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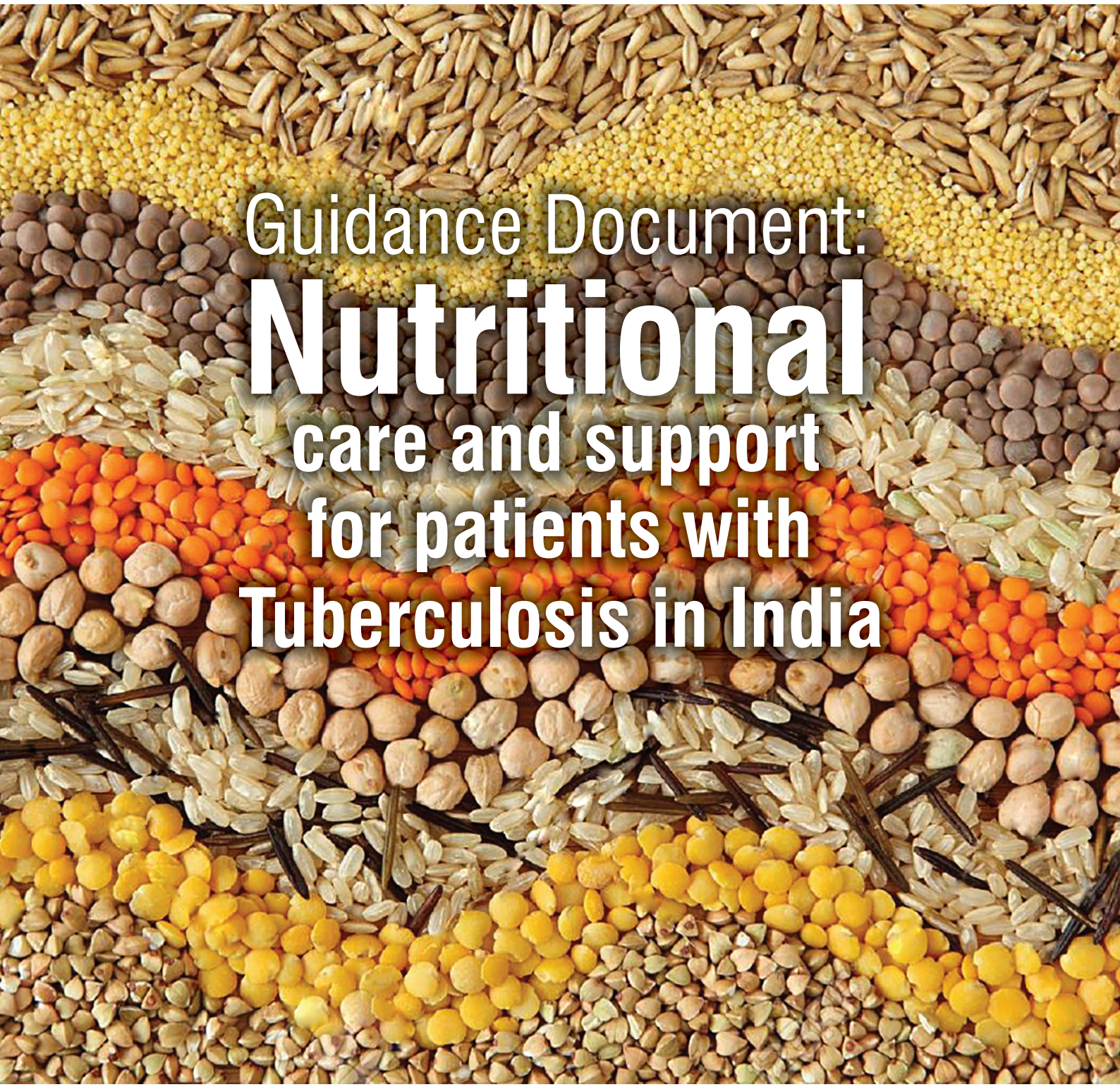

Guidance Document:
Nutritional care and support for patients with Tuberculosis in India

Central TB Division
Directorate General of Health Services
Ministry of Health and Family Welfare
Government of India, New Delhi

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Contents

Acknowledgements

The Guidance Document on Nutritional Care and Support for patients with Tuberculosis in India has been developed as the end-product of a series of deliberations and two national workshops. The first national workshop was organized by Central TB Division (CTD), Ministry of Health and Family Welfare (MoHFW), Government of India (GoI) with technical and organizational support from World Health Organization Country Office for India (WCO India) in August 2015 at New Delhi. The deliberations and workshop was to offer a platform for sharing various programmatic experiences in providing nutritional assessment and supplementation to TB and MDR-TB patients in seven states of India with recommendations on the way forward to formulate a guidance document for nutritional assessment and supplementation of TB patients in India based on the lessons learnt from the experiences in the seven states and respecting the regional variations in cultural and food preferences in India. The second national workshop was organized by Yenepoya University (YU) Mangalore, Central TB Division (CTD), Directorate General of Health Services (Dte.GHS), Ministry of Health and Family Welfare (MoHFW), Government of India (GoI) with technical support of representatives from World Health Organization Country Office for India, New Delhi (WCO India); National Institute for Research in TB (NIRT), Chennai; National Institute of Nutrition(NIN), Hyderabad; World Food Programme, New Delhi(WFP India); St. John's Research Institute, Bangalore; All India Institute of Medical Sciences, New Delhi; Christian Medical College, Vellore; National Institute for Research in Tribal Health; Lokmanya Tilak Medical College, Mumbai; State TB Cells of Kerala and Maharashtra; and State Health Resource Centre, Chhattisgarh in February 2016 at Mangalore. The funding support to organize this workshop was provided by Letzdream Foundation, New Delhi. It involved various stakeholders (including TB specialists, physicians, experts and researchers in nutrition, dieticians, programme managers, WHO RNTCP Consultants), extensive review of literature on nutrition and TB from India and global level including the WHO End TB Strategy and WHO Guideline: Nutritional care and support for patients with tuberculosis.

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This guideline is consistent with the WHO Guideline: Nutritional Care and Support for patients with Tuberculosis (2013), and aligned with RNTCP National Strategic Plan 2017-25. The technical and operational aspects in this guideline are intended to complement the existing RNTCP Technical and Operational Guidelines as well as the updated Guidelines for programmatic management of drug resistant TB (PMDT) in India. The principles and strategies for nutritional care and support in this guidance document are applicable to all tuberculosis patients seeking care in public as well as private sector across India.

Executive summary

Undernutrition and tuberculosis (TB) have a bidirectional relationship, which is especially relevant in the Indian context. Undernutrition is an established risk factor for progression of latent TB infection to active TB. Undernutrition at the population level contributes to an estimated 55% of annual TB incidence in India. TB leads to weight loss, wasting and worsening of nutritional status.

Studies on nutritional status of TB patients in India have shown high levels of moderate to severe undernutrition in both women and men. According to programme data, the median weights in men and women are 43 kg and 38 kg, respectively. Even lower weights have been documented in patients from rural areas, the poor and marginalized communities.

Undernutrition is a serious co-morbidity in patients with active TB in India, and increases the risk of severe disease, death, drug toxicity, drug malabsorption and relapse after cure. In the absence of nutritional support, undernourished patients with TB do get enmeshed in a vicious cycle of worsening disease and undernutrition, which can be detrimental and even fatal. Food insecurity in household contacts of TB patients in India increases their risk of developing active TB. This has serious implications, especially for contacts of patients with multidrug-resistant TB.

Weight gains in Indian patients without nutritional support have been in the range of 3–4 kg, which is suboptimal. There has been a paucity of research on the effect of nutritional support to undernourished patients on TB treatment outcomes. Significantly higher weight gain has been recorded in patients on macronutrient supplementation with reduced mortality, improved functional status, improved pharmacokinetics and faster sputum conversion.

In 2013, World Health Organization (WHO) released operational guidelines for nutritional care and support of patients with TB. These guidelines recommended nutritional assessment, counselling and support as integral parts of management of patients with TB, and suggested country-specific adaptation of the guidelines. The guidance document is based on these guidelines but has made India-specific adaptations related to criteria for hospitalization, expanding provision of nutritional support to patients with moderately severe undernutrition and drug-susceptible TB and addressing food insecurity in households affected by TB.

Addressing undernutrition and nutritional support to households with TB patients are in line with Sustainable Development Goals (SDGs 1, 2 and 3). Nutritional support to TB patients is consistent with the new End TB strategy, as nutritional support is an

important component of patient-centred care (Pillar 1), while addressing food insecurity as part of action on poverty constitutes a bold policy (Pillar 2).

The guidance document aims to provide technical guidance on the nutritional assessment, counselling and management of undernutrition (macronutrient and micronutrient) in adults and children with active TB in India. It also aims to provide operational guidance on the implementation of nutritional support for patients with TB in India.

Nutritional assessment of patients consists of eliciting a nutrition-oriented history and performing a nutrition-oriented examination, including anthropometric measurements of body weight and height. Nutritional status should be classified using body mass index (BMI) (for adults), BMI for age charts (for children aged 6–18 years), or WHO growth charts (for children under 5 years). In pregnant women, those with oedema or those unable to stand, the mid-upper arm circumference should be used to classify nutritional status. Anemia is common in TB patients and contributes to morbidity and poor functional status. Hemoglobin estimation should be performed at baseline in patients with active TB.

Nutritional counselling should be offered to all patients with active TB. The emphasis in counselling should be on consumption of a healthy balanced diet to achieve the desired energy and protein intake with three meals and three snacks, clarifying misconceptions and practices to be avoided such as consumption of tonics or expensive food supplements and promoting food hygiene and healthy cooking practices.

Patients with active TB require approximately 40 kcal/kg of ideal/desirable target body weight. This is a body weight corresponding to the desirable BMI of 21 kg/m^2 before the end of treatment. A protein intake of 1.2 to 1.5 g/kg of ideal/desirable body weight per day is recommended for patients with active TB. Patients also require intake of the recommended dietary allowance of micronutrients daily.

The recommendations of nutritional support envisage a community-based model of nutritional care and support for patients with TB. This includes provision of an enhanced ration for the patient and the family supplied by the public distribution system to ensure an adequate caloric intake, and an additional food basket designed to address the enhanced calorie and protein requirements of the patient. This basket consists of a cereal (including local millets), milk powder/groundnut/pulses and cooking oil, and is designed to supply around 1000 calories and 30–50 g proteins for adults and around 550–600 calories and 21 g proteins for children. Patients need to be provided 1 recommended dietary allowance (RDA) of micronutrients with a multivitamin preparation, and receive treatment for anemia, if present. Treatment

supporters and health-care providers will monitor patients for their overall condition and nutritional recovery.

The guidance document provides criteria for short-term inpatient treatment of patients based on BMI, presence of oedema, performance status, disease status and comorbidities to prevent a serious outcome like TB mortality. It also provides guidance for management of severe acute malnutrition in adult TB patients, comprising sequentially the phases of stabilization, rehabilitation and recovery. The importance of management of fluid and electrolyte disturbances and cautious feeding in the stabilization phase to prevent the re-feeding syndrome, is emphasized.

Implementation of the programme for nutritional support will require linkages and coordination between the departments and ministries of health and food and civil supplies to ensure access to the enhanced rations and food baskets for patients. Local governments can play a crucial role in planning, resource mobilization and implementation of nutritional and social support for patients, as seen in Kerala. Civil society organizations too can help in the organization, delivery and monitoring of nutritional support. The generic guidance provided in this document can be adapted to local contexts, opportunities and constraints and the patients' preferences, which may vary across India.

The programme of nutritional support will require training and capacity building of general health staff and key Revised National TB Control Programme staff in nutritional assessment, counselling and principles of nutritional support.

The key indicators that will be monitored in the implementation of nutritional support will be–the nutritional status of patients at diagnosis and end of therapy; indicators of access to nutritional support; and effect on programmatic outcomes like treatment adherence and mortality rates.

1. Introduction

1.1 Undernutrition and tuberculosis

Undernutrition and tuberculosis (TB) are closely linked co-epidemics in India (1, 2). Both are public health problems. In TB, as in many other infectious diseases, there is a bidirectional interaction between nutritional status and active disease (3). Undernutrition is associated with an increased frequency, severity and fatality of infections, including TB; while infections in turn lead to undernutrition. An estimated 40% of the Indian population has latent TB infection. Undernutrition also affects a third of the adult population. Undernutrition increases the risk of latent TB infection progressing to active TB(4). At the population level in India, undernutrition is the most widely prevalent risk factor for TB. An estimated 55% of TB incidence in India (or more than 1 million new cases annually) are attributable to the effect of undernutrition (5), which is significantly greater than those attributable to other risk factors like HIV (5%), diabetes (9%) or smoking (11%) (6).

The first three Sustainable Development Goals (SDGs 1, 2 and 3) deal with action on poverty, hunger and ensuring healthy lives and well-being of people. Action on chronic undernutrition and nutritional support to TB affected households are consistent with the SDGs and have a potential for a significant impact on TB incidence, especially in poor and marginalised communities.

"A population's nutritional profile is an important determinant of its TB incidence"(7).

"Ultimately, reduction of TB burden in India and its elimination will require improving the nutritional status of the community as a whole" (2).

Undernutrition is a widely prevalent comorbidity with potentially serious and even lethal implications for patients with TB in India, which needs to be addressed with nutritional support. In the last few years, a number of studies in different rural and urban settings have documented high prevalence of moderate to severe undernutrition in patients with active TB in India, in both men and women(8, 9). This has been confirmed by the data on weights in more than a million patients now available through the electronic case-based surveillance platform of NIKSHAY(2). It has also been observed that in the setting of poverty and food insecurity prevalent in TB patients, patients are unable to regain a normal weight, despite effective treatment (9, 10). There is increasing evidence that undernutrition in patients with active TB is associated with a two- to four-fold increase in mortality (9, 11, 12), with a five-fold risk of drug-induced hepatotoxicity(13). A suboptimal weight gain during treatment increases the risk of long-term relapse even after initial cure(14). Undernutrition has also been associated with malabsorption of key anti-TB drugs

(15, 16). Food insecurity and undernutrition in people in close contact of a patient with active TB (including in those of patients of multidrug-resistant [MDR]-TB and extensively drug-resistant [XDR-TB] increases their risk of developing TB (17).

Evidence suggests that nutritional interventions are associated with better outcomes in TB patients including reduced mortality(18, 19), improved weight gain and body composition(20), earlier sputum conversion(21), improved pharmacokinetics of key drugs(22), improved functional status and adherence to therapy(18) .

According to WHO, “Because of the clear bidirectional causal link between undernutrition and active TB, nutrition screening, assessment and management are integral components of TB treatment and care” (23).

The above statement is from a WHO guideline for nutritional care and support for patients with TB which has focused on the need to address undernutrition as a co-morbidity in patients with active TB (23). This guideline outlined broad principles of nutritional care and support, recommendations for management of undernutrition in specific population groups and types of patients and suggested that these need to be adapted to different country settings.

1.2 End TB strategy

In the new End TB strategy, Pillar 1 addresses integrated patient-centred care; Pillar 2 calls for application of bold policies and supportive systems; while Pillar 3 addresses the need for intensified research and innovation(24). In countries like India, where undernutrition is a common and potentially serious comorbidity in TB patients, nutritional support would be a significant step forward in implementing patient-centred care as well addressing comorbidities of patients with TB. Improving food security of the patient and the family is a bold policy which addresses social determinants of TB, and this could form an important part of the Social Action Plan designed to address the issue of high burden of TB in marginalized communities like tribals in India. There is scope for basic, clinical as well as implementation research under Pillar 3 related to nutritional interventions as part of TB treatment and prevention strategies.

1.3 Need for programmatic guidance on nutritional support

Overall, there is need for a guidance on the nutritional requirements of children and adults with active TB, on the assessment of nutritional status, counselling of patients with TB and undernutrition, and guidance on management of undernutrition to improve outcomes of patients with TB in India. There is also a need for scientifically

acceptable and operationally feasible guidelines for implementation of nutritional support under programme conditions in the country. This guidance document has been prepared with the objective of meeting these needs. This is primarily intended for use by the RNTCP but is also a generic document of relevance to other health-care providers in India and also to other stakeholders including administrators, funding agencies and policy makers who are involved in design, implementation of public health programmes for nutrition and social security in India. The document is a step forward in the attempt to link the RNTCP with nutrition-related programmes and social assistance schemes.

2. Objectives and scope of the Guideline

2.1 Objectives of the Guideline

- To provide guidance on nutritional assessment and counselling of patients with active TB and their contacts in India
- To provide guidance on management of undernutrition (micronutrient and macronutrient) in patients with active TB in India
- To provide operational guidelines for implementation of nutritional support to households with patients with active TB in India.

2.2 Scope of the Guideline

This guideline covers the following population groups, target audience, health-care settings and key clinical issues.

2.2.1 Population groups

- Children with active TB in India
- Adults with active TB in India, including pregnant women.

These guidelines apply to both children and adults with active TB regardless of site (pulmonary and extrapulmonary), treatment history (new or previously treated) and drug susceptibility. It also applies to patients with TB-human immunodeficiency virus (HIV) coinfection. A separate national guideline exists for a detailed discussion of HIV-specific issues. This guideline also discusses briefly the dietary management of patients with active TB and important comorbidities with nutritional implications, like diabetes.

2.2.2 Target audience

- Healthcare providers in the public and private sectors at all levels, with special focus on providers at primary- and secondary-care level
- Programme managers in TB control programme and organizations involved in design and implementation of nutrition-related programmes.
- Health administrators, especially at the local self-government level.
- Information material developed as a supplement to this document would be useful to patients.

2.2.3 *Key clinical issues covered*

- **Nutritional assessment**
  - Clinical assessment of nutritional status – nutrition-oriented history and nutrition-oriented examination
  - Anthropometric measurements in children and classification of nutritional status using WHO recommended cut-offs
  - Anthropometric measurements in adults and classification of nutritional status according to ranges of BMI appropriate for Asian populations
  - Use of mid upper arm circumference for classification of nutritional status in patients who are unable to stand or in whom BMI is inappropriate (pregnant women, patients with oedema)
  - Clinical and nutritional indicators of need for inpatient care (red flags)

- **Nutritional counselling**
  - Concept of healthy balanced diet
  - Understanding the impact of TB on nutritional status and importance of nutritional recovery in patients with TB
  - Advice on increasing energy intake of diet by using locally available nutrient-rich food
  - Understanding foods and practices to avoid, and clarifying myths and misconceptions including expenses on costly fruits, costly tonics, commercial food supplements and IV fluid therapy
  - Understanding the role of physical activity in strengthening muscles and improving appetite

- **Nutritional management**
  - Recommended energy, protein and micronutrient intake in patients with active TB
  - Management of moderate to severe undernutrition in patients with enhanced family PDS ration and a food basket for the patient
  - Management of severe undernutrition requiring hospitalization – initial stabilization phase and rehabilitation phase.
  - Micronutrient supplementation in patients with active TB.

2.3 Outcomes and indicators

2.3.1 *Direct nutritional and patient-important outcomes*

- Improved nutritional intake
- Improved anthropometric measures and nutritional recovery at the end of treatment
- Improved functional status

- Improved health-related quality of life

2.3.2 Clinical outcomes

- Reduction in TB related mortality
- Reduction in rates of adverse drug events
- Reduction in rates of relapse.

2.3.3 Programmatic outcomes

- Case notification rates
- Reduced default rates.

The guidance document development process is detailed in Annexure 1.

3. Background

3.1 Overview of TB and nutrition in India

3.1.1 Magnitude of the TB problem in India

TB continues to be a major public health problem in India, and results in a high burden of morbidity and mortality. India has 17% of the world's population, but contributes about a quarter (2.8 million) of the global annual burden of new cases(25) . The rates of TB mortality are still significant and revised estimates suggests that mortality due to TB continues to be high in India – with an estimated 480,000 deaths annually (25).

TB in India affects poor families and communities disproportionately, with a 4 fold higher prevalence in those with a low standard of living index compared to those with a high standard of living index (26). The burden of TB mentioned above has very significant social, economic and health related implications for such patients, families, and communities affected by TB(27). The social consequences include the problem of stigma and discrimination, (particularly for women), interruption of schooling of children with subsequent dropouts. The economic impact due to loss of wages due to absenteeism, indebtedness with mortgaging or loss of assets may be long-lasting. This economic impact can lead to worsening of food insecurity in households with members with TB, and this can increase risk of development of TB in contacts (17).

3.1.2 Magnitude of the problem of undernutrition in adults and children

Good nutrition is essential for individuals to lead a healthy and productive life and is a pillar central to the development of a nation. India continues to face a large burden of undernutrition in both children and adults, which has an enormous impact on morbidity and mortality. Undernutrition in children is measured by calculating rates of underweight (low weight for age), stunting (low height for age) and wasting (low weight for height), while in adults undernutrition is usually classified using the body mass index (calculated by dividing weight in kilogrammes by the square for the height in metres).This is primarily due to suboptimal dietary intakes with deficits involving both macronutrients (calories, proteins) and micronutrients (vitamins and minerals). Data from the erstwhile National Nutritional Monitoring Bureau suggests that there is a deficit of calories, protein, and micronutrient intake in different age groups, which is marked in the case of women, adolescent boys and girls(28).

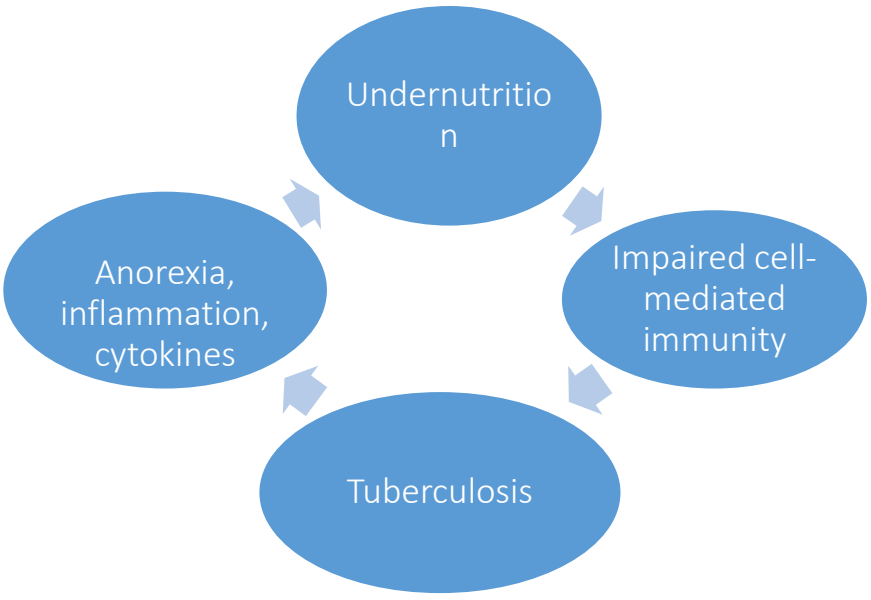
Over the past few decades in India, there has been a significant decline in rates of severe undernutrition and wasting in children. However high proportions of underweight and stunting in children continue to be noted in successive national

surveys. Micronutrient deficiencies are also highly prevalent. In the National Family Health Survey-3 for example, forty three percent of children under five were underweight, 48% were found to have stunting, and 75% of children between 6 months and 5 years were anaemic (29). With regard to adults, one third of both adult men and women were found to have evidence of chronic undernutrition, with a BMI less than 18.5 kg/m^2 in the National Family Health Survey of 2005-6(29). The proportion of undernourished adults was higher in those in the 15-19 age groups, those in rural areas, in women, in those belonging to the scheduled castes and scheduled tribes, and in those in the lower quintiles of income(29).

There have been a number of initiatives to address the problems of undernutrition in India, with varied coverage and success. These relate to attempts to improve complementary feeding practices in children, improve coverage of immunisation and basic health services, supplementary feeding programs for children under 5 years, school going children, and pregnant women. The Food Security Act also provides for a minimum entitlement of food grains at highly subsidised rates to a large part of the population.

3.2 TB–nutrition Interaction – a vicious cycle of malnutrition and disease

Fig. 1: The vicious cycle of undernutrition and TB



Undernutrition can lead to progression of latent infection to TB. TB worsens undernutrition, which in turn increases the severity of TB disease. This is the vicious cycle of worsening disease and worsening undernutrition that needs to be addressed with nutritional support.

3.2.1 Effect of TB on nutritional status

TB is a disease classically associated with wasting, which occurs because of 3 mechanisms (30, 31). The first is decreased intake because of anorexia and its severity correlates broadly with the severity of clinical disease. TB increases the basal metabolic rate because of fever, although this increase is offset by the decreased energy expenditure due to decreased activity before the clinical improvement starts as a result of treatment. Finally TB causes protein catabolism with a resultant negative nitrogen balance, with muscle breakdown under the influence of the acute phase response.

In India TB occurs more often in the poor who are likely to have chronic undernutrition, food insecurity and more likely to encounter delays in initiation of treatment. In such patients TB worsens the already poor nutritional status.

Box 4.1 mentions the available data on dietary intakes, nutritional status and weight gain in patients with active TB in India. The available data suggests that dietary intakes are lower than those recommended for the age group, that Indian patients with TB are severely underweight at the initiation of treatment, when compared to the reference weights considered normal for Indian men and women (60 kg for men and 55 kg for women), and that weight gains are suboptimal. These mean body weights suggest that men and women are on average 28-30% below their respective reference weights. However nutritional recovery is possible with an adequate balanced diet, as was seen in patients in the sanatorium group in the Madras trial, who received an adequate diet in terms of calories and proteins. The weight gain in these patients was 1.6-2 times that in the home group who were on the usual inadequate diet (21).

The nature of weight gain is also important, and the aim of nutritional support should be to restore the lost lean body mass. Increase in weight due to increase in fat mass will not improve functional status. However it has been seen that patients whose intake of calories and proteins are normal, can regain lean body mass in a linear manner during TB treatment (32)

Box 4.1: Data on dietary intake, nutritional status and weight gains in TB patients in India

1. **Dietary intake**

Study in HIV positive patients with/without TB: 1546-2016 calories (Recommended population norm=2400 calories) (8)

2. **Nutritional status of adult patients with active TB in India**

a. **Data from NIKSHAY**: (2)

Median weights in men= 43 kg

Median weights in women=38 kg

b. **Large cohort from rural central India**: (9)

Median weights in men = 42 kg, Median BMI in men=16.0 kg/m^2

Median weights in women= 34.1 kg, Median BMI in women=15.0 kg/m^2

53% of patients with MDR-TB under the PMDT had a BMI of less than 18.5 kg/m^2

3. **Weight gains in patients in India**

a. In the absence of nutritional support:

RNTCP cohort: Mean weight gain =3.22 kg (10)

Non-RNTCP cohort(Rural central India) Mean weight gain= 3.9 kg (9).

With nutritional support e.g. provided in the Madras trial (21)

Men: 7.8 kg (sanatorium treatment group) vs. 5.5 kg (domiciliary treatment group)

Women: 11.0 kg (sanatorium treatment group) vs. 4.8 kg (domiciliary treatment group)

Prevalence of TB in India is higher in the lower socioeconomic status groups who are also more likely to have food insecurity. With the low baseline weights and suboptimal weight gain, many patients with active TB in India may not achieve nutritional recovery and are likely to be underweight at the end of treatment.

Patients with active TB also suffer from micronutrient deficiency, esp. iron and folate, vitamin A, zinc, vitamin D (33-35). These micronutrient deficiencies are important as they can impair the cell mediated immune responses (e.g. zinc, vitamin D), anemia can impair quality of life and physical function. Seventy three percent of adults with active pulmonary TB in rural India had anemia, while in 20% the anemia was severe (9). The levels of some of the micronutrients can also be depressed by the acute phase response associated with active TB and can normalise at the end of treatment (36). Anti-TB drugs can also result in micronutrient deficiencies. For example

isoniazid administration can cause pyridoxine deficiency, and rifampicin can induce metabolism of vitamin D, and lower its levels(37) .

3.2.2 Effect of nutritional status on risk and outcomes of active TB including drug-resistant TB

Undernutrition impairs cell mediated immunity which is critical for protection from active TB. Undernutrition is the most widely prevalent risk factor for development of TB in India and is a major driver of the TB epidemic in India contributing to around half of annual TB incidence in India. Undernutrition in a patient with active TB is strongly linked to a number of adverse outcomes, and this deserves greater attention(38).Undernutrition can impair cell mediated immunity and increase the severity of TB disease (39). Moderate to severe undernutrition increases the risk of death related to TB and this is consistent in adults and children, in patients with/without HIV infection and in patients with drug susceptible as well as drug resistant TB(12). A weight of < 35 kg was associated with a nearly 4 fold risk of death in South India compared to weights more than 35 kg (40). The nutritional status of patients is a strong predictor of treatment success in patients with drug resistant TB. In a recent study in a cohort of 330 patients with XDR-TB, the strongest predictor of unfavourable outcome was a weight less than 50 kg at the start of treatment (41). Undernutrition is also a risk factor for development of drug induced hepatotoxicity, which is a major side effect of anti-TB therapy, and this has documented in a number of studies in India(13, 42, 43). In one recent study, the risk of drug induced hepatotoxicity was 5 times higher in patients with a BMI less than 17 kg/m^2 (13). Drug induced hepatotoxicity canlead to treatment interruptions and default. Nutritional status can also influence drug pharmacokinetics and lower levels of some drugs like Rifampicin have been documented in undernourished patients in India (15, 16). Undernutrition at diagnosis and inadequate weight gain during treatment, was associated with a 2- 4 higher risk of relapse in a trial (14). There is risk of TB among contacts of TB patients and food insecurity and undernutrition among contacts can increase this risk substantially (17) . The weight gain in the initial few months of treatment has been noted to predict treatment outcomes.. A weight gain of fiver percent after completing 3 months of treatment was associated with good outcome among patients with multi-drug resistant who were underweight before treatment (OR 2.1; 95% confidence interval [CI], 1.05 to 4.4)(44) Therefore nutritional support should aim at a weight gain of approximately 5% of body weight during the initial intensive phase of treatment.

Box 4.2: Effect of undernutrition on outcomes in TB

Effects on disease :	Increased severity of disease Increased risk of death
Effects on treatment:	Delayed sputum conversion Risk factor for drug induced hepatotoxicity Malabsorption of rifampicin Reversion of positive cultures in MDR-TB
Effects on long-term outcomes:	Increased rate of relapse
Effects on contacts:	Increased incidence in undernourished contacts

3.2.3 Effect of nutritional interventions on outcomes in patients with TB

The effect of nutritional interventions on nutritional, clinical, and patient-important outcomes has been a neglected area of TB research. According to a recent systematic review on the effect of nutritional supplementation on outcomes in patients with TB, *there has been insufficient research in the form of randomised trials on the effect of macronutrient and micronutrient supplementation, to either confirm or exclude a beneficial effect of nutritional supplementation on outcomes in patients with TB (45)*.

This conclusion needs to be interpreted in the light of the poor nutritional status and food insecurity in patients with TB in India. There are a number of methodological concerns with the evidence reviewed in this systematic review. In severely underweight patients, where the effect of such interventions would be most apparent, a randomised control trial of nutritional supplementation would be unethical. Similar interventions in mild and moderately undernourished patients with TB reviewed in a Cochrane review have been characterised by limited number of studies of small size, variable nature and quantum of nutritional support, paucity of direct nutritional and patient important outcomes like amount of weight gain , quality of life, performance status and return to work (45). The total number of subjects in which the effect of macronutrient supplementation on TB mortality has been studied is for example only 567 (45). The possible benefits of nutritional support are summarised in Box 4.3. In trials involving HIV negative patients there was a 80% relative risk reduction for death in the group receiving macronutrient supplement (Risk ratio for death in the supplemented group was 0.18 (95% CI : 0.02, 1.48), which however did not attain statistical significance because the study was underpowered (45). The available data

suggests that nutritional support has been associated with earlier sputum conversion (21, 46), improved muscle strength(20) (18), improved pharmacokinetics of rifampicin in HIV positive subjects(22), and enhanced adherence to therapy(18).

Box 4.3: Reported effects of nutritional support in patients with active TB

1. **Improved weight gain**. Weight gains 1.6–2 times higher in group given adequate diet in Madras trial (21).

2. Decreased mortality in HIV negative patients was seen in two randomised controlled trials in the group given macronutrient supplement (RR =0.18, 95%: Confidence intervals : 0.02, 1.48)(45)3. **Decreased rate of unfavourable outcome**. In an observational study from West Bengal, patients who received nutritional support had a 50% reduced risk of unsuccessful treatment outcome compared to those who did not receive nutritional support (Risk Ratio: 0.51, 95% confidence intervals : 0.30-0.86) (47) .

4. **Shorter time to sputum conversion**: In the Madras study which was a randomised controlled trial, patients in the sanatorium group had a shorter time to sputum conversion(3 months vs. 4 months), and higher rates of sustained microbiological cur(21)Shorter time to conversion also seen in a RCT from India (18)5. **Increased muscle strength** was seen in 2 randomised control trials (18, 20). **Improved adherence to therapy and reduced rates of default** in programmatic setting in Africa, India (18, 48).

A recent study in programmatic conditions evaluated the association of nutritional support with favourable outcomes in 171 patients with TB who were living below the poverty line and were provided monthly rations (rice, pulses) compared to 400 patients who were not given nutritional support. The supplemented group had a substantially lower rate of unfavourable outcome (9% vs. 21%, p<0.0001). On multivariable analysis, a reduction of 50% was seen in the rates of unfavourable outcome(Risk ratio 0.51, 95% confidence intervals : 0.30, 0.86)(47).

3.3 Nutritional requirements (macronutrients and micronutrients) in patients with active TB

The nutritional requirements of TB patients can be considered in terms of their energy requirements, macronutrients (carbohydrates, protein, fats) and micronutrients (vitamins, minerals, and trace elements).

3.3.1 Energy requirements

The energy requirements of patients with active TB, varies with their age, gender, their activity levels as in persons without active TB. The requirements of energy in a patient with active TB can be divided into the energy requirements appropriate to their age, gender and activity levels, the additional requirements in view of the active TB disease, and the energy requirements for recovery of nutritional deficit.

For estimation of the energy requirements patients with TB can be considered to be following a sedentary lifestyle, at least in the initial few months of treatment. The average requirement for energy for a sedentary adult is estimated to be 37 kcal/kg/day (man 39 kcal/kg/day and woman 35 kcal/kg/day) (49). This calculation assumes that the body weight is in the normal range.

The additional requirements of energy in view of active TB disease are uncertain. A study in male patients with TB in India documented a 14% rise in their basal metabolic rate (50). Also in patients with active HIV disease an additional energy requirement of 10% has been recommended and we recommend the same in the case of patients with active TB (51). When this additional requirement is added to the average recommended intake, we arrive at a figure of approximately 40 calories/kg/ body weight per day.

Finally we have to consider the energy requirements for recovery of nutritional deficit. This will vary between patients depending on the severity of wasting and undernutrition. In patients with active pulmonary TB in India, given the distribution of weights recorded in the programme, a significant proportion of patients are likely to have moderate to severe undernutrition. The goal of nutritional support would be to achieve nutritional recovery in these patients, so that the patients attain their target (desirable) body weight.

Note that these requirements above, are based on the actual body weight. Although there are rules of thumb to estimate the desirable/ideal body weight, this is best determined by a calculation of the weight which will correspond to the ideal BMI. WHO considers the range of BMI from 18.5- 24.9 kg/m^2 as normal. However in developed countries, a BMI of 18.5 -20 is considered as marginal, while a BMI or more than 20 kg /m^2 is considered as adequate nutrition, as in the Malnutrition Universal Screening Tool (52). A WHO/FAO suggested an optimum median BMI at the population level of21-23 kg/m^2. Based on these considerations we suggest that the minimum acceptable weight be the one which corresponds to the BMI of 18.5 kg/m^2 , which is the lower bound for the normal range of BMI. However the desirable body weight would be the one which corresponds to the desirable/ideal BMI of 21 kg/m^2. A simplified field chart that allows health care providers to estimate the desirable body weight based on the measured height of the patient is mentioned in Annexure 9. This chart enables the estimation of the desirable body weight without the use of any calculation in field situation.

Box 4.4: Example of calculation of minimum acceptable or desirable body weight at the end of treatment (calculated to achieve target BMI of 21kg/m^2)

A young woman with pulmonary TB has a weight of 38 kg and a height of 152 cm. or 1.52m. What should be her minimum acceptable body weight or her desirable body weight at the end of treatment?
Her current body mass index = weight in kg/(height in m)^2= 38 /$(1.52)^2$.
Using a calculator we find that 1.52^2 is equal to 2.31. Her current BMI is therefore 38/2.31 = 16.45 kg/m^2

Since BMI = weight/ (height in m)^2 ; on rearranging this equation we get:
Body weight = BMI x (height in m)^2.

Desirable body weight = Desirable BMI x(height in m)^2
The weight corresponding to the desirable BMI of 21 kg/m^2 = 21 x 2.31= 48.5 kg.
The weight corresponding to the BMI of 18.5 kg/m^2=18.5 x 2.31 = 42.7 kg.

This patient should therefore gain at least 4.7 kg from her current weight of 38 kg to achieve the minimum acceptable BMI of 18.5 kg/m^2, and around 10.5 kg to achieve the desirable BMI of 21 kg/m^2

A nomogram to estimate the desirable body weight corresponding to the patient's height is available in the annexure 9 (Bhargava A, Bhargava M. manuscript submitted for publication)

Box 4.4 offers an example of the calculation of the desirable body weight to be achieved by the end of treatment, and therefore an estimation of the amount of

weight gain to be achieved during treatment. The median weights of Indian patients suggest that they have a weight of 10-20% on an average below the minimum acceptable or desirable, in those who are moderately undernourished. As discussed earlier in the section 3.2.2., a weight gain of more than 5% of baseline body weight would be desirable in the first 2 months of therapy. In those with severe undernutrition, the loss of body weight is likely to be even higher. It would be desirable in the interests of early return to work that the weight and the lean body mass is regained in the first 2-4 months of therapy. We suggest therefore that a desirable rate of weight gain would be in the 2.5-5% per month in those with moderate undernutrition and about 5% per month in those with severe undernutrition. In the example given in the box above, it would take about 2-3 months to regain body weight to a 'minimum acceptable' weight at the regain rate of 5% per month, or 5 months at a regain rate of 2.5%. For regaining a 'desirable' weight, it would take 5-6 months at the regain rate of 5% per month, or 10-12 months at a regain rate of 2.5%.

To achieve a weight gain of 1 kg, an excess of 7500 calories of intake over expenditure is required. To achieve a weight gain of 5-10 kg in the first 3-6 months, then an excess of around 37500-75000 calories over the patient's expenditure, would be required in the first3-6 months. For practical reasons, a single point estimate of the time required can be taken, this is an average value of 4 months; then, the additional energy requirement would be 312 -625 kCal/day, or 7-15 kCal/kg /day This would require an additional 312 -625 calories per day, over the usual recommended intake, which can be met with the additional nutritional support offered. Two important caveats are to be noted with this high intake: first, it may not be possible for a sick person to eat so much initially, and small frequent feeds should be tried while avoiding overenthusiastic feeding. The appetite of the patient provides a good guide, and with its improvement with effective therapy in the initial phase, patients with severe undernutrition should be allowed to eat as much as they desire. Second, as recovery occurs, it is very important that patients do not remain completely sedentary, and engage in some physical activity (such as house chores and walking) as tolerated, since it helps build muscle mass and excess fat deposition should be avoided in the regained weight.

3.3.2 Carbohydrate requirements

The proportion of carbohydrates in the diet recommended is 55-75% of total energy intake, and this is derived from intake of cereals, pulses, roots and tubers and vegetables. Carbohydrates are major sources of energy and patients can consume them during meals as well in snacks between meals to increase their energy intake. It is important to emphasize that the intake of complex carbohydrates (as found in low glycemic index foods) and adequate dietary fibre are essential.

3.3.3 Protein requirements

The requirements of protein would be 1.2-1.5 g/kg ideal body weight per day. The higher requirement of protein is in view of the metabolic stress related to the active infectious disease. Proteins should comprise around 10-15% of the total energy intake. A technical explanation for the calculation of the protein requirement is mentioned in Annexure 7.

In the example quoted in Box 4.4 a daily protein intake of 51 -64 grams per day, would be required if we target the weight corresponding to the BMI of 18.5 kg/m^2. If we consider the desirable weight as 48.5 kg corresponding to the BMI of 21 kg/m^2, then the protein requirement would be in the range of 58-73 gms per day.

Proteins in the diet can be of animal or plant origin. Proteins of animal origin like milk, eggs, and meat have relatively higher proportion of essential amino acids and are therefore considered as of higher biological value. However these may not be taken because of cultural, religious or economic considerations. Eggs have high quality protein and are cheaper than fish, meat. A mixture of vegetable proteins from cereals and pulses is complimentary and can represent an adequate mix for dietary purposes in those who are vegetarian. True vegans who do not consume milk are uncommon in India, and milk and milk products can be also a good source of high biological value protein in vegetarians in India, who do consume these.

3.3.4 Fat requirements

These can comprise 15-30% of total daily energy intake. Fats are present in oils, nuts, milk and milk products, meat. Most cereals and pulses have low fat concentrations, except bajra and Bengal gram (around 5%). Groundnuts have around 40 percent fat, apart from being a good source of protein.

Fats and oils are dense in calories as each gram yields 9 kcal. In patients with reduced intakes like patients with TB, the addition of oil, ghee and nuts to the diet can help achieve the goals of energy intake.

3.3.5 Micronutrients

The recommended daily allowances of vitamins, minerals for Indians has been determined. These daily allowances can be obtained if the patient has an diet adequate in quantity and quality, with recommended intakes of the basic food groups- cereals and pulses; vegetables and fruits; milk or eggs or meat; oils, fats, nuts. However nutritional surveys have shown that in the general population, the intake of some of these ingredients of a balanced diet are suboptimal in India especially pulses, fruits, milk. These deficits are likely to be even commoner in TB patients who have reduced appetites, and are also likely to be poor.

We recommend that provision of 1 RDA of micronutrients as a supplement in view of the micronutrient deficiencies present in TB patients, their anorexia as well as the likelihood of limited food diversity. The approximate quantities of these micronutrients is mentioned in Annexure 8. There is no evidence that TB patients benefit from mega-doses of any micronutrients.

We recommend screening of TB patients for the presence of anemia, which is very common in these patients as mentioned earlier. Iron and folic acid tablets can be added to the micronutrient supplement after 2 weeks of starting Anti-TB therapy.

3.3.6 Nutritional requirements in pregnant and lactating women with TB

Pregnant and lactating women have additional requirements of energy, proteins, folic acid, calcium and iron, in addition to the enhanced requirements related to active disease and nutritional recovery. Pregnant women need an additional 300 cal, 15 g protein, 400 micrograms of folic acid, 1000 mg of calcium and 38 mg of iron per day. Lactating women require about 400-550 extra calories per day, 18-25 g additional protein, additional amounts of vitamin A.

Take home messages

TB and Undernutrition interactions

TB can lead to undernutrition and which in turn leads to increased risk and severity of TB.

TB and undernutrition can generate a vicious cycle of worsening disease and undernutrition**,** which needs to be addressed with nutritional support.

Nutritional status of TB patients in India

There is high prevalence of moderate-severe undernutrition in patients with active TB in India, with median BMI in the range of 15.0-16.5 kg/m^2 in adults. More than half of patients with MDR-TB are undernourished(BMI <18.5 kg/m^2).

Dietary intake of calories in patients with TB in India are inadequate and their weight gain is suboptimal. The average weight gain is in the range of 3- 4 kg in adults in India, in the absence of nutritional support.

Effects of nutritional status on outcomes in patients with TB

Undernutrition is linked to a number of serious outcomes related to the disease, treatment.

- Disease: Increased severity, Higher mortality
- Treatment: Increased adverse effects (liver toxicity), malabsorption of drugs like rifampicin, increased relapse after cure, delayed sputum conversion.
- TB transmission in household: Increased risk of TB incidence in undernourished contacts

Effects of nutritional support on outcomes in patients with TB:

Research has been limited and is complicated by methodologic and ethical issues. Available evidence suggests

- Improved weight gain, muscle strength and quality of life.
- Reduced mortality.
- Shorter time to sputum conversion and greater sustained microbiological cure.
- Improved adherence to therapy.

Dietary requirements in patients with active TB:

The goal of nutritional support is to restore body weight in the desirable range, with emphasis on regaining lost lean body mass.

- **Energy requirements:** Approx. 40 kcal/kg of desirable body weight. Aim for 3 meals and 3 snacks to achieve desired intake in the undernourished.
- **Protein requirements:** 1.2 -1.5 gm/ideal body weight. Use animal foods if possible, esp. eggs, milk and milk products. Mixture of cereals and pulses also nutritionally adequate if given in adequate quantity.
- **Fats:** Same requirement as general population. Use to increase calorie density of food.
- **Micronutrients:** Same requirement as general population. However TB patients are deficient in micronutrients and may be unable to attain desired intake because of anorexia, lack of access to desired food quality and diversity.

One daily allowance in the form of a multivitamin supplement is recommended.

4. General principles of nutritional care and support

4.1 WHO guideline for nutritional support

WHO released a Guideline for Nutritional Support of TB patients in 2013 which summarized the existing evidence as presented in a Cochrane review (53), outlined key guiding principles for providing nutritional care and support and formulated recommendations for nutritional support(23). As mentioned earlier, the Cochrane review referred to insufficient research in the form of randomised controlled trials, on the effects of nutritional supplementation in patients with active TB. The reviewers added that the "food supplementation would plausibly have its biggest effect in highly food-insecure or emergency settings which are not reflected in these trials."

WHO guidelines formulated some key guiding principles (23). The guideline clarified that "a guiding principle in health is a rule that has to be followed, or that may be desirable to follow, and cannot be proved or contradicted, unless propositions are made that are even clearer….A guiding principle reflects a set of values that contextualize the provision of care in programmatic settings. Such values cannot be subjected to formal research but reflect preferences regarding public health approaches and goals"(23).

Box 4.1: Nutritional care and support – WHO guideline

The five guiding principles for providing nutritional care and support as an integral part of TB care and prevention mentioned in WHO guideline are as follows

1. All people with active TB should receive TB diagnosis, treatment and care according to WHO guidelines and international standards of care. When malnutrition is identified at the time of TB diagnosis, TB is considered a key causal factor that needs to be addressed.
2. An adequate diet, containing all essential macro- and micronutrients, is necessary for the well-being and health of all people, including those with TB infection or TB disease.
3. Because of the clear bidirectional causal link between undernutrition and active TB, nutrition screening, assessment and management are integral components of TB treatment and care.
4. Poverty and food insecurity are both causes and consequences of TB, and those involved in TB care therefore play an important role in recognizing and addressing these wider socioeconomic issues.
5. TB is commonly accompanied by comorbidities such as HIV, diabetes mellitus, smoking and alcohol or substance abuse, which have their own nutritional implications, and these should be fully considered during nutrition screening, assessment and counselling.

Table 4.1 gives a summary of the broad principles and recommendations of the Guidance document for nutritional care and support for patients with TB in India, based on adaptation of WHO guideline for nutritional care and support for patients with TB (23).

Table 4.1: Recommendations for nutritional care and support – WHO guideline

Patient or population group	Patients with mild- Moderate undernutrition (BMI or Z score based criteria)	Patients with Severe undernutrition (BMI or Z score based criteria)	Micronutrient Supplementation
Children	Treat	Treat initially as per WHO guidelines for severe acute malnutrition. Later with food support for patients. Admit for Inpatient care all patients with red-flag features.	1 RDA of micronutrients as a supplement.
Adolescents, adults	Treat	Treat initially as per WHO guidelines for severe acute malnutrition. Later with food support for patients. Admit for Inpatient care all patients with red-flag features .	1 RDA of micronutrients as a supplement.
Pregnant women	Treat	Treatinitially as per WHO guidelines for severe acute malnutrition. Later with food support for patients. Admit for Inpatient care all patients with red-flag features.	1 RDA of micronut.+iron-folate.

Patients with drug resistant- TB	Treat	Treat as per WHO guidelines for acute malnutrition. Later with food support for patients. Patients are eligible for initial inpatient care under RNTCP.	1 RDA of micronutrients as a supplement.

The first guiding principle underlines the primacy of implementation of diagnosis, treatment and care according to WHO guidelines and international standards of care, to address active TB as a primary cause of wasting in patients with TB. *We strongly support this principle, as effective treatment is of primary importance, as nutritional recovery is unlikey to occur even with nutritional support in its absence.* In India this is especially important in the case of patients with drug-resistant TB where cure rates are in need of improvement. This issue is being addressed in the revised technical guidelines of the RNTCP. The next 3 guiding principles refer to issues which are being addressed by this guidance document.

This guidance document recognises that WHO Guideline needs to be adapted, contextualised and operationalised in the programmatic setting in India. There are issues related to need for hospitalization, nutritional support for patients with moderate undernutrition and food security for the family which are highlighted below:

4.2 Adaptation of WHO guideline to Indian context

WHO guideline for nutritional care and support has been adapated in the following areas in view of the India specific context:

More Restricted indications for hospitalization for patients with Severe Acute Malnutrition and TB: WHO guidelines for nutritional care and support recommend that patients with severe undernutrition be managed in accordance with WHO guidelines for this condition (54). WHO guidelines for management of SAM in adults recommend hospitalization of all such patients. This may not be operationally feasible in India, where in patients with active TB (especially pulmonary TB), severe undernutrition is highly prevalent (50% in a study from rural Chhattisgarh)(9). We have therefore suggested different criteria for hospitalization depending upon BMI, disease and functional status, as discussed in Chapter 6.

Provision of nutritional support to patients with moderate undernutrition and active TB: WHO guidelines currently recommend treatment of moderate undernutrition in children and pregnant women with active TB, in patients with MDR-TB, patients with HIV-TB coinfection, and recommend nutritional counselling and monitoring of nutritional status in non-pregnant adult patients with drug susceptible TB (45). This recommendation is at variance with other international guidelines which recommend that such levels of undernutrition be treated(55) . In the context of

the TB literature, even moderate undernutrition has been reported to be a risk factor for early death during TB treatment (11). Also a cohort study from India showed that a BMI of less than 17 kg/m^2 was associated with a 5 fold higher risk of drug induced hepatotoxicity which is a major side effect of anti-TB therapy (13). Moderate undernutrition is a risk factor for early death in the first month, as well as drug induced hepatotoxicity which also occurs predominantly in the first few months of starting anti-TB treatment. It would therefore be prudent to correct moderate undernutrition in a patient with active TB with nutritional support and reduce the risk of these adverse outcomes.

Addressing food security in patients and their households: In India, studies have shown that undernutrition is highly prevalent in patients with TB. Also in both the general population, as well as in patients with TB, the dietary intake of calories is significantly lower (500-700 calories) than recommended (8). In this situation, it is reasonable to ensure that all patients with active TB, including those with mild undernutrition, are protected against food insecurity which will be ensured by provision of a food basket to all patients. The quantum of nutritional support may also mitigate the food insecurity in close contacts. Otherwise the nutritional support given to the patient may get shared among the contacts and may not have the desired impact on nutritional and clinical outcomes.

Food insecurity at the household level is common in India and is a strong risk factor for progression of latent infection to active TB in household contacts (17, 56). This is likely to be of greatest significance in households where levels of baseline food insecurity and undernutrition are high,(e.g. in the poorest households, persons belonging to scheduled castes and tribes) and in households where there are persons with multi-drug resistant TB. In households of MDR-TB patients, there is no proven tool for chemoprophylaxis and mitigating and preventing food insecurity and undernutrition may be protective against development of disease, as has been documented in household contacts of TB patients in the pre-chemotherapy era (57).

Our recommendations are in line with the principles and components of the current End TB strategy which emphasise patient-centred care and prevention, and bold policies to address social determinants of TB, to improve outcomes in patients with TB and to reduce TB incidence (24). Nutritional support improves weight gain and muscle strength, has the potential to reduce fatal and serious complications of TB, can function as an enabler and incentive for the patient as part of patient support, and as an intervention on the most prevalent risk factor for TB incidence in TB affected households.

5. Nutritional assessment

Nutritional assessment is a prerequisite for provision of appropriate nutritional support in patients with TB, and on follow-up of the patient. Nutritional assessment may vary according to the population groups, e.g. adult patients (above 18 years), children and adolescents (6–18 years), children under 5 years of age, and pregnant mothers.

5.1 General

Nutritional assessment will include the following:

- **Clinical assessment:** This includes a nutrition-oriented history and a nutrition-oriented examination
- **Anthropometric assessment**
- **Dietary assessment and laboratory assessment** wherever feasible and appropriate.

5.1.1 Assessment at diagnosis

It is important to identify undernutrition at the onset of diagnosis and and establish the baseline of nutritional indicators to monitor the response to treatment in patients with TB. It is also important to identify children and adults who may be severely undernourished, with or without other complications and who may require initial treatment in a hospital. (*see later sections).*

5.1.2 Assessment at follow up

In patients who continue to be moderate- severely undernourished during follow-up, further risk factor and dietary assessment will be necessary, as follows:

- Poor TB treatment adherence and/or response , resistance to TB drugs
- Clinical assessment for other non-dietary causes of malnutrition, including identification of important co-morbidities such as diabetes, HIV, alcohol abuse.
- Biochemical assessment whenever possible
- Dietary assessment, including assessment of food security.

Weight loss or failure to regain or maintain a healthy weight, at any stage of disease should trigger further assessment and appropriate interventions. Nutritional status of patients with MDR-TB is particularly important as treatment outcomes in this group of patients are sub-optimal and poor nutritional status has been associated with greater frequency of side-effects(58), delayed time to sputum conversion (59), and mortality (58, 60).

5.2 Nutritional assessment of adult patients

5.2.1 Clinical assessment

Nutrition oriented history relevant for all TB patients is given in Table 5.1.

Table 5.1: Nutrition oriented history in patients with active TB

Clinical history	Dietary assessment	Socioeconomic status	Family history
• **History of unintended weight loss: >10% weight loss in 6 months or more than 5% of loss of in 1 month indicates severe weight loss** • **History of alcohol intake** • **History of abdominal pain/nausea and vomiting/diarrhoea** • **History of diabetes**	• Vegetarian/non-vegetarian • Appetite and intake of food • Ability to cook and/or availability of nutritious food at home • Anyfood preferences (assess in terms of acceptability of supplements)	• Income: regular income • Number of family members • Availability of a care giver in family • Any eligibility for a social assistance scheme*	• Number of people in the family living together • Family history of TB or death due to TB. • Diabetes

*Please check if the patient is eligible for any national or state-level scheme for nutritional /social support. Check for BPL status or membership of ESIC scheme, or eligibility for Antyodaya Anna Yojana. Young children, pregnant and lactating mothers are eligible for benefits under ICDS. Many states support TB patients financially (A list of schemes is available in annexure 10)

Table 5.2: Nutrition-oriented examination in patients with active TB

Macronutrient malnutrition	
Loss of body fat	Seen in Orbital region (sunken eyes), over ribs, over triceps
Loss of muscle mass	Wasting over temples, clavicles,scapula, thigh, calf
Protein deficiency	**Bilateral oedema**: It may be classified as- +/Grade 1: over both feet(below ankles); ++/Grade 2: over both feet and legs(below knees);

	+++/Grade 3: over feet,legs, arms, face Easily pluckable sparse, depigmented hair , flag sign
Body mass index	**Calculate as weight in kg/ (height in metre)^2**
Mid-upper arm circumference	**Measure in centimetres at the mid-point between the acromion and the olecranon process (see annexure 3). Measure in patients with severe undernutrition (BMI < 16 kg/m^2), where the patient cannot stand, has pedal oedema or in a pregnant woman with TB.**
Micronutrient deficiencies	
Iron	Pallor, spooning of nails, angular stomatitis
Iodine	Goitre
Vitamin A	Conjunctivalxerosis, Bitot spots, follicular hyperkeratosis
Folic acid	Pallor
B_{12}	Pallor, loss of joint position and vibration sense
Vitamin C	Swollen , bleeding gums,
Vitamin D	Bone pain, tenderness, Costochondral beading, tetany

5.2.2 Anthropometric assessment

Height and weight: The methods for height and weight measurement are as indicated in annexure 3. The equipment for these measurement should be calibrated and maintained.

Body Mass Index (BMI): This is a measure of weight adjusted for height, which is calculated by dividing the weight in kg by the square of height in metres.

$$\text{BMI}= \frac{Weight\ in\ kg}{(Height\ in\ m)^2}$$

BMI is useful as a measure of the fat and muscle mass of the body. It is also useful as an indicator of risk of morbidity and mortality, which increase linearly in subjects with both BMI higher and lower than normal. At higher BMI, the risk of CVD deaths increases, while at lower BMI subjects are at greater risk of dying due to respiratory causes including TB (61).

Table 5.3: Classification of nutritional status and associated risk using BMI as criteria

BMI (Kg/m^2)	Weight category	Risk
< 14.00	Extremely underweight	Extremely high
<16.00	Grade III underweight	Increased
16.00 – 16.9	Grade II underweight	
17.00 – 18.4	Grade I underweight	
18.50 – 24.9*	Normal weight	Normal
25-29.9 *	Overweight	Increased
30.0 – 34.9#	Grade 1 obesity (Overweight)	High
35.0 – 39.9#	Grade 2 obesity (Obesity)	Very High
> 40.00#	Grade 3obesity (Morbid Obesity)	

Source: (62, 63)

*A WHO expert consultation in 2004 proposed different cut-offs for overweight and obesity in Asians on the basis of available data which suggests that Asians have a higher percentage of body fat than White people of same age, sex and BMI. The consultation identified potential action points: Underweight BMI less than 18.5; Normal- BMI 18.5-22.9; Overweight-BMI 23.0-26.9; Obesity-BMI> 27.0 (64).

Situation not likely to be common in case of TB patients.

Body mass index is not accurate for estimation of nutritional status in those with oedema (e.g. due to hypoalbuminemia) and for pregnant women. In these situations, the mid-upper circumference may be used for nutritional assessment.

The cut-off of BMI <16 kg/m^2 is used to define severe undernutrition, and a WHO guideline recommends admission of all patients with BMI < 16 kg/m^2(51)(54). However in a cohort of rural patients with pulmonary TB in India, nearly half of the patients had a BMI<16 kg/m^2 and it may not be feasible to admit all such patients in an inpatient facility. In the same cohort the median BMI of both male and female patients at death was around 14 kg/m^2(9), and therefore this level has been suggested as an absolute criterion for admission for initial nutritional support.

Mid upper arm circumference (MUAC)

MUAC is the circumference of the left upper arm -measured midway between the tip of the shoulder (acromion) and elbow (olecranon).It is an indicator of nutritional

status (including fat and protein stores), and like the BMI is also independent of height. It can be measured in pregnant women and those who are unable to stand.

MUAC <23 cm in Men and < 22 cm in women correlates with a BMI of < 18.5 kg/m^2 and is suggestive of undernutrition (65).MUAC reflects of the effect of acute undernutrition more than BMI (66), and has been seen to an independent predictor of mortality in both HIV positive and HIV negative individuals (67). Patients with a MUAC less than 19 cm had 5 times the mortality rate of those with a MUAC > 24 cm (67).
The method for measurement is as indicated in annexure 3.

There are no standard MUAC cut-offs for different grades of adult undernutrition. In WHO Integrated management of Adolescent and Adult illness, a cut-off of MUAC < 16 cm was used to define severe undernutrition (68). However a cut off of less than 16 cm would correspond to a situation of virtually no peripheral energy stores, and excess mortality has been seen at levels of MUAC which are higher than this cut-off in patients with active TB (67). It may be therefore prudent to have a higher cut-off of MUAC as suggested in recent guidelines (69), and some national protocols for management of severe acute malnutrition in adults (70).

We therefore propose the following criteria for initiation of nutritional support in an inpatient setting for adults (>18 years):

Suggested cut-offs for MUAC for moderate – severe undernutrition in adults

MUAC < 19 cm: Severe undernutrition

MUAC 19–22 cm: Moderate acute malnutrition

5.2.3 Biochemical and laboratory evaluation including HIV testing

Hemoglobin: Anemia due to deficiency of micronutrients like iron and folates is very common in patients with TB and can contribute to poor performance status in patients with TB. It can be assessed at PHC/CHC levels using available methods.

Table 5.4: Criteria to classify anemia in males and females (WHO)

	Normal Hb	Mild anemia	Moderate anemia	Severe anemia
Men	≥13 g/dl	10 – 12.9 g/dl	7 – 9.9 g/dl	< 7 g/dl
Non-pregnant women	≥12 g/dl	10 – 11.9 g/dl	7 – 9.9 g/dl	< 7 g/dl
Pregnant women	≥11 g/dl	10 – 10.9 g/dl	7 – 9.9 g/dl	< 7 g/dl

Serum albumin is affected by malnutrition but is also affected by inflammation. The normal range is 3.5 to 5.5 g/dL. In patients with TB, hypoalbuminemia (e.g. serum albumin less than 2.7 g/dl) has been associated with increased risk of death (71, 72), while a higher albumin was inversely related to treatment failure in patients with extensively drug resistant TB (73).

HIV testing should be considered in adults with severe wasting as outlined in the box below.

Severe acute malnutrition: The issue of unrecognised HIV infection or HIV related illness in adults:
In case the HIV status of an *adult* patient with severe undernutrition or severe weight loss is not known, HIV testing should be offered and conducted according to programme guidelines.
In case the patient is known to be HIV positive and has severe wasting, the possibility of other HIV related illnesses apart from active TB should also be considered. In particular patients may suffer from infections which impair intake (e.g. esophageal candidiasis), or lead to nutrient loss like chronic diarrhea, and these should be addressed.
Severe wasting in a patient with HIV infection is a sign of advanced immunosuppression, and early initiation of ART should be considered in such patients.

Serum electrolytes: Measurement of serum potassium and magnesium is desirable, if patient has severe undernutrition and has been admitted for inpatient management. This is because patients with severe undernutrition are deficient in these, and low levels of potassium and magnesium are risk factors for re-feeding syndrome (See section 6.3.2)

5.3 Nutritional assessment of children and adolescents

This covers the 6–18 year age group. History and examination in terms of clinical assessment are the same as in adults. The presence of bilateral oedema should be noted.

For anthropometric assessment, height and weight to be measured as indicated in annexure 3. In children between 6 and 18 years the classification of malnutrition can be based on the BMI-for-age percentile charts for girls and boys. Simplified field tables or percentile based charts can be used for classifying the nutritional status of the patient (Annexure 4). The MUAC can be also used to define acute malnutrition and the cut-offs suggested (70)are at Table 5.5.

Table 5.5: Anthropometric measurements and classification in children 6–18 years of age

Nutritional indicator	Age group	Severe acute malnutrition (SAM)	Moderate acute malnutrition (MAM)
BMI for age	6 years to less than 18 years	Less than -3 z score (< -3 z score)	>-3 z score to < - 2 z score
MUAC	6 years to less than 10 years	Less than 11.5 cm (<11.5 cm)	>13.5-14.5 cm
	10 years to less than 18 years	Less than 16.0 cm (<16.0 cm)	≥16.0 &< 19.0 cm
Edema	6 years -18 years	Present	Absent

For biochemical assessment the cut-offs for anemia are given in Table 5.6.

Table 5.6: Cut offs for diagnosis and classification of anemia in children 5–18 years of age

Age group	Normal Hb	Mild anemia	Moderate anemia	Severe anemia
Children 5-11 years	≥11.5	11 – 11.4	8 – 10.9	< 8
Children 12-14 years	≥12	11 – 11.9	8 – 10.9	< 8
Boys >15 years	≥13	10 – 12.9	7 – 9.9	< 7
Girls >15 years	≥12	10 – 11.9	7 – 9.9	< 7

Hb= hemoglobin in gm/dL

5.4 Nutritional assessment of under-5 patients

1) Clinical assessment: History and examination
2) Documentation of social assistance schemes patient is already entitled to/
3) Anthropometric assessment
   - Weight for length (0-1 year of age)
   - 1-5 years: WHO growth charts, weight for age for boys and girls (annexure 4)
4) Biochemical assessment
5) Basic dietary assessment as informed by mother.

5.5 Nutritional assessment of pregnant women

The clinical assessment remains same with added information about

- last menstrual date and trimester
- pre-pregnancy weight if available
- clinical assessment to rule out high risk pregnancy or pregnancy with complication
- routine antenatal care and advise

For first trimester BMI can be used for nutritional assessment.Throughout pregnancy, weight gain should be recorded during each visit and mother should be asked to come with her Mother and Child Protection card to the DOTS center. During second and third trimester, MUAC can be used for classifying nutritional status. During pregnancy the suggested MUAC cutoff for severe malnutrition is <22 cm. Cut-offs for anemia are as indicated in table 6.4.

6. Nutritional counselling

6.1 General

Nutritional counselling by health-care providers at all levels of public health system is an integral part of nutritional care and support of TB patients. Each individual has unique patterns of food intake and preferences, and there is a need for a responsible, culturally sensitive, scientifically accurate and feasible nutrition counselling by healthcare providers especially those at the primary care level which include:

- Accredited Social Health Activists (ASHAs)
- Auxiliary Nurse Midwife
- TB treatment supporter
- Medical officers at PHC, CHC level

6.1.1 Assessment

Nutritional counselling begins with following practical rapid assessment:

- **Nutritional status:** Does the person look well-nourished or not. Has the weight, height and BMI been recorded in the TB-treatment card and treatment book.
- **Diet and preferences:** What is the usual diet and any favorite foods?
- **Current appetite and intake:** How is the current appetite and food intake of the patient? If there is no appetite and patient has little or no intake for many days, it is a matter of concern and may require referral.
- **Food security:** What is the situation with regard to access to adequate food for the patient? Which schemes related to subsidised foodgrains, nutritional supplementation is the family entitled? Are they using them? What supplementation schemes is the patient/family availing at the moment

6.1.2 Dos and don'ts

During nutritional counselling statements that include phrases such as given below

- You should…..
- You must……
- You really need to…….

may not evoke positive response from the patients as they may feel powerless and even develop anger and hostility in case of food insecure circumstances. Instead, methods that create a conducive environment to approach diet and food are better. These can be done using:

- Open ended questions mixed with close ended ones

- Listening
- Suggesting and taking feedback

6.2 Goals of counselling

The patient counseling should be done along with family member/care giver:

- Assess patient's nutrition and food needs clearly in the context of his/her living conditions
- Any co-morbidity/special medical need
- Identify alternatives for correcting the problem or meeting the need and make best possible choices
- Identify likely constraints so as to address them
- Create environment so that the patient is able to convey fears/concerns with confidence

6.3 Content of counselling

- Understanding the impact of TB on nutritional status and importance of nutritional recovery.
- Providing intake of adequate energy, protein –"Food first"
  - Concept of healthy balanced diet
  - What should be avoided
  - Advice on increasing energy intake of diet by using locally available nutrient-rich food
- Clarifying myths and misconceptions including expenses on costly fruits, costly tonics, commercial food supplements, and IV fluid therapy
- Food hygiene and cooking practices
- Understanding role of physical activity in strengthening muscles and improving appetite.
- When to refer for admission and care.

6.3.1 Impact of TB on nutritional status and nutritional recovery

The role of TB in reducing appetite, dietary intake and leading to weight loss needs to be discussed. Low body weight in turn can increase risk of many complications including death, and drug toxicity while also producing symptoms of fatigue, low work capacity. Nutritional recovery with an adequate diet is essential to reduce risk of complications and an earlier return to normal work.

The patient should be explained that initially the appetite may be low, but within a few weeks of treatment the appetite will increase and come back to normal.

6.3.2 Provision of adequate energy, protein- FOOD FIRST

Concept of a healthy balanced diet

A balanced healthy diet is one which has all nutrients in required amounts and proper proportions. It can be achieved by foods from four basic food groups:

- Cereals, millets and pulses
- Vegetables and fruits
- Milk and milk products, meat, eggs, fish
- Oils, fats and nuts and oil seeds

Food classification based in function: (BASED on Dietary Guidelines for Indians – a Manual. 2nd edition 2011. National Nutrition of Nutrition; available at www.ninindia.org/DietaryGuidelinesforNINwebsite.pdf)

Table 6.1: Types of foods

	Major Nutrients	Other Nutrients
Energy rich foods- THE GO foods	**CARBOHYDRATES AND FATS** Whole grain cereals, millets Vegetable oils, ghee, butter Nuts and oilseeds Sugars	Proteins, fibre, minerals, calcium, iron and B-complex vitamins Fat soluble vitamins (A, D, E, K), essential fatty acids Proteins, vitamins, minerals Nil
Body building foods- The GROW foods	**PROTEINS** Pulses, nuts and some oilseeds Milks and milk products Meat, fish, poultry	B-complex vitamins, invisible fat, fibre Calcium, vitamin A, riboflavin, vitamin B12 B-complex vitamins, iron, iodine, fat
Protective foods-The GLOW foods	**VITAMINS AND MINERALS** Green leafy vegetables Other vegetables and fruits Eggs, milk and milk products and flesh foods	 Antioxidants Fibre, sugar and antioxidants Proteins and fats

At any time, if the food contains elements from all the above food groups, the diet is healthy. It cannot be stressed enough that in the nutritional care of patients with TB, the emphasis should be on “food first”. The recommendations for daily intakes of these food groups are mentioned in annexure 5.

Most of the energy in the Indian diet is derived from cereals like wheat, and rice, and local millets can also be used. Refined wheat flour (maida) is lower in vitamin content than whole wheat flour. Milled rice is also lower in vitamin content than parboiled

rice. Local millets like jowar, bajra are also good in nutritional terms and some millets like Ragi are high in calcium and particularly good for children, lactating women.

Oils and fats are a source of energy. In terms of oil, soyabean oil, mustard oil, groundnut oil and coconut oil are all acceptable, while butter and ghee eaten in moderation are also recommended. In terms of nuts, groundnuts are a good source of calories as well as protein and are therefore good as energy giving as well as body building foods. They are equivalent in nutritional terms to more expensive nuts like almonds, cashews and can be consumed as snacks.
Proteins can be of animal origin like milk, eggs, meat and fish or of plant origin like in cereals and pulses. For vegetarians in India, a combination of cereals and pulses can give a quality of protein equivalent to that of animal proteins. Also most vegetarians in India do consume milk and milk products like curds, and the daily consumption of these is also beneficial. In the case of non-vegetarians, consumption of eggs on a daily basis may provide the same benefit as meat and fish at a lesser cost.

Vegetables especially leafy vegetables and fruits are vital sources of vitamins and minerals and should be part of the daily diet with about 5-6 servings per day. These can be had as a fruit with breakfast and in the evening, some salad and cooked vegetable at lunch and dinner. Locally available fruits like bananas, guavas, amla, mango,papayas, are as good as more expensive fruits transported over long distances.

What should be avoided

- Alcohol in any form is dangerous for the patient as it increases the risk of drug toxicity, and the patient should be supported in his attempt to quit alcohol.
- Carbonated drinks
- Excess of tea and coffee, or their intake with food.
- Tobacco and tobacco products
- Excess of spices and salt

Increasing the energy and nutrient content of food

- Patients with TB have a poor appetite initially and should be encouraged to have more frequent food intake in the form of 3 meals and 3 snacks.

  All attempts should be made to increase the energy and protein content of the food in the meals and snacks without increasing its volume. Addition of oil, butter or ghee(if easily available) to the chapatti or rice can increase the energy content of the diet. The patient should also be encouraged to eat pulses in other forms e.g. sprouts, roasted chana. Nuts like groundnuts are good sources of energy and proteins and can be taken as snacks in either

fried or in roasted form. The calories in commonly prepared food items are mentioned in annexure 6.

Dietary preferences and practices in India are diverse, and there are many traditional foods and recipes which are sound in a nutritional sense. Patients may be non-vegetarian in their habits. In each case, the emphasis should be in promoting the use of easily available nutritious foods in contrast to exotic foods, as is discussed below.

The food basket to the patient provided as part of the nutritional support contains sources of additional calories and proteins like additional cereals, oils and groundnuts/pulses/milk powder. Some model diets which incorporate foods from these food baskets are mentioned in annexure 6.

The patient and the family can be counselled about preparation of easily prepared foods and drinks high in energy and protein based on these.

6.3.3 Addressing misconceptions and myths in nutrition

There are some misconceptions and myths in relation to nutrition, which may result in a significant amount of expenditure which is not beneficial for the patient. Sometimes patients demand these kinds of interventions, and they should be advised to avoid them.

- **Many people in India during their episodes of illness, believe that they require special foods . So a rice eating person may shift to wheat or vice versa**. This makes cooking for such a person a difficult task in the context of a household, especially a poor one. It is important to emphasise that a patient needs a balanced diet rather than a special diet.

  There is also a misconception that more expensive foods are better than less expensive ones. For example that costlier varieties of rice are better than cheaper ones, that apples or grapes are more nutritious than locally available fruits, mutton is better than eggs, or cashews are better than groundnuts. This needs to be addressed as it increases the expense to the family with no additional benefit.

- In many parts of India, especially rural India, people often believe that administration of **IV fluids containing "glucose"** will be beneficial for their weakness. This is exploited by practitioners who may charge hundreds of rupees for a drip containing glucose, salt and a multivitamin mix. Patients often are administered B-complex injections for the same purpose, often in an unsterile manner.

- Similarly, patients often buy **expensive commercial food supplements**, costing hundreds of rupees, which have protein derived from milk, groundnut or soya protein, along with multivitamins. It would have been much cheaper and equally effective had the patient consumes the actual constituents.

- Patients also have belief in the power of **"tonics"** which are little more than liquid preparations of multivitamins, often in amounts less than the RDA. A daily multivitamin supplement tablet provided in the programme can provide the recommended daily allowance at much lesser cost.

6.3.4 Food hygiene and food cooking practices

Hand washing is very important before cooking, eating and after using toilet. Vegetables and fruits should be washed well to remove contaminants/parasites/pesticides before cutting. They should be washed before cutting. Do not soak the cut vegetables in water for long periods. Cook vegetables with lid to maintain their nutritive value. Cooking at very high temperature leads to destruction of nutrients and formation of harmful substances. Cooking with excess of water for cooking should also be avoided.

Fermentation and germination increase digestibility and nutrients such as B-complex vitamins and vitamin C. There are numerous examples of such foods in each part of India.

6.3.5 Understanding role of physical activity in strengthening muscles and improving appetite.

If the patient is able to indulge in any physical activity, he or she should be encouraged to do so. This may take the form of household chores, light work. Physical activity helps the food intake to be converted into muscle mass, and also improves the appetite.

6.3.6 Identifying people who need referral or hospitalization

- A bed ridden patient who can't stand
- Patients with no appetite
- Those with recurrent vomiting or jaundice
- Breathless or drowsy patient

7. Nutritional support

7.1 Management of moderate to severe undernutrition in adult men and non-pregnant non-lactating women with TB at the community

Nutritional care and support is required to improve the health outcomes in people with TB. Moreover, in food insecure settings, food assistance as part of a larger package of services is likely to improve the access and adherence to treatment and mitigate the financial consequences of TB. Government provisioning of quality food may help TB patients deal with stigma, in fact it may help the community recognize the importance of TB patients, and thus raise their status.

The mean weights of TB patients (men and women) as reported by the Revised National TB Control Programme are 40-45 kg and 33-35 kg respectively. Assuming the average heights similar to the NFHS-3 sample (165 cm and 152 cm in men and women respectively), the average BMIs would be in the range of 14.7-16.5 for men and 14.3-15.1 for women. In order to attain a BMI of 20, a shift in the BMI by 4-6 units would be required. This would translate to a weight gain of about 10-16 kg in men and women. Substantial enhancement in energy and protein intake would be required to achieve this weight gain.

Clinical improvement with increase in appetite occurs within first few weeks of anti-TB therapy and the patients may need to return to workforce soon due to economic compulsions. The weight gain which occurs as a result of successful treatment enhances the basal metabolic rate. Therefore, to achieve weight gain of about 1-2 kg per month in order to attain a healthy BMI (about 20-22 kg/m^2) over a period of 6-9 months, the calorie gap between the existing diets and the recommended dietary allowance needs to be bridged.

Assuming that the existing energy intakes (40 Kcal/kg body weight/day) in TB patients are 1500 and 1300 Kcal in men and women, the calorie gap between the existing diets and the RDA (2500 and 2100 Kcal /day: average of the RDAs for sedentary and moderately active individuals as the patients are likely to a mix of these two categories) would be about 800-1000 Kcal/day. Food assistance needs to aim at bridging this nutrient gap and also provide a food basket for the family members who are likely to be food insecure, chronically energy deficient and at high risk of contracting TB.

Weight gain with optimal body composition would require adequate intake of protein as dietary protein. This adequate intake when supplemented with exercise or work related activity, is known to increase muscle protein synthesis rates and inhibit muscle protein breakdown, thereby allowing net protein accretion. Higher intake of

protein, particularly milk-based protein, has been associated with higher muscle mass during childhood, puberty and adulthood. As the intakes of foods that provide high quality protein (pulses, oilseeds, and animal source foods) are very low in food insecure families, specific emphasis on inclusion of protein sources (that would provide about 30-40 g/day of protein) in the food assistance package provided to TB patients is required.

7.1.1 Recommended food assistance package

The recommended food assistance package would consist of two components:

Doubling of PDS ration of cereals for the family

It is suggested that the patient with TB and family be made eligible for enhanced ration for the duration of TB treatment through the PDS. The enhanced ration would have an expiry date which will be 6 months after the cessation of the TB treatment, since often the return of the patient to full work or nutritional recovery may not have occurred by the end of treatment.

Due to non-uniform pattern of cereal grain distribution in different states across different types of cards (APL, BPL, AAY etc.), a maximum limit of 50 Kg per family is recommended. This would lead to additional ration of 15-20 Kg cereal grains per month for a family of four persons.

Assuming that the patient's family receives additional 5 kg cereal grains per person per month, doubling the usual quantity (5 kg/person/month ≈ 167 g/person/day)would provide additional 560 Kcal per day to the patient as well as to the other family members. Additional 250-500 Kcal for the patient would therefore be required from a food supplement.

Food supplement for the patient: adults

As sufficient amount of cereal grains for the patient and his/her family would be made available from the PDS, the food supplement for the patient would focus on provision of high quality protein sources such as pulses, oilseeds and dried milk powder. Additional quantities of protein rich foods would be provided to the family members assuming some amount of sharing of foods by them but counselling would be provided to the patient's family members to emphasize the importance of these foods for the patients.

The following food assistance packages are suggested for adult patients with family size of four (Table 7.1).

Table 7.1: Food assistance packages

Option 1:

Food item	Per month	Per day	Calories	Proteins
Wheat/millet	3 Kg	100 g	350	8
Dried Milk powder	1.5 Kg	50 g	180	19
Groundnuts	3 Kg	100 g	550	25
Total	7.5 Kg	250 g	**1080**	**52**

Option 2:

Food item	Per month	Per day	Calories	Proteins
Rice/millet	3 Kg	100 g	345	7
Groundnuts	3 Kg	100 g	550	25
Edible oil	1 kg	33 g	297	0
Total	**7 Kg**	233 g	**1192**	**32**

Option 3:

Food item	Per month	Per day	Calories	Proteins
Wheat/rice/millet	3	100	350	8
Pulses (Arhar, Chana etc.)	3	100	350	20
Edible oil	1 kg	33 g	297	0
Total	**7 Kg**	233 g	**997**	**28**

Food support for patients less than 10 years of age

Food assistance packages for these patients would be modified taking into consideration their nutritional requirements and the amount of foods provided would be calculated as per the consumption units (CU) (Table 7.2).

Table 7.2 Consumption units

Age (yrs)	Gender	CU
1-3		0.45
4-6		0.58
7-9		0.72

The following package is recommended for patients in the age group below 10 years by estimating their requirement to be 0.5-0.6 Consumption Units (Table 7.3).

Table 7.3: Food packages – below 10 years

Option 1:

Food item	Per month	Per day	Calories	Proteins
Dried Milk powder	1 Kg	33 g	120	13
Groundnuts	1 Kg	33 g	183	8
Vegetable oil	1 Kg	33 g	297	0
Total	3 Kg	100 g	600	21

Option 2:

Food item	Per month	Per day	Calories	Proteins
Dried Milk powder	1 Kg	33 g	120	13
Roasted bengal gram	1 kg	33 g	123	8
Vegetable oil	1 Kg	33 g	297	0
Total	3 Kg	100 g	540	21

For patients with family size more than 4, the contents of the food basket will be modifiedas follows:

- For family size of 5-7 : the amount of food items in the food basket would be enhanced by 50%
- For family size of 8 and above: the amount of food items in the food basket would be doubled.

Adult men and women with BMI less than 14

These patients need hospitalization and facility based nutrition rehabilitation for at least 2-3 weeks. The details of management are discussed in the following section on inpatient care of those with severe acute malnutrition **(section 6.3.2).**

Pregnant women

- First trimester: Patients in first trimester of pregnancy would be provided food assistance similar to other adult patients.
- Second and third trimester: In case of any complications, these patients should be admitted irrespective of BMI. Uncomplicated cases would receive nutrition supplementation similar to other adult patients in addition to their usual take home ration from the ICDS program.

7.2 Inpatient management of severe acute malnutrition in adults with active TB

Studies have shown that most of the deaths during TB treatment occur in the initial few weeks or months following initiation of treatment. Currently most deaths with TB in India occur outside the health facility. The End TB strategy has elimination of TB deaths as a goal Prevention of TB related deaths if we identify and address the factors at diagnosis or follow up, which are associated with increased risk of mortality.

We recommend that routine nutritional assessment of patients with TB in India should be done and may help identify moderate to severe undernutrition which is associated with increased risk of early death (11). Studies in India have also consistently shown that severe undernutrition is associated with 2-4 higher risk of death. Undernutrition is also a marker of disease severity in patients with TB. This nutritional assessment should be accompanied by an overall clinical assessment of the patient for signs of cardiovascular, respiratory dysfunction which may serve as “red flags” indicating risk of deterioration (74), and complications related to pulmonary and extra-pulmonary disease or may also require admission for management.

While the large majority of patients with TB can and should be treated on an outpatient basis, it is desirable that those identified as being at high risk of adverse outcomes and mortality, be admitted to an appropriate health facility for stabilization of their condition.

I. PROPOSED CRITERIA FOR ADMISSION OF PATIENTS WITH ACTIVE TB BASED ON NUTRITIONAL AND CLINICAL ASSESSMENT WITH A GOAL TO REDUCING TB MORTALITY:

A. Related to nutritional status

1. **Patients with body mass index less than 14 kg/m^2** OR MUAC< 16 mm(if patient unable to stand for a height measurement)
2. **Patients with body mass index of 14.0 -15.9 kg/m^2** OR MUAC 16-19 mm,
   - with bilateral oedema OR
   - with no appetite OR
   - inability to stand.
3. **Patients with severe anemia** (Hemoglobin less than 7 g/dl) with or without heart failure.

B. Related to Medical condition

1. Related to disease status

- **Patients with unstable vital signs**-tachycardia (pulse rate>100 per minute), tachypnea (respiratory rate>24 per min), hypoxemia (oxygen saturation less than 94 percent) or systolic blood pressure < 100 mm Hg **or with a very poor performance status** (bed-ridden, extremely limited mobility)
- **Patients with complications of pulmonary TB** like moderate-massive hemoptysis, hydropneumothorax.
- **Patients with complications of extra-pulmonary TB**: altered consciousness, seizures (tubercular meningitis), and weakness of lower limbs (Pott's spine), suspected intestinal obstruction or perforation (Intestinal TB).

2. Related to therapy

Patients with complications of therapy- drug induced hepatotoxicity, seizures.

3. Related to co-morbidities

Patients with diabetes, HIV, liver or renal disease with complications ,who need admission for management of these co-morbidities according to the judgement of the treating physician.

7.3 Principles of management: background information

7.3.1 Background of organ and systems dysfunction in severe malnutrition

Knowledge of the abnormalities in organ and systems is crucial for the management of severe malnutrition in both adults and children.

7.3.2 Organ dysfunction is severe malnutrition

Severe malnutrition can affect the function of various organs and body systems. Immune function is compromised and immune responses including innate immunity, cell mediated immunity and phagocytic function are significantly affected in patients with severe acute malnutrition. A severely malnourished adult or child must be considered as an immunosuppressed or immunocompromised individual. Epidemiological and clinical studies have shown a high prevalence of respiratory, urinary tract infections and bacteraemia which may often not be symptomatic with fever or leucocytosis. These patients may show bacterial overgrowth in the small intestine with possible translocation into the bloodstream, which may present without significant fever, leucocytosis, but as hypotension, hypothermia, or hypoglycaemia.

Cardiac abnormalities

These can include a reduced cardiac output and stroke volume and the tendency to develop acute heart failure following an increased sodium load and due to severe anemia. The kidneys have a reduced glomerular filtration rate and ability to excrete sodium. Patients should not get intravenous saline and should be rehydrated with a low osmolarity solution designed for use in patients with SAM (ReSoMal). Patients with severe anemia, which may occur due to iron/folate deficiency, poor iron utilisation, (anemia of chronic disease), malabsorption (in intestinal TB) must be transfused with packed red cells if Hb is less than 5 g/d to avoid risk of heart failure. There is a reduced capacity in the **liver** to synthesise proteins and the gut to absorb nutrients, necessitating small frequent feeds without excessive levels of proteins, initially.

Risks during treatment of severe malnutrition

The nutritional therapy of patients with severe malnutrition has a potentially serious and lethal complication related to the electrolyte abnormalities-the refeeding syndrome. Patients with SAM have electrolyte disturbances with excess body sodium and low intracellular and extracellular levels of potassium, magnesium and phosphate. Patients with SAM are also deficient in vitamins including thiamine, and micronutrients. It is important to identify these disturbances at baseline and correct them with a mineral mix to prevent the refeeding syndrome. This complication occurs more frequently in those with BMI < 16 kg/m^2, those with little or no oral intake, patients with chronic alcoholism. During poor oral intake there is a switch from carbohydrate to protein and fat metabolism to support energy needs. During refeeding, introduction of carbohydrates stimulates insulin release and increases

glycogen, fat and protein synthesis. This results in uptake of phosphate, magnesium, potassium and water uptake into cells, and can result in hypophosphatemia which is a hallmark of this condition and results in disturbance of cellular processes throughout the body. The manifestations of this syndrome can be diverse including cardiac complications (cardiac failure, arrhythmias), electrolyte disturbances (hypophosphatemia, hypokalemia, hypomagnesemia), hyperglycemia, neurological complications (confusion, seizures, Wernicke's encephalopathy). The prevention of refeeding syndrome lies in identifying patients at risk, checking serum electrolytes (potassium, magnesium, phosphate, calcium), administration of thiamine, vitamin B before and during feeding, start feeding at 10 kcal/kg and gradually increasing the provision of energy over the next 4-7 days, correcting and supplementing potassium, phosphate, calcium, magnesium during feeding and monitoring their levels.

7.4 Phases of management of severe malnutrition

The management of patients with severe malnutrition can be divided into the 3 phases of initial treatment (stabilization), rehabilitation and follow up (Table 7.4).

Table 7.4: Phases of management of severe malnutrition

	Initial phase		Rehabilitation	Follow up
	Day 1-2	Day 3-7	Weeks 2-6	Weeks 7-26
1. Hypoglycemia	→			
2. Hypothermia	→			
3. Fluid imbalance	→			
4. Electrolyte imbalance	→			
5. Treat infection	→			
6. Correct micronutrient deficiencies	Without iron ↔ / with iron ↔			
7. Cautious feeding	→			
8. Increase feeding to recover lost weight			→	

Adapted from Management of severe malnutrition: A manual for physicians and other senior health workers. Geneva: World Health Organisation; 1999.

7.5 Initial treatment or stabilization phase

The primary goal of the initial phase of treatment, which usually lasts for one week, is to prevent further loss of tissue and treat and prevent complications which can be lethal for the patient. This is achieved by:

- Treating life-threatening problems associated with the disease,
- Preventing and treating medical complications which can occur in severely malnourished patients like hypoglycaemia, hypothermia and dehydration, electrolyte imbalance and micronutrient deficiencies, and infections (whose presentation may be subtle).
- Initiate feeding while avoiding a refeeding syndrome.

The patient is not expected to gain weight during this initial phase of treatment.

7.5.1 Key guidelines for management during the stabilization phase

History and physical examination

The patient's appetite and recent food intake should be assessed. Anthropometry including weight, height, and MUAC should be performed. The history related to presence of diabetes and HIV infection or any other comorbidities like liver disease should be taken. Patients with HIV infection may have other contributors to undernutrition like inadequate intake related to oral lesions, esophageal candidiasis, and ineffective absorption related to chronic diarrhea, which need to be evaluated and addressed.

In patients with severe undernutrition, evaluation of the vital signs (including pulse oximetry), supplemented by plasma/capillary glucose estimation is vital to guide immediate management.

Abnormality	Possible Causes	Comment
Hypotension (systolic BP < 90 mmHg) with weak pulse	Severe dehydration (if h/o diarrhea) Severe sepsis (if no h/o diarrhea) Adrenal insufficiency	Signs of sepsis like fever, leucocytosis may not be obvious in SAM. Treat with IV antibiotics after evaluating source of sepsis.
Hypothermia (Rectal temp <35.0^{0}C)	Severe undernutrition Sepsis	Often coexists with hypoglycaemia
Hypoglycemia	Severe undernutrition Sepsis Adrenal insufficiency	Often coexists with hypothermia
Hypoxemia	Arterial oxygen saturation <94	May be secondary to pulmonary TB, or a secondary bacterial pneumonia

7.5.2 Immediate treatment

- **Hypoglycemia:** This can occur due to severe malnutrition per se because of poor intake, or can be secondary to a serious infection. Patient should be given frequent feeds at every 2-3 hours to prevent this complication. If the patient develops unconsciousness or convulsions then glucose needs to be given IV. (25 ml of 50% dextrose or 100 ml of 10% dextrose), otherwise a conscious patient can be given a feed or 10-20 g carbohydrate- 2 teaspoons of sugar, 200 ml milk.

- **Hypothermia:** The management essentially focuses on preventing further heat loss, covering the patients with warmed blankets, placing a heater or lamp nearby, avoiding unnecessary exposure, and monitoring the body temperature. All hypothermic patients must be screened and treated for hypoglycemia, incipient sepsis and should receive antibiotic therapy.
- **Dehydration:** If the patient has signs of dehydration, then they should be rehydrated through oral route using the lower osmolarity solution for malnourished children (ReSoMal), since patients with severe malnutrition need lower amounts of sodium and higher amounts of potassium. ReSoMal is commercially available through some companies in India but can be constituted using the new WHO –ORS as mentioned in the box below:

Component	Concentration
Glucose	125 mmol/L
Sodium	45
Potassium	40
Chloride	70
Citrate	7
Magnesium	3
Zinc	0.3
Copper	0.045

Table: Composition of ORS for severely malnourished children and adults (ReSoMal)

How to make ReSoMal (if it is not available) from standard WHO ORS:
Dissolve one sachet (for 1 L of standard WHO low-osmolarity oral rehydration solution) in 2 L water (instead of 1 L). Add 1 level scoop of commercially available combined minerals and vitamins mix or 40 ml of mineral mix solution, and add and dissolve 50 g of sugar.

If there are signs of shock, then IV fluids may be used. The choice of fluids includes 0.45% saline with glucose (half-normal saline) or Ringer's lactate with glucose. These patients should also be treated with antibiotics as discussed below.

- **Correct electrolyte imbalance**

Patients with severe undernutrition have excess body sodium and deficiencies of potassium and magnesium which will require correction in the initial 2 weeks.

- Potassium needs to be given in a dose of 3-4 mmol/kg/day as the potassium deficit can affect cardiac function, gastric emptying, and muscle strength. The mineral mix added to F-75 can satisfy this requirement. If the mineral mix is unavailable then the potassium chloride available as a syrup commercially can be used. This has 20 mmol per 15 ml of solution, and should be given only after dilution in at least 100 ml of water.
- Magnesium needs to be given in a dose of 0.4-0.6 mmol/kg/day delivered through the mineral mix added to the F-75. Magnesium is needed to allow potassium to be retained within cells.
- If the patient is being eating food, it should be free of salt for the initial few days.

- **Treat infections**
  - In patients who are hypotensive or hypoglycaemic or hypothermic or who have documented urinary tract, or respiratory tract infections should receive parenteral antibiotics (beta-lactam with an aminoglycoside e.g. ceftriaxone 1 g 12 h + Gentamicin 5.1 mg/kg/d or Amikacin 15 mg/kg/d as a single IM or IV dose) for a period of 5 days (can be avoided in MDR-TB patients who will anyway be on an aminoglycoside).
  - WHO has recommended a course of oral antibiotics to children with severe acute malnutrition, with no complications of the nature listed as before, or any clinical evidence of infection, in light of improved nutritional recovery and mortality reduction . **Amoxicillin** in appropriate doses given for 7 days may suffice.
  - Patients (both children and adults) may be offered deworming on follow up (at 2 weeks) with **albendazole.**

- **Dietary requirements for initial treatment of severely malnourished adults**

Composition

The formula feed recommended for nutritional therapy in adults during the stabilization phase is the F-75 feed, which has 75 calories per 100 ml, and lower amounts of protein, fat and sodium. This is necessary since patients with SAM have infections, impaired liver and intestinal function, electrolyte imbalance which make the normal amounts difficult to tolerate. A F-75 feed can be prepared using locally available constituents like cow's milk/skimmed milk, sugar, cereal flour, oil with added minerals and vitamins for adults as shown in the table below. Adults are often reluctant to accept formula feeds and it may be explained that it is a form of medicine. The volume of F-75 should be around 70-80 ml/kg per day offered in small amounts at a time. Upto 8 feeds may be given in a day, but in case supervision is difficult, there can be 6 feeds a day.

It is important to understand the following facts about the F-75 feed

- The F-75 feed is designed to restore physiological and metabolic functions before the process of nutritional recovery with formation of new tissues begins.
- It is not a dilute form of F-100 (which has a different composition).
- The adult or child is not expected to gain weight on the F-75 feed, which is given only in the stabilization phase.

Since a majority of severely malnourished adults with TB are anorexic, it is recommended that the formula be given via NG tube, especially during the first week if the patient is unable to take the required volume orally [refer section for indications for NG tube feeding in TB patients with undernutrition].

Ingredient	**F-75***	**F-100[§]**
Dried skimmed milk OR Fresh Cow milk	25g	80g
	300 ml	880 ml
Sugar	70 g	50 g (use 75 g if using cow's milk)
Cereal flour	35 g	-
Vegetable oil	27 g (17 g if using cow's milk)	60 g
Mineral mix**	20 ml	20 ml
Vitamin mix (of water soluble and fat soluble vitamins)	140mg	140mg
Water to make	1000 ml	1000 ml

*Composition of F-75 diet per 100 ml: Protein: 0.9 g, Lactose: 1.3 g, Percentage of energy from protein 5%, from fat 32%; Potassium:3.6mmol, Sodium: 0.6 mmol,Magnesium: 0.43 mmol

[§]Composition of F-100 diet per 100 ml: Protein: 2.9 g, Lactose: 4.2 g, Percentage of energy from protein 12%, from fat 53%; Potassium:5.9 mmol, Sodium: 1.9 mmol,Magnesium: 0.73 mmol

**Composition of mineral mix: This is prepared by mixing Potassium chloride 89.5 g,Tripotassium citrate 32.4 g,Magnesium chloride ($MgCl_2 \cdot 6H_2O$) 30.5 g,Zinc acetate 3.3 g

Copper sulfate 0.56 g to 1000 ml water. This may be mixed with ReSoMal or liquid feed at a concentration of 20 ml/litre. (Mineral mix is not commercially available in India and may have to be prepared. Certain physicians use potassium alone as potassium preparatonis are easily available)

Age	Daily energy requirement kcal/kg	Volume of diet required F-75 (ml/Kg/hour)
19-75	40	2.2
>75	35	2.0

[a] Individual needs may vary by up to 30% from these figures.

Frequency of feeds

To avoid overloading the intestine, liver and kidneys, it is essential that food be given frequently and in small amounts. Patients who can eat should be given the diet every 2, 3 or 4 hours, day and night. If vomiting occurs, both the amount given at each feed and the interval between feeds should be reduced. Night feeds can be useful in preventing hypoglycaemia and hypothermia.

Indications for NG feeding

Indications for NG feeding in patients with TB would include any one or more of the following –

- In patients in the initial phase of treatment due to severe anorexia, stomatitis glossitis or frequent vomiting
- Patients with severe dysphagia or odynophagia due to any cause
- Patients with tuberculous meningitis with an obtunded sensorium
- Critically ill patients in shock

Any patient on NG feeding should always have the head end of the bed elevated to a 45-degree elevation or at least for 2 hours after a feed, to minimise the risk of aspiration. The nasogastric tubes are of 36-48 inches length and the tube diameter varies between12-20 French units (1 French unit=0.33 mm). The smaller gauge tubes may be more comfortable but have a higher chance of getting clogged. After each feed the tube should be flushed with water to prevent clogging.

If anti-TB medicines are to be given to a patient on a NG tube, they should be crushed and reconstituted in at least 10-15 ml water. Rifampicin capsules will need to be opened and emptied. The timing of the feeds should be adjusted to ensure that some medications like rifampicin and isoniazid are administered on an empty stomach. The feeding tube should be flushed with water (10-30 ml) after the administration of the medicine.

The position of the NG tube should be checked daily and NG tube should always be aspirated before fluids are administered. It should also be properly fixed so that it cannot move to the lungs during feeding. NG feeding should be done by experienced staff. NG feeding should end as soon as possible. At

each feed, the patient should first be offered the diet orally. After eating as much as he or she wants, the remainder should be given by NG tube. The NG tube should be removed when the patient is taking three-quarters of the day's diet orally, or takes two consecutive feeds fully by mouth.

Correct micronutrient deficiencies

Micronutrient deficiencies are common in SAM and should be corrected as these micronutrients incl. vitamins as these affect immunity (including mucosal immunity), have antioxidant properties, reduce morbidity due to infections.

Vitamin A: Vitamin A should not be routinely administered if the patient is pregnant or the patient has oedema.

Vitamin B: Higher doses may be required initially in light of increased thiamine requirement.

Iron: Iron supplementation is withheld during the initial phase since SAM can be associated with reduced iron binding capacity , iron may reduce resistance to infection, and may have adverse effects. Once appetite returns, and the acute complications have been dealt with the patient can be given an iron supplement containing 60 mg elemental iron.

Criteria for discharge from hospital

Adults can be discharged when they are eating well and gaining weight,have a reliable source of nutritious food outside the hospital, clinically stable, any other healthproblems have been diagnosed and treatment begun. This may require admission for 1-2 weeks in patients with severe acute malnutrition.

7.6 Rehabilitation phase

The rehabilitation phase, which lasts from the 2nd to 6th week, begins with the return of the appetite, and aims at intensive recovery of lost weight and lean body mass.

7.6.1 Key guidelines for management during the rehabilitation phase

The formula feed recommended during the rehabilitation phase is the F-100 feed, which can be used at a rate of 1.7 ml/kg/hour for the initial few days. During rehabilitation however, it is usual for adults to experience increasing hunger. When the medical complications have been taken care of, the appetite is returning, the patient can be discharged with and the food supplement basket and the enhanced ration arranged for the patient and his family. The diet should be given that is based on traditional and home foods, but with a calorie and protein value which is as per

the requirements. The target protein intake is 1.2-1.5 g/Kg/Ideal body weight/day during the rehabilitation phase.

The patient should be having 3 meals and 3 nutrient-dense snacks per day. Oil supplied with the ration can be added to increase the calorie density of the meal. The milk powder can be used to provide 2-3 cups of milk per day, or can be used to prepare porridge of wheat or rice gruel.

Iron supplements may be introduced if indicated, at this stage to target a RDA of 8mg/day in men and post-menopausal women and 18mg/day in women 19-50 years. The patient should be encouraged to increase physical activity which helps in increasing lean body mass.

7.6.2 Response assessment and failure to respond to treatment

Response to nutritional replacement may be assessed by serial documentation of weight, changes in appetite and degree of independent activity. Patients, who do not display weight gain, continue to be anorexic and are unable to perform basic daily routine activities may be considered to have failed to respond to nutritional therapy. Failure to respond to treatment in adults is usually due to an unrecognized underlying illness (see page 37), a nutrient deficiency or refusal to follow the treatment regimen.

7.7 Follow-up phase

In the follow up phase which may last up to 6 months the patient is monitored in the progress towards normal nutritional status which may be recorded in a suggested RNTCP register for patients receiving nutritional support (annexure 11). Since a number of studies have documented a higher risk of adverse outcomes during and after treatment with a less than 5% weight gain in 2 months, this is the minimum desirable weight gain in the first 2 months. A 10% weight gain in 3 months would be optimal. The target body weight in a patient varies according to the height of the patient and will correspond to one which correspond to at least a BMI of greater than 18.5 kg/m^2 or ideally will correspond to a BMI of around 21 kg/m^2 (see box below)

Document weight and appetite at each outpatient visit. A limited number of observations and tests from the table below may also be performed. Other associated abnormalities documented during admission such as anemia must be reviewed on an outpatient basis till normal.

Weight gain to be achieved during therapy: An example (annexure 9)

If the patient has a baseline weight of 40 kg and has a height of 160 cm. Then the baseline BMI is 15.62 kg/m^2, which indicated severe undernutrition. The patient should gain at least 10% of his body weight in 3 months i.e. a gain of 4 kg in 3 months, of which at least 2 kg should be in the first 2 months.

The minimum desirable body weight in the patient corresponding to a BMI of 18.5 kg/m^2 in this patient will be equal to 18.5 x $(1.6)^2$= 47.4 kg

An optimal body weight in this patient which will correspond to a BMI of 21 kg/m^2 would correspond to a weight of 21 x $(1.6)^2$= 53.8 kg.

7.7.1 Follow up monitoring

Parameters	Frequency of observation by healthcare staff	Rationale
Anthropometric		
Weight /weight for age	Monthly or at least on 2,4,6 months	The nutritional improvement can be documented and troubleshooting done.
BMI/BMI for age	Monthly, or at least at 2,4,6 months	
MUAC	Monthly, or at least at 2,4,6 months	
Clinical condition		
Fever , cough	Weekly by treatment supporter then monthly	To document clinical improvement And refer if failure of response
Appetite	Weekly by treatment supporter then monthly	
Edema	Weekly by treatment supporter then monthly	
Breathlessness	Weekly by treatment supporter then monthly	

7.7.2 Nutritional outcomes and their recording in patients

Discharged/cured: Weight for height scores > -2 z- scores (for 6 -59 months), BMI for age > -2 z-scores for age. BMI for adults> 18.5 kg/m^2 in 2 successive visit.

Non-cured: Absence of weight gain of 10% of baseline weight in 3 months.

The suggested pathway for nutritional assessment, counselling and support in patiens with active TB is available at annexure 2.

8. Implementation of nutritional support for patients with active TB in India

Nutritional assessment, counselling and support are now considered integral aspects of the care of TB patient. Therefore these elements need to be integrated into the overall management of patients with active TB in India (including those with TB-HIV co-infection). India has the experience of conducting nutritional interventions on a large scale for certain segments of the population- there are supplementary nutrition programs for children between 6 months and 6 years, and pregnant and lactating women. There are nutritional rehabilitation centres for severely underweight children. In addition to these, in view of the concerns of food insecurity, people below the poverty line have access to food grains at subsidised rates, across the country, under the targeted public distribution system (PDS) and Antyodaya Anna Yojana (AAY).

The following discussion is aimed at providing operational options for delivery of nutrition support to patients with active TB. The working of the supplementary nutrition programmes and the PDS differ from state to state in the amount of allocation of food grains, the foodstuffs distributed, and this has to be factored in the implementation of the nutritional support initiative.

8.1 Nutritional assessment

At treatment initiation, the treating doctor should take note of the height and weight of the patient. If the patient is a child then z scores of weight for height, are useful to determine the nutritional status. If the patient is an adult and is unable to stand then the MUAC may be recorded. These measurements can be done by the staff nurse at the healthcare facility. In the case of children and adolescents, the charts of weight for height and BMI for age will be consulted by the physician/paediatrician to determine the severity of undernutrition. The assessment of vital signs in patients may indicate need for inpatient care.

As discussed earlier, patients with extremely low BMI (BMI < 14 kg/m^2) will need admission for stabilization, inpatient care and initiation of nutritional support to an appropriate healthcare facility, where specialised in-patient care can be provided.

8.2 Nutritional counselling

This will involve assessing the current dietary intake of the patient, the dietary preferences and discussing the appropriate diet in terms of composition, frequency of meals and snacks. The patient will be advised on how to use to increase the

calorie and nutritional density of locally available foods. The family members of the patient will also be explained that the nutritional supplement (milk powder, groundnuts, pulses) are a kind of medicine for the patient in order to ensure recovery of the lost weight and muscle mass, and that the supplement should be primarily be consumed by the patient.

8.3 Nutritional support

8.3.1 Resource mobilization

Many states have demonstrated successful models on a small scale.

a. Local Self Government initiatives. The three tier Panchayati Raj system has provided ample opportunities for decentralized planning and implementation of developmental projects. Nutritional support to TB patients may find place among the annual projects of district/block/gram panchayats with appropriate estimates of budgets considering the annual TB notification, proportion of cases that would require additional nutrition and cost of food basket with locally available ingredients.

b. Corporate Social Responsibility (CSR): There are some successful initiatives utilizing CSR funding for nutritional support to TB patients. This has a role especially in piloting new strategies for certain defined population, eg- miners, urban slum population, certain tribal areas etc. However expandability and sustainability of these initiaves need to be planned carefully.

c. Intersectoral collaboration. Many state government departments are implementing various support including nutritional support to citizens generally or to patients suffering from specific diseases. Since the beneficiaries and often the providers are not aware about these supports, public resources for the same are not being effectively utilized. Some of these schemes are monitory, these could be pooled and converted to nutritional support.

8.3.2 Procurement of food baskets for patients

a. Linkage with the public distribution system: A state/Panchayati Raj Institution may coordinate with the PDS for procurement of these food items.
b. Procurement and delivery of these food items may be done by NGOs under a scheme evolved for this purpose.

8.3.3 Delivery of enhanced ration through linkage with the public distribution system

An enhanced PDS ration needs to be provided for the duration of anti-TB treatment along with a supplement food basket. Most of the patients who develop active TB are likely to have a BPL card which will enable access to an enhanced ration (double the usual allocation) through the targeted PDS system. It is expected that state

Departments of Health and Family Welfare establish linkages with the Department of Food and Civil Supplies at all levels. Necessary Government Orders may be issued in this regard to the functionaries of both departments. Program staff and healthcare staff need to facilitate the dissemination of nutritional support guidelines and supportive Government Orders down to the most peripheral level of PDS distribution. Diagnosis of TB makes the BPL patient eligible for a double ration.

However if the patient does not have a BPL card, it is recommended that a card be issued to the patient and his family which shall cover the duration of the treatment. Necessary clauses to this effect may be included in the GOs. Alternatively, food vouchers could be evolved which can enable the patient to access an enhanced PDS ration.

In case of beneficiaries of the Antyodaya Anna Yojana, an additional 10 kg of foodgrain could be made available in addition to the supplemental food basket.

Once a TB patient is diagnosed, the PHI Medical Officer may certify that the patient is eligible for a double ration. In the case of both the BPL and APL patients, the local PDS distributor should be able to take the decision to provide the support. Coordination between the programme and the PDS system authorities will prevent any delay in initiation of food support.

8.3.4 Delivery of supplemental food basket: available options

Food items like milk powder, groundnuts, are not routinely distributed through the PDS outlets.

The delivery of the supplemental food basket may be entrusted to NGOs under a scheme evolved for this purpose. The patient may verify the delivery of the food items in this model.

Food vouchers is another option, with which patients can access defined food items from neighbourhood shops

8.3.6 NGO Scheme for nutritional Support to TB patients

Suitable schemes may be developed for providing nutritional support to patients in line with existing other schemes for engagement of NGOs.

8.3.7 Inpatient nutritional support and care

The inpatient facility at a community health centre or of a district hospital/medical college can serve as the point of care for a patient with Severe Acute Malnutrition and active TB. This is being recommended as the investigations (electrolytes for example), as well as specialist staff are available at the CHC. Once the patient recovers his/her appetite and starts gaining weight the patient may be followed up at the PHC level.

8.4 Social support as part of patient-centred care

Social support as part of patient-centred care is needed to ensure long-term food security for patients and households suffering serious and catastrophic consequences. Some families of patients with TB suffer serious consequences as a result of the disease and its sequelae, which have short as well as long term impact on their food and income security. The new End TB strategy emphasises patient-centred care and provision of social protection measures. According to the International Labor Organisation these measures comprise access to essential social services and social transfers including in cash and in kind paid to the poor and vulnerable to enhance food security and nutrition, provide a minimum income security and access to services, as well as income replacement and social support in the event of illness. Some illustrative examples of these serious situations are listed below:

- Death (especially premature) of any of the parents during TB treatment
- Occurrence of TB in more than one member of the family, which can be especially serious in the case of MDR-TB
- Severe disability due to TB: This is usually a result of extensive pulmonary TB with extensive fibrosis which may not allow a person to return to his usual occupation. However TB meningitis, intestinal TB, bone and joint TB, pericardial TB may also cause disability, which may be serious or permanent
- Occurrence of TB, or TB death secondary to silica exposure at work
- Catastrophic costs resulting in loss of assets like land.

Such situations may come to the knowledge of the treatment supporter, or the field level supervisor. Knowledge of some of the social sector schemes might help the programme enable the access of the patient's family to these schemes. E.g. in the case of death, the family is eligible for assistance of Rs. 20,000 under the National Family Benefit Scheme, or in the case of patients dying of silico-TB, a compensation of Rs. 3 lacs has been enforced by the Government of Rajasthan. These schemes are listed in annexure 10. Across India for certain population groups like persons belonging to scheduled castes and scheduled tribes are provide financial and nutritional support on the initiative of local developmental agencies e.g. Integrated Tribal Developmental Agency. Such situations can also be documented by the programme and an effort can be made for provision of social support through other channels – e.g. corporate social responsibility initiatives.

8.5 Roles and responsibilities of staff

8.5.1 General health staff

RNTCP operates through the general health system. Identification of presumptive TB cases, referral for diagnosis, initiation of treatment, public health support like contact

tracing, treatment adherence support, airborne infection control and clinical support like follow up and monitoring of treatment, detection and management of adverse drug reactions, management of comorbidities are being provided by the Medical officers and staff of the Peripheral Health Institution catering to the residential area of the patient. Whenever a patient is diagnosed/managed elsewhere, s/he would be referred to the local PHI for continuation of management if such necessity arises. Medical Officer of the PHI is expected to assess the requirement of nutritional support at the time of initiation of treatment. A severely malnourished patient need to be referred to the nearby tertiary care centre or nutritional rehabilitation centre for therapeutic nutrition. Moderately malnourished patients and patients referred back from tertiary centres after stabilizing on nutrition have to be managed on a domiciliary basis along with domiciliary TB treatment. To summarise, the roles and responsibilities of the medical officer of the PHI are:

- Assessment of nutritional status of the patient at the time of treatment initiation
- Referral of severely malnourished patients to appropriate tertiary care centre
- Link the patient to nutritional support schemes pertaining to the state
- Monitor the nutritional status at least once monthly along with clinical follow up of TB treatment
- Monitor the supply and consumption of the food basket
- Document the nutritional status and details of intervention in the treatment record (TB treatment card (or a Clinical Information Format provided for this purpose).

Medical Officer accomplishes these activities with the support of peripheral health workers (MPW/ANM) in his team. Thus, lnkage of patients to the nutritional support program, monitoring of the supply and consumption of food basket, counselling and guidance to the patient and family are provided through the PHWs.

8.5.2 RNTCP key staff

Senior Treatment Supervisor of the TU is responsible for monitoring and supporting the nutritional support activities. The STS would:

- disseminate the nutritional support guidelines to MOs and staff of all PHIs in the TU
- coordinate with the NGO that implements nutritional support scheme if present
- link with the agencies that provide nutritional support beyond local PHI/panchayat e.g. CSR operating at district/regional level, tribal department, revenue offices etc.
- during patient visit, ensure that the patient is aware of nutritional support scheme operational in that area.
- support the PHI staff to monitor the supply and consumption of food baskets.

In urban areas, where the field network of PHWs are not available, RNTCP has provided a network of TB Health Visitors (TBHVs) to support the field activities. TBHV will support the MO of the PHI in field activities required for nutritional support of TB patients.

8.6 Monitoring and evaluation of the implementation of the guidelines

8.6.1 Capacity building of healthcare providers and programme staff

In view of the decision to provide nutritional support as part of the package of patient-centred care in the RNTCP, and the development of this guidance document, there is a need to build capacities of the healthcare providers for the same. These guidelines will be utilised to develop an integrated skills-based training curriculum for doctors, nurses and counsellors at primary, secondary and tertiary care level. A one -day training program on the nutritional care of adults and children with active TB (including those with HIV-TB) will be part of the ongoing service induction/refresher training of the staff at district and sub-district level. The training program focuses on building skills in the assessment of the nutritional status, including anthropometry, counselling and delivery of nutritional support at outpatient and inpatient level.Nutritional support will be integrated into the future technical guidelines of the program.

8.6.2 Monitoring and evaluation indicators

Monitoring and evaluation will generate information regarding the extent to which the objectives of this guideline in improving the nutritional status of patients with active TB and reducing the adverse outcomes during therapy, are being met. The launch of this nutritional support initiative is also likely to increase the participation of patients in the RNTCP as well as promote adherence to TB therapy. There are areas of uncertainty as well in the field of TB and nutrition interaction. Systematically collected data may help improve interventions in this field.

8.6.3 Indicators of nutritional status and response to therapy

- For adults - Height measurement at baseline and weight at every visit (at the start,2, 4, 6 months in new patients; The increase in BMI can be estimated from these figures
- For children – Weight and Height measurement every visit with weight for height Z score at every visit. If height cannot be measured for some reason, MUAC should be measured
- No. of adult patients with BMI < 16 kg/m^2
- No. of adult patients with BMI<14 kg/m^2.

8.6.4 Indicators of access to nutritional support

- Number and proportion of patients who underwent weight and height measurements, in every quarter
- Number and proportion of eligible patients who received enhanced PDS ration, in every quarter
- Number and proportion of eligible patients who received supplemental food basket, in every quarter
- Number and proportion of patients with very severe undernutrition who were admitted for inpatient care and nutritional support

8.6.5 Programmatic outcomes indicators

- Death rate in diagnosed patients
- Proportion of patients lost to follow up

8.6.6 Equipment required for implementation of nutrition guidelines

- Stadiometer: for measuring height
- Adult Weighing scale: digital scale
- Infant weighing scale: The digital scale should have the following features – a. Solidly built and durable; b. Electronic (digital reading); c. Measure to a precision of 0.1 kg (100g)
- Mid-Upper-Arm circumference(MUAC) measurement tape
- Body mass index charts

8.6.7 Essential medicines required for the implementation of the guideline

The following medicines will be required to implement the outpatient and inpatient components of nutritional support To be procured through general health service drug procurement system:

- Multivitamin and micronutrient pill supplying 1 RDA of these substances for all patients
- Iron and folic acid tablets
- Vitamin A : 200,00 units tablets
- Mineral mix for patients with severe acute malnutrition
- Albendazole tablets
- Potassium chloride solution – oral
- WHO standard low osmolarity ORS
- 0.45% saline with glucose
- Cow milk, sugar, oil for preparation of F-75 and F-100 feeds for inpatient management.

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Annexures:

Annexure 1: Guidance document development process

This guidance document was developed by a group formed as a follow up of a National Level Workshop on Guidance for Nutritional Support for Patients with Tuberculosis in India. This Workshop was held on 25th and 26th February 2016 at Yenepoya Medical College, Mangalore, Karnataka, and was attended by 40 resource persons from national level institutions like National Institute of Nutrition, All India Institute of Medical Sciences, National Institute for Research in Tuberculosis, St. John's Medical Research Institute, Christian Medical College, Vellore, National Institute for Research in Tribal Health, State Health Resource Centre, Chhattisgarh, Lokmanya Tilak Medical College, and Yenepoya Medical College. No pharmaceutical company or manufacturer of nutritional supplements was involved in the sponsorship of this workshop.

The Workshop comprised presentations including reports on field level experiences of nutritional supplementation and group work including Nutritional Assessment, Nutritional Support, Operational Implementation. A guidance document drafting group was constituted with the following members.

Coordinator	Anurag Bhargava, Professor, Dept. of Medicine, Yenepoya Medical College, Mangalore, Karnataka
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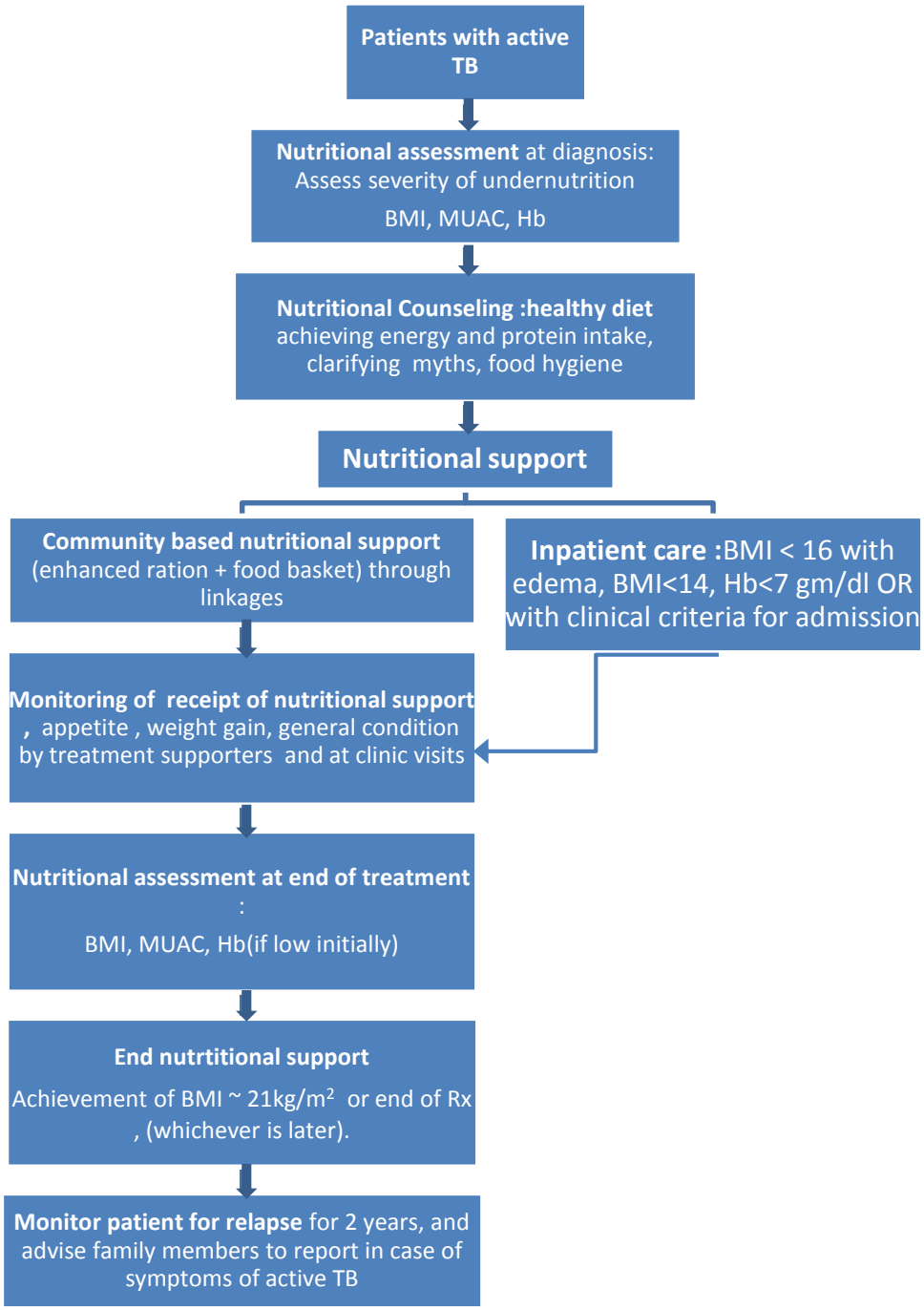
Pharmacologist	Geetha Ramachandran, Scientist E, National Institute of Research in Tuberculosis, Chennai.
Health Administrators	Raghuram Rao, DADG(TB), Central TB Division, Government of India.
NGO representatives	Aditi Krishnamurthy, Karnataka Health Promotion Trust, Bangalore

The writing team developed the scope of the guidelines, searched the literature and generated a draft based on the best available evidence and consensus. The draft went through 3 iterations through an online process of consultation. This was later shared with the Central TB Division, which submitted this draft for peer review to experts. These comments were responded to and were incorporated in a pre-final draft.

A meeting was held with the experts at the Central TB Division on 29th December, 2016 to discuss the draft document. A revised document was shared and vetted in a meeting of Experts on 30th December 2016, at the Ministry of Health, Government of India, which included the Deputy Director General TB, Central TB Division,

representatives of WHO, National Institute for Tuberculosis and Respiratory Diseases, Indian Council of Medical Research. Their comments and suggestions were reflected in the final draft.

Annexure 2: Pathway of nutritional assessment, counselling and support in patients with active TB



Annexure 3: Methods of anthropometric assessment

1) Measurement of height or length:

Height can measured using a standard stadiometer or using a wall mounted, easy-to-use and portable staturemeter made of non-stretchable metallic tape with an accuracy of 0.1 cm. It should be mounted at a known height (usually 200 centimetres) on the wall with a flat surface underneath. Fixing of the stature meter needs to be accurate in terms of height while making sure that the tape extends vertically and is not at an angle.

The patient is then made to stand without the footwear, with heels slightly separated and the weight borne evenly on both feet. Knees should be straight with the back of head, shoulder blades, buttocks and heels touching the wall. The head is so positioned that the person looks directly forwards in Frankfurt plane (the line joining floor of external auditory meatus to the lower margin of the orbit) and bi-auricular plane being horizontal. The horizontal blade of the staturemeter is then brought straight on the head and height noted. The eyes of the investigator should be in level of with the reading.

In case the patient is taller than the investigator, a stool should be used and if the patient is shorter, the investigator should stoop to make the measurement.

Length is used for children upto 2 years of age. Ideally two persons are required to measure recumbent length. The child is made to lie down in the infantometer. The crown of the head should touch the stationary, vertical headboard. The shoulder and buttocks should be flat against the horizontal surface. The legs should be extended at the hips and knees with gentle pressure on the knees. Now move the board gently towards the soles touching flatly to it. Measure the length to the nearest 0.1 cm.

2) Weight

For individuals who are able to stand without support, standing weight can be used using weighing scales, preferably a digital weighing machine. Person should stand with light clothing without shoes, sweaters, belts, jackets, etc. The patient is then made to stand still and upright with weight evenly distributed between two feet. Measurement is made to the nearest of 100 gms.

For infants up to 10 kg, weighing machine with an infant tray can used. The weight is recorded when the body is stable. This may require patience to wait for the time when the baby is asleep or quiet and settled.

Alternately for younger children, a weighing sling or a spring balance can be used for this purpose. For this, adjust the pointer of the scale to zero level. Take off any heavy clothing and shoes. Put the child with his or her legs through the leg holes

first. Now hand the child on the scale and read the scale with eye at the same level to the nearest of 0.1 kg.

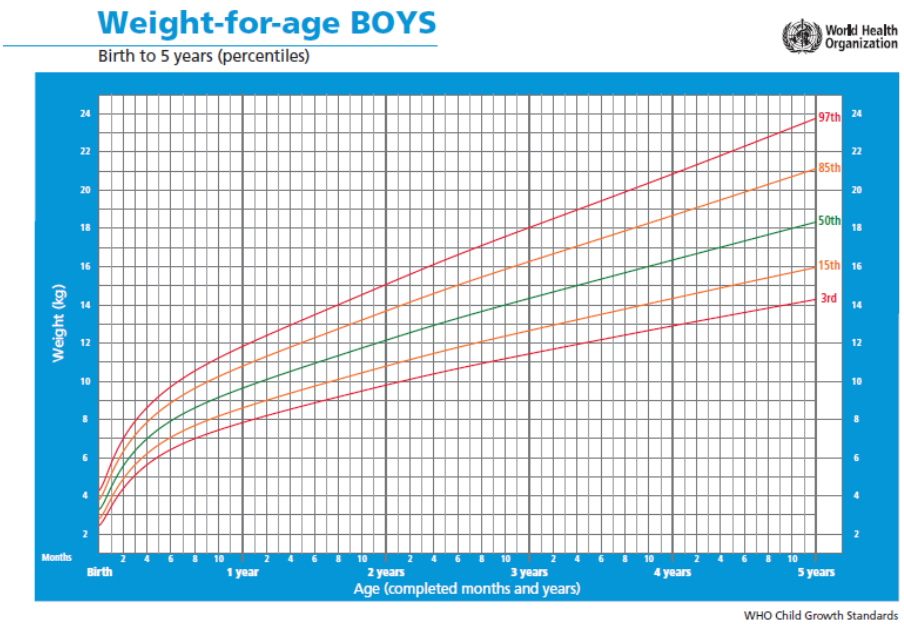
3) Mid upper-arm circumference (MUAC)

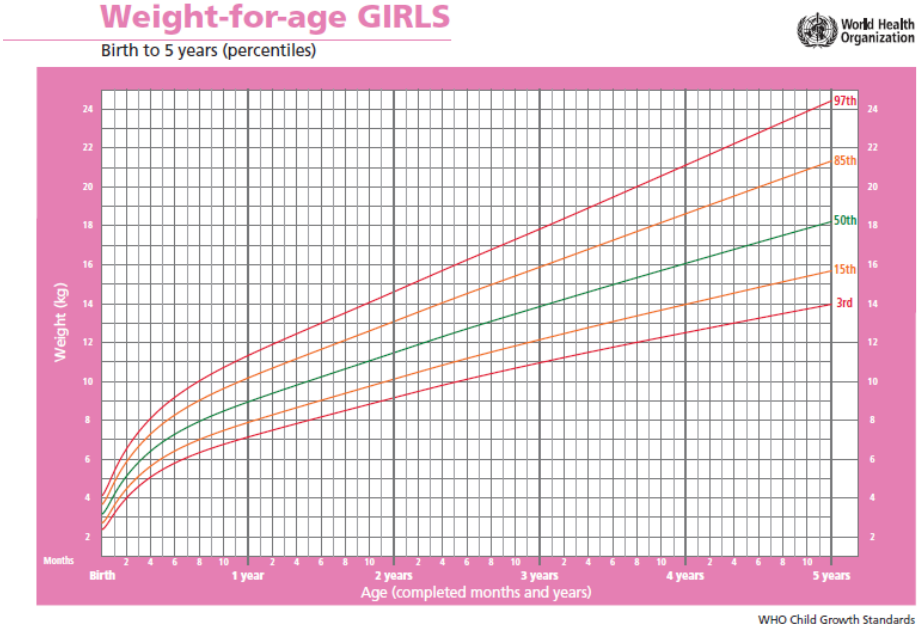
The circumference of the upper arm is measured at the midpoint. This is located by flexing the elbow at 90 degrees with palm facing upwards. Now locate the lateral tip of the acromion process at the shoulder and olecranon process of the ulna at the elbow. Measuring tale is placed between these two points and mid point is identified between these two.

For MUAC, ask the patient to stand erect, with the arms hanging freely by the side and palms facing the thighs. The arm and the shoulder area should be exposed. The tape is now placed around the arm at the midpoint and snug to the skin but not compressing the soft tissues. The measurement is made to the nearest 0.1cm.

Annexure 4: Anthropometry charts and cut-offs

Weight for age (Boys and girls),
BMI percentile charts (boys and girls),
MUAC cut-offs,
Classification of Nutritional status based on BMI





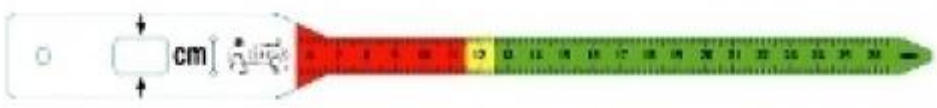
CLASSIFICATION OF NUTRITIONAL STATUS OF WOMEN WHO ARE PREGNANT OR WITHIN SIX MONTHS OF POST-PARTUM BY MID UPPER ARM CIRCUMFERENCE (MUAC)

MUAC	**CLASSIFICATION**
< 19 cm	Severe malnutrition
≥ 19 and < 22.0 cm	Moderate malnutrition
≥ 22 and < 23.0 cm	Mild malnutrition
≥ 23.0	Normal

Based on:
PEPFAR policy guidance as of 2009 states that PEPFAR resources may be used for food support for HIV-positive pregnant and post-partum women regardless of nutritional status. Programs that choose to screen pregnant and post-partum women for provision of specialized food products based on nutritional status could use MUAC as an eligibility criterion.

CLASSIFICATION OF NUTRITIONAL STATUS OF CHILDREN IN THE AGE GROUP USING MUAC CRITERIA

MUAC	**CLASSIFICATION**
< 11 cm	Severe malnutrition
≥ 11 and < 12.5 cm	Moderate malnutrition
≥ 12.5 and < 13.5 cm	Mild malnutrition
≥ 13.5	Normal



Classification of nutritional status in adults BMI as criteria

Weight category	BMI (Kg/M^2)
Extremely underweight	< 14.00
Grade III underweight	<16.00
Grade II underweight	16.00 – 16.9
Grade I underweight	17.00 – 18.4
Normal weight	18.50 – 24.9*
Overweight	25-29.9 *
Grade 1 obesity (Overweight)	30.0 – 34.9
Grade 2 obesity (Obesity)	35.0 – 39.9#
Grade 3 obesity (Morbid Obesity)	> 40.00

Annexure 5: Recommended dietary intake for Indians: Energy, Protein, Fats, Calcium, Iron

Recommended daily intake of Food Groups in Balanced diet for various ages (ICMR)

Recommended Dietary Allowance (RDA) of calories, proteins, fats, iron and calcium in Indian (Based on ICMR-NIN guidelines)

GROUP	PARTICULAR	BODY WT	CALORIES (Kcal/d)	PROTEINS Gm/day	FATS Gm/day	CALCIUM Mg/day	IRON Mg/day
MAN	SEDENTARY	60	2,320	60	25	600	17
	MODERATE WORK		2,730		30		
	HEAVY WORK		3,490		40		
WOMAN	SEDENTARY	55	1,900	55	20	600	21
	MODERATE		2,230		25		
	HEAVY WORK		2,850		30		
	PREGNANT		+350	78	30	1200	35
	LACTATING (0-6)		+600	74			21
	(6-12 M)		+520	68			
INFANTS	0-6 MONTHS	5.4	92/KG	1.16/KG		500	46µgm/kg/d
	6-12 MONTHS	8.4	80/KG	1.69/KG	19		05
CHILDREN	1-3 YEARS	12.9	1,060	16.7	27	600	09
	4-6 YEARS	18.0	1,350	20.1	25		13
	7-9 YEARS	25.1	1,690	29.5	30		16
BOYS	10-12 YEARS	34.3	2,190	39.9	35	800	21
	13-15 YEARS	47.6	2,750	54.3	45		32
	16-17 YEARS	55.4	3,020	61.5	50		28
GIRLS	10-12 YEARS	35.0	2,010	40.4	35	800	27
	13-15 YEARS	46.6	2,330	51.9	40		
	16-17 YEARS	52.1	2,440	55.5	35		26

BALANCED DIETS (Recommended dietary intakes by Indians: ICMR)

Adult Man (quantities in grams)

Food Item	Sedentary worker	Moderate worker	Heavy worker
Cereals	460	520	670
Pulses	40	50	60
Leafy vegetables	40	40	40
Other vegetables	60	70	80
Roots and tubers	50	60	80
Milk	150	200	250
Oils and fats	40	45	65
Sugar or jaggery	30	35	55

Adult Woman (quantities in grams)

Food Item	Sedentary worker	Moderate worker	Heavy worker
Cereals	410	440	575
Pulses	40	45	50
Leafy vegetables	100	100	50
Other vegetables	40	40	100
Roots and tubers	50	50	60
Milk	100	150	200
Oils and fats	20	25	40
Sugar or jaggery	20	20	40

Children (quantities in grams)

Food Item	1-3 years	4-6 years	Boys: 10-12 years	Girls: 10-12 years
Cereals	175	270	420	380
Pulses	35	35	45	45
Leafy vegetables	40	50	50	50
Other vegetables	20	30	50	50
Roots and tubers	10	20	30	30
Milk	300	250	250	25
Oils and fats	15	25	40	35
Sugar or jaggery	30	40	45	45

SUGGESTED SUBSTITUTION FOR NON-VEGETARIANS

Food item which can be deleted from non-vegetarian diets	Substitution that can be suggested for deleted item or items
50% of pulses (20-30 gm)	1. One egg or 30 gm of meat or fish 2. Additional 5 gm of fat or oil
100% of pulses (40-60 gm)	1. Tow eggs or 50 gm of meat or fish OR One egg plus 30 gm meat 2. 10 gm of fat or oil

ADDITIONAL ALLOWANCES DURING PREGNANCY AND LACTATION:

Food item	During pregnancy (gm)	Calories (Kcal)	During Lactation (gm)	Calories (Kcal)
Cereals	35	118	60	203
Pulses	15	52	30	105
Milk	100	83	100	83
Fat	-	-	10	90
Sugar	10	40	10	40
total		293		521

Person should resume normal physical activity once his functional status returns towards normal

Annexure 6: Model diets for TB patients with sample plan Calorie contents of common foods, Food exchange lists

Model diets

The patient should be encouraged to have three meals and three snacks in order to enhance their dietary intakes for achieving optimal weight gain. The following examples of diet plans would guide the health functionaries while counselling the patients and formulating the diets by using the ingredients from the food assistance package.

Model diet 1

Meal timing	Item	Ingredient	Quantity(g)	Energy(Kcal)	Protein(g)
Breakfast	Tea	Dried milk powder	30	107	11.4
		Sugar	10	40	0
		Biscuits	25	112.5	1.6
	Poha	Rice flakes	60	207.6	3.96
		Groundnut	30	171	7.86
		Oil	5	45	0
Midmorning		Banana	100	116	1.2
	Porridge	Ragi	30	98.4	2.19
		Dried milk powder	15	53.5	5.7
		Sugar	5	20	0
Lunch	Chappati	Wheat flour	60	204.6	7.26
	Curry	Bengal gram	30	108	5.13
		Oil	10	90	0
		Amaranth	100	67	5.9
Evening	Laddu	Groundnut	50	285	13.1
		Oil	5	45	0
		Sesame	15	84.45	2.74
		Dried milk powder	5	17.85	1.9
Dinner	Chapati	Wheat flour	60	204.6	7.26
	Curry	Brinjal	50	12	0.7
		Oil	10	90	0
Bedtime	Milk	Milk	100	67	3.2
		Sugar	5	20	0
Total				2266.5	81.1

Model diet 2

Meal timing	Item	Ingredient	Quantity(g)	Energy(Kcal)	Protein(g)
Early morning	Tea	Milk	100	67	3.2
		Sugar	10	40	0
Breakfast	Idly and chutney	Idli rava	90	310.5	10.9
		Black gram	60	208.2	14.4
		Groundnut	30	171	7.9
		Oil	5	45	0
Midmorning		Guava	100	51	0.9
Lunch	Rice	Rice	60	206	7.3
	Curry	Lentils	30	102.9	7.5
		Oil	10	90	0
Evening	Snack (Laddu)	Groundnut	50	285	13.1
		Oil	10	90	0
		Sesame	15	84.5	2.7
		Jaggery	50	191.5	0.2
		Ragi	60	206	7.3
Dinner	Rice	Rice	30	103	3.6
	Curry	Cabbage	100	27	1.8
		Oil	5	45	0
Total				2323	81

Food exchange list

S.No	Food group	Categories	For 1 portion(qty) (choose any one /portion)	Quantity/portion* (g)
1	Cereals and millets	Whole grains: rice, wheat Millets: ragi, maize, jowar etc Flours: wheat flour, rice flour, etc Other cereal products: semiya, sooji,poha,noodles,pasta etc	• ½ cup cooked rice • 2tbsp of flours • ¼ cup uncooked other cereal products • 1 (15cm wide) Chapatti/ roti • 1(25cm wide) dosa • 2 small size idli • 1-11/2 slice bread	30
2	Pulses and legumes	Whole grains: Kabuli channa,green gram etc Dhal(broken):red gram dhal,moong dhal etc	• 2 tbsp uncooked • ½ cup :thick consistency • 1 cup:if eaten after sprouting/boiling etc	30
3	Vegetables	Green leafy vegetables: amaranth,palak,cabbage etc Other vegetables:brinjal,ladies finger etc Roots and tubers: potato,yam etc	• ½ cup if raw • 1 cup if cooked or to be consumed as salad • Roots and tubers to be considered as cereals	100
4	Fruits	All	• 1-2 cup of edible portion	100
5	Milk and milk products	Also include commercial milk powder/dairy whitener	• 1cup milk/buttermilk • ½ cup curd(1 katori) • 1/4th cup paneer(60g)	100
6	Fats and oils	All	• 1 tsp cooking oil • 1 tsp ghee/butter	5
7	Sugar and jaggery	All	• 1 tsp sugar	5

CEREAL PREPARATION

No	Preparation	Quantity of serving	Calories (Kcal)
1	Rice	1 cup	170
2	Roti	1	80
3	Paratha (oil/ghee)	1	150
4	Puri	1	100
5	Bread	2 slices	170
6	Upma	1 cup	270
7	Idli	2	150
8	Dosa	1	125
9	Khichdi	1 cup	200
10	Cereal/porridge	1 cup	220

PULSES PREPARATION

11	Plain dhal	1 cup	200
12	Sambhar	1 cup	110

VEGETABLE PREPARATIONS

13	Dry/roast	1/2 cup	150
14	With Gravy	1 cup	170

NON-VEGETARIAN PREPARATIONS:

	Boiled egg	1	90
	Omelette	1	160
	Fried egg	1	160
	Mutton curry	3/4 cup	260
	Chicken curry	3/4 cup	240
	Fish fry	2 big pieces	220
	Fish curry	With 2 pieces	140
	Prawn curry	1 cup	219
	Keema kofta curry	3/4 cup	240

SAVOURY SNACKS

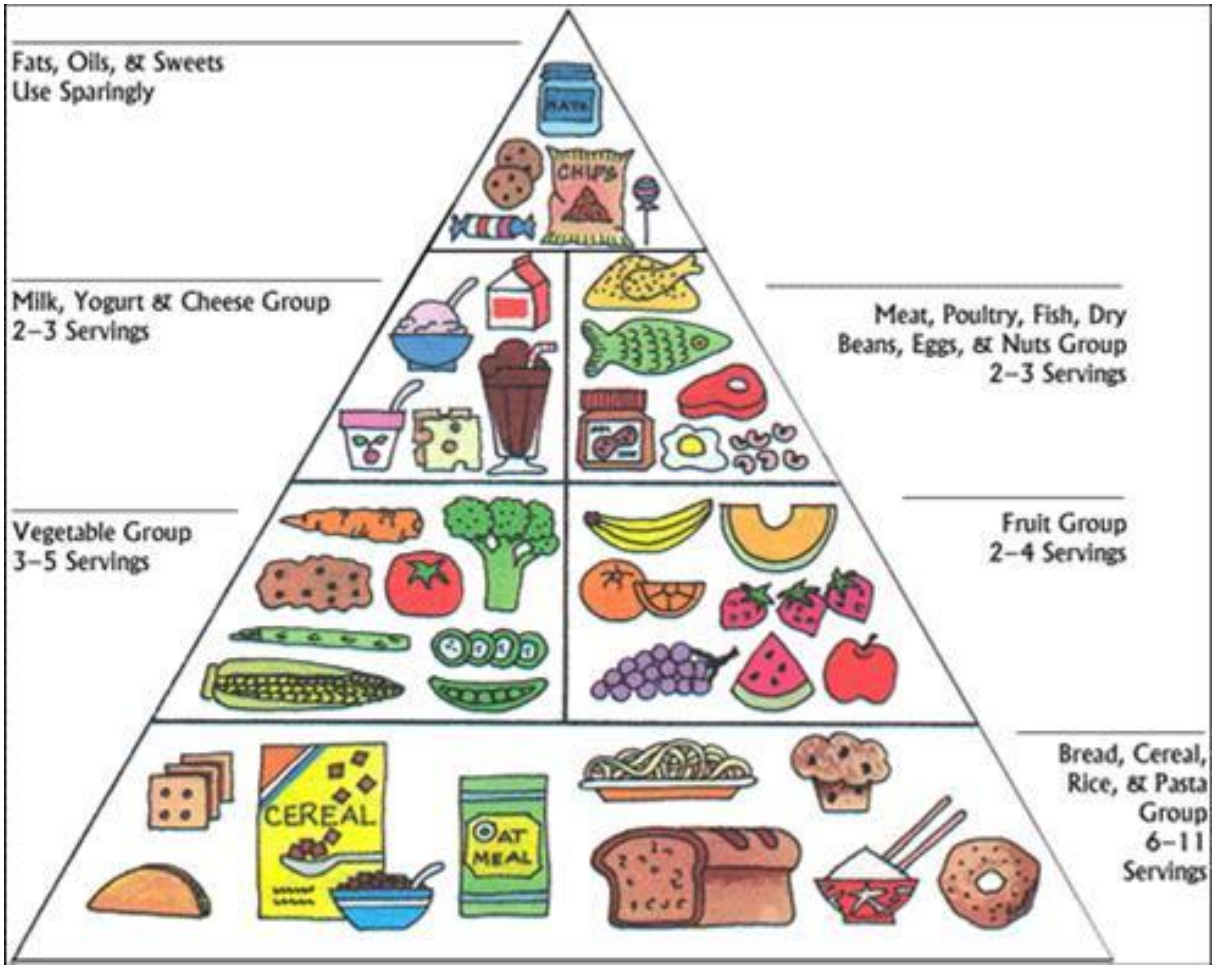
No	Preparation	Quantity of serving	Calories (Kcal)
	Bajjis or Pakoras	8 in No	280
	Chat/bhel puri	5 pieces	220
	Dahi Vada	2	180
	Vada	2	140
	Masala Vada	2	150
	Masala dosa	1	200
	Kachori/Biscuit roti	2	380
	Potato Bonda	2	200
	Samosa	1	200
	Sandwich	2 slices/1 sandwich	200
	Vegetable Puff	1	200
	Chicken Puff	1	240
	Pizza: cheese-tomato	1/4 slice	200
	Vegetable Burger	1	220
	Chicken Burger	1	260
	Vegetable Pasta	1 plate/serving	200
	Non-vegetarian Pasta	1 plate/serving	240
	Veg-Noodles	1 plate/serving	200
	Non-vegetarian Noodles	1 plate/serving	240

SWEETS AND DESSERTS

No	Preparation	Quantity of serving	Calories (Kcal)
	Besan Barfi	2 small pieces	400
	Chikki	2 pieces	290
	Fruit cake	1 piece	270
	Rice puttu	1/2 cup	280
	Sandesh	2 pices	140
	Halwa/sheera	1/2 cup	320
	Jam/jelly	1 table spoon	20
	Custard	1/2 cup	160
	Shrikhand	1/2 cup	380
	Milk chocolate	25 gm	140
	Ice cream	Ice cream	200

BEVERAGES:

Preparation	Quantity of serving	Calories in Kcal
Tea (2 tsp sugar + 50 ml milk)	1 cup	75
Coffee (2 tsp sugar + 100 ml)	1 cup	110
Cow's milk (2 tsp sugar)	1 cup	180
Buffalo's milk (2 tsp sugar)	1 cup	320
Lassi (2 tsp sugar)	Glass 200 ml	110
Squash	Glass 200 ml	200
Cold drinks	1 bottle of 200 ml	150


Fats, Oils, & Sweets
Use Sparingly
Milk, Yogurt & Cheese Group
2–3 Servings
Meat, Poultry, Fish, Dry
Beans, Eggs, & Nuts Group
2–3 Servings
Vegetable Group
3–5 Servings
Fruit Group
2–4 Servings
Bread, Cereal,
Rice, & Pasta
Group
6–11
Servings
CHIPS
CEREAL
OAT
MEAL

Annexure 7: Technical note for derivation of protein requirements in patients with active TB - Dr Anura Kurpad

For the requirement of protein, the framework remains the same as for the estimation of the energy requirement. The base protein requirement, as the RDA for a normal person, is 0.8g/kg/day. This requirement refers to high quality protein, as is found in a diet with adequate legumes and animal source proteins. The digestibility and essential amino acid score of cereal based proteins is less than optimal (these are digested to about 80% in a mixed diet). Therefore, in populations eating a predominantly cereal based diet, an additional allowance is made for this wastage, and the protein requirement is usually set to 1 g/kg/day (RDA book, ICMR, 2010). The additional requirement imposed by the TB infection is about 15% over the base (WHO TRS 937). Adding this to the 'normal requirement' yields a protein requirement figure of 1.15 g/kg/day. In addition, TB patients often are detected after there has been considerable wasting, and a catch-up, or replenishment of body protein stores, in the form of fat free mass (FFM) or lean tissue, is required.

An example of a catch-up, or replenishment rate, based on the considerations in section 4.3.1, and box 4.4, is about 5% of body weight per month in about 4 months, in a person weighing about 40 Kg. This works out to about 1g/kg body weight/day. This is a figure for the catch up weight of the body as a whole; however, for protein, the fat-free mass (FFM) is where it is deposited. If we assume a proportion of 0.6g FFM in every 1 g of body weight that is regained, and further, assume that the FFM contains 25% protein (weight for weight), then, an additional 0.15g protein/day will be deposited per 1g body weight/day gained. However, one cannot simply ingest this amount of protein and assume that 100% of the ingested protein will be deposited – there are inefficiencies of utilization, and typically, once could assume an efficiency of utilization of protein is 70% of the weight eaten. Then, the actual protein intake required (of a high quality protein) to support a 1g/kg body weight/d gain, is an additional 0.2 g/kg/day. For a slower rate of catch up growth like 2.5% of the body weight gained in the same period of time, the requirement will be half or an additional 0.1g/kg/day. Adding this amount of quality protein (in the form of foods such as legumes or milk) to the RDA and the additional TB infection based requirement (as above), gives a rounded total of 1.3-1.4g/kg/day. Since it is difficult to maintain this on a day-to-day basis, a broader range of 1.2-1.5g/kg/day has been suggested, which also takes into account different rates of weight gain.

Annexure 8: Recommended daily allowance of Micronutrients and composition of a micronutrient pill for adults:

Vitamin A : 600 micrograms (Retinol) or 2000 IU

Vitamin D: 200 IU or 5 microgram

Vitamin E: 10 mg

Vitamin B group

- **Vitamin B1**: 1.4 mg
- **Vitamin B2**: 1.4 mg
- **Niacin** : 16-21 mg
- **Pyridoxine**: 10 mg (this is higher than the RDA and is being recommended in view of Isoniazid therapy)
- **Folic acid**: 100 micrograms
- **Vitamin B_{12}** : 2 micrograms

Vitamin C (ascorbic acid) : 40 mg

Iron : 30 mg

Zinc : 15 mg

Copper : 2 mg

Annexure 9: Field chart to determine target weight to be achieved with nutritional support in undernourished patients with active TB- Dr A. Bhargava, Dr M. Bhargava

Height in cm	Weights in kg corresponding to BMI <14.0 kg/m^2 (Indication for admission)	Weights in kg for the range of BMI of 14.0-15.9 kg/m^2	Weights in kg for the range of BMI of 16.0-16.9 kg/m^2	Weights in kg for the range of BMI of 17.0-18.4 kg/m^2	Weights in kg for the range of BMI of 18.5-22.9 kg/m^2	Weight in kg for a BMI of 21 kg/m^2 (Target Weight)	Caloric Intake 40 Kcal/Ideal body weight (approximate) assuming sedentary activity
143	28.6	28.7 - 32.5	32.6 - 34.8	34.9 - 37.8	37.9 – 46.8	42.9	1700
144	29.0	28.1 - 33.2	33.3 - 35.3	35.4 - 38.3	38.4 - 47.5	43.5	1750
145	29.4	29.5 - 33.6	33.7 - 35.7	35.8 - 38.9	39.0 – 48.1	44.2	1800
146	29.8	29.9 - 34.1	34.2 - 36.2	36.3 - 39.4	39.5 – 48.8	44.8	1800
147	30.3	30.4 - 34.6	34.7 - 36.7	36.8 - 40.0	40.1 – 49.5	45.4	1800
148	30.7	30.8 - 35.0	35.1 - 37.2	37.3 - 40.5	40.6 – 50.2	46.0	1850
149	31.1	31.2 - 35.5	35.6 - 37.7	37.8 - 41.0	41.1 – 50.8	46.6	1850
150	31.5	31.6 – 35.9	36.0 - 38.3	38.4 - 41.6	41.6 – 51.5	47.3	1900
151	31.9	32.0 - 36.5	36.6 - 38.8	38.9 - 42.2	42.3 – 52.2	47.9	1900
152	32.3	32.4-	37.0 -	39.4 -	42.8 –	48.5	1950

		36.9	39.3	42.7	52.9		
153	32.8	32.9 - 37.4	37.5 - 39.8	39.9 - 43.3	43.4 – 53.6	49.2	1950
154	33.2	33.3 - 37.9	37.8 - 40.3	40.4 - 43.9	44.0 – 54.3	49.8	2000
155	33.6	33.7 - 38.4	38.5 - 40.8	40.9 - 44.4	44.5 – 55.0	50.5	2000
156	34.1	34.2 - 38.9	39.0 - 41.4	41.5 - 45.0	45.1 – 55.7	51.1	2050
157	34.5	34.6 - 39.4	39.5 - 41.9	42.0 - 45.6	45.7 – 56.4	51.8	2100
158	34.9	35.0 - 39.9	40.0 - 42.4	42.5 - 46.2	46.3 – 57.2	52.4	2100
159	35.4	35.5 - 40.4	40.5 - 43.0	43.1 - 46.7	46.8 – 57.9	53.1	2100
160	35.8	35.9 - 40.9	41.0 - 43.5	43.6 - 47.3	47.4 – 58.6	53.8	2150
161	36.3	36.4 - 41.4	41.5 - 44.1	44.2 - 47.9	48.0 – 59.4	54.4	2200
162	36.7	36.8 - 42.0	42.1 - 44.6	44.7 - 48.5	48.6 – 60.1	55.1	2200
163	37.2	37.3 - 42.5	42.6 - 45.2	45.3 - 49.1	49.2 – 60.8	55.8	2250
164	37.7	37.8 - 43.0	43.1 - 45.7	45.8 - 49.7	49.8 – 61.6	56.5	2250
165	38.1	38.2 - 43.5	43.6 - 46.3	46.4 - 50.3	50.4 – 62.3	57.2	2300
166	38.6	38.7 - 44.1	44.2 - 46.8	46.9 - 51.0	51.1 – 63.1	57.9	2300
167	39.0	39.1 - 44.6	44.7 - 47.4	47.5 - 51.6	51.7 – 63.9	58.6	2350
168	39.5	39.6 - 45.1	45.2 - 48.0	48.1 - 52.2	52.3 – 64.6	59.3	2400
169	40.0	40.1 -	45.8 -	48.7 -	52.9 –	60.0	2400

		45.7	48.6	52.8	65.4		
170	40.5	40.6 - 46.2	46.3 - 49.1	49.2 - 53.4	53.5 – 66.2	60.7	2450
171	40.9	41.0 - 46.8	46.9 - 49.7	49.8 - 54.1	54.2 – 67.0	61.4	2450
172	41.4	41.5 - 47.3	47.4 - 50.3	50.4 - 54.7	54.8 – 67.7	62.1	2500
173	41.9	42.0 - 47.9	48.0 - 50.9	51.0 - 55.3	55.4 – 68.5	62.9	2500
174	42.4	42.5 - 48.4	49.5 - 51.5	51.6 - 56.0	56.1 – 69.3	63.6	2550
175	42.9	43.0 - 49.0	49.1 - 52.1	52.2 - 56.6	56.7 – 70.1	64.3	2550
176	43.4	43.5- 49.5	49.6-52.6	52.7-57.2	57.3-70.9	65.0	2600
177	43.9	44.0- 50.0	50.1-53.2	53.3-57.9	58.0-71.7	65.8	2650
178	44.4	44.5- 50.6	50.7-53.8	53.9-58.5	58.6-72.6	66.5	2650
179	44.9	45.0- 51.2	51.3-54.4	54.5-59.2	59.3-73.4	67.3	2700
180	45.4	45.5- 51.7	51.8-55.0	55.1-59.8	59.9-74.2	68.0	2700

Field chart for estimation of desirable weight and BMI using current height in underweight patients (Bhargava A, Bhargava M: Manuscript submitted for publication)

Note on using the chart: To use this chart measure the patient's height and current weight. E.g. if a female patient's height is 150 cm and weight is 36.5 kg. Go to the row corresponding to the height of 150 cm in the first column. The patient's weight of 36.5 puts her in the category of moderately severe undernutrition as her weight falls in the BMI range of 16.0-16.9 kg/m^2. Her minimum desirable weight would be 41.6 kg while her body weight for a target BMI of 21 would have to be 47.3. Her weight gain therefore should be at least 5 kg or preferably 10.8 kg to achieve a BMI of 21 kg/m^2. Her desirable calorie intake would be at least 1900 calories per day.

Annexure 10: Social and nutritional support schemes in India

A. Nutritional support:

Existing nutrition related schemes by Government of India

1) Integrated Child Development Services Scheme
2) Mid-day meal
3) Rajiv Gandhi Schemes for Empowerment of Adolescent Girls (RGSEAG), SABLA
4) Indira Gandhi Matritva Sahyog Yojana (IGMSY)
5) Antyodaya Anna Yojana
6) Public Distribution System which provides cereals in all states and pulses and oil in some states (Telangana, West Bengal, Tamil Nadu, Rajasthan, Punjab, Himachal Pradesh, Haryana, Chhattisgarh and Andhra Pradesh).

Schemes at State Level:

1) Amma Canteens provide free breakfast to TB patients.
2) Farmer's benefit scheme (Ushavar Pathukapu Thittam) Rs 1000 per farmer patient per month
3) Nutrition kit to TB patients in Kasaragod, Kerala.
4) Nutrition supplement initiative by Chhattisgarh

B. Social support schemes[1]:

The following schemes are also relevant to TB patients and their families.

1) National Family Benefit Scheme: This is administered by the Ministry of Rural Development and entitles family members to receive a lumpsum assistance of Rs. 20,000 in the event of a death due to TB. Patients who are living below the poverty line are eligible for this assistance. Widows of HIV positive patients are also eligible.
2) Group Life insurance scheme: Jan Shree Bima Yojana administered by LIC is a group life insurance scheme with an annual premium of Rs. 200 of which half which may be paid by member or the government Coverage is for low income groups including those working in unorganised sector, including rickshaw pullers
3) Compensation for victims of silicosis: The National Human Rights Commission has fixed a compensation of Rs. 300,000 for patients dying of silicosis.
4) Handloom Weavers Comprehensive welfare scheme is administered by Ministry of Textiles and addresses the healthcare needs (including ambulatory care) of those in the weaving industry and its ancillary industries and their families(warping, dyeing, winding, dyeing, printing, finishing, sizing, jhala making, jacquard cutting etc are also eligible to be covered. State Directorate of Handlooms can certify eligibility.

[1]There may be many other state specific social welfare schemes. These can be incorporated according to individual states

Annexure 11: Revised National Tuberculosis Control Programme: Register for patients receiving nutritional support

Name	Age/sex	ID no.	Type of TB	Date of start of Rx	BMI at Ds	Date of start of nutr. support	Receipt of monthly food basket (please tick for every month	Outcome	BMI at 2 months of Rx	BMI at end of Rx	Date of end of nutr. support