveness, i.e. before evaluating impact on biological outcomes such as micronutrient status, and morbidity. The issues identified, as well as how they have been addressed, need to be well documented.

The objectives for implementing a home fortification program should be clearly stated and program appropriate targets, consistent with program design, should be specified before implementation. Program monitoring and evaluation should be designed to ensure that key information that is collected to assess whether these targets are being met is included in a timely fashion.

## Questions and Answers

### 1. Can MNP be provided in combination with other fortified products and supplements, such as

a. High-dose vitamin A capsules (VAC)
b. Iodized salt
c. General food fortification of flour, oil, salt etc
d. Specially formulated products (LNS, RUTF, CSB+/++, WSB+/++, RUSF etc)

MNP can be safely provided in addition to twice-yearly high-dose VAC[9], iodized salt and general food fortification.

Combining it with other specially formulated products, such as RUTF (ready-to-use therapeutic food) for treatment of SAM (severe acute malnutrition), RUSF (ready-to-use supplementary food) or fortified blended foods such as WSB++ (wheat-soy blend) or CSB++ (corn-soy blend) for treatment of MAM (moderate acute malnutrition), or small-quantity LNS (lipid-based nutrient supplement, ≤= 20 g/d, providing ≤=120 kcal/d) is not appropriate, because those products already contain a similar or higher amount of micronutrients. In this case, one can recommend keeping the MNP for later, when the other products are no longer used.

### 2. Can the same amount of one sachet/d with the 15 micronutrient formulation be used by all 6-59 month old children, or should younger children use smaller portions?

All children, as of six months of age, can consume the full sachet once per day, because the RNI is actually designed to provide one RNI for children 6-59 months old[5].

### 3. Is it harmful when some children reach an intake above the Tolerable Upper Limit (UL) from the combination of the diet and the MNP for one or more micronutrients?

The Tolerable Upper Limit (UL) is the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals (97.5%) in the general population and applies to daily use for a prolonged period of time[10].

Furthermore, it is important to note the following about the UL:

- The UL is well above the RNI for most nutrients in the MNP
- It is not the level at which adverse effects have been observed – it includes a safety margin and is conservative
- The adverse effects that have been considered for setting the UL are associated with chronic intake, rather than with acute toxicity which occurs at much higher intake levels
- Where nutrient-nutrient interactions determined the UL (such as a higher zinc intake affecting copper status, or higher folic acid intake affecting vitamin B12 status), a concurrent increase of the intake of both micronutrients involved would allow a higher intake.
- The UL applies to normal, healthy individuals with adequate stores and no deficits to be corrected
- Recommended nutrient intakes for treatment of severe and moderate acute malnutrition exceed the UL for 3 nutrients that are also included in MNP (zinc, vitamin A, folic acid), which is considered safe and necessary for treatment[7].

Thus, there is no immediate safety risk when an individual's intake occasionally exceeds the UL. Furthermore, consuming more than the UL is very unlikely to occur for most micronutrients.

### 4. Have adverse events been reported from the use of MNP?

Diarrhea is sometimes reported by caretakers when children start using MNP, usually by <1% of the population. Whether this is related to the MNP itself is not known. When a new product or treatment is introduced, consumers may ascribe any health problems that concurrently arise to the product or treatment. Communications messages when introducing the MNP should say that mild diarrhea may occur but one should not worry, that it should be treated as usual with increased liquids, and that MNP consumption does not need to be interrupted. When the diarrhea is severe, or is bloody or with mucus, care should be sought as it would have been without concurrent use of MNP.

### 5. Can MNP be used in malarial areas?

In malaria-endemic areas, the provision of iron-containing MNP should be implemented in conjunction with measures to prevent, diagnose and treat malaria[11]. WHO will soon publish a specific guideline on the use of iron in malaria-endemic areas.

## Notes and References

[1] Note that children should be exclusively breastfed until six months of age and should be introduced to complementary food at six months of age.

[2] WHO. Guideline: Use of multiple micronutrient powders for home fortification of foods consumed by infants and children 6–23 months of age. Geneva, World Health Organization, 2011.

[3] De-Regil LM, Suchdev PS, Vist GE, Walleser S, Peña-Rosas JP. Home fortification of foods with multiple micronutrient powders for health and nutrition in children under two years of age. Cochrane Database of Systematic Reviews 2011, Issue 9. Art. No.: CD008959. DOI: 0.1002/14651858.CD008959.pub2

[4] De Pee S, Kraemer K, van den Briel T et al. Quality criteria for micronutrient powder products: report of a meeting organized by the World Food Programme and Sprinkles Global Health Initiative. Food Nutr Bull 2008; 29: 232-41.

[5] WHO, WFP, UNICEF: Joint statement. Preventing and controlling micronutrient deficiencies in populations affected by an emergency (2007). http://www.who.int/nutrition/publications/micronutrients/WHO_WFP_UNICEFstatement.pdf

[6] 150 µg folate is equivalent to 88 µg folic acid.

[7] Golden MH. Proposed recommended nutrient densities for moderately malnourished children. Food Nutr Bull 2009; 30: S267-342.

[8] Micronutrient supplements that are sold over-the-counter in developed countries and to the upper market segment in developing countries usually contain 1 RNI of each nutrient, and the recommended intake of these supplements is usually daily.

[9] Kraemer K, Waelti M, de Pee S et al. Are low tolerable upper intake levels for vitamin A undermining effective food fortification efforts? Nutr Rev 2008; 66: 517-25.

[10] Food and Nutrition Board, Institute of Medicine. 1998. Dietary Reference Intakes: A Risk Assessment Model for Establishing Upper Intake Levels for Nutrients.

[11] WHO. Guideline: Use of multiple micronutrient powders for home fortification of foods consumed by infants and children 6–23 months of age. Geneva, World Health Organization, 2011

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## HF-TAG

The Home Fortification Technical Advisory Group (HF-TAG) is a community of stakeholders involved in home fortification, comprised of members from the public, private, academic and non-governmental organization sectors. The initiative aims to build technical consensus on issues related to home fortification and to provide guidance on standards, guidelines and other resources to policymakers, non-governmental organizations, international organizations, corporations (manufacturers and suppliers), innovators/social entrepreneurs, academia and media. The group's mission is to facilitate implementation of well-designed and effective home fortification projects at scale, based on sound technical guidance and best practices, integrated into comprehensive nutrition strategies for children. Its vision is of a world without malnourished children.

## Partners involved in the production of this document

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