Guidelines for the nutritional management of anorexia nervosa

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Contents

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Executive summary and recommendations

The nutritional management of patients with anorexia nervosa forms an essential part of treatment. However the principles of nutritional intervention have received relatively little attention in the literature and current practice is based largely on experience rather than published evidence. Reference to other forms of malnutrition may offer some guidance, but does not take account of aspects that are specific to anorexia nervosa. These guidelines reflect this difficulty. Wherever possible, they are based on published studies; in areas where there is no relevant published research, recommendations are based on a consensus of expert opinion drawn from a number of disciplines.

This document should therefore be regarded as a series of provisional recommendations rather than a definitive statement. The authors hope that it will prove useful in clinical practice but also that it will stimulate discussion and research into this important aspect of patient care. It is intended that the guidance will be updated in due course in the light of increased knowledge and understanding of the nutritional aspects of anorexia nervosa.

General considerations

Nutritional interventions should be considered within the patient's overall psychological context. Correcting body composition is an ultimate objective, but can only take place if there is competent cellular function. This requires the correction of biochemical abnormalities before weight gain. A dietary history taken by a dietician can be used to identify specific deficiencies of protein, fatty acids and micronutrients. The diet history should include information on fluid intake, consumption of alcohol and caffeine, smoking, use of vitamin supplements and measurement of weight and height.

Biochemical and metabolic problems

Hypokalaemia is usually the result of self-induced vomiting and/or laxative misuse; supplementation is often required. Refractory hypokalaemia may be the result of underlying hypomagnesaemia or hypocalcaemia. Measurements of serum electrolytes may be misleading as they may mask a significant total body deficit. Hyponatraemia may result from diarrhoea and vomiting, misuse of diuretics or excessive intake of water. Rapid correction of hyponatraemia and the use of hypertonic fluids are hazardous.

Folic acid deficiency may occur and those who have been avoiding animal foods may be deficient in vitamin B_{12}. However supplemental iron may be dangerous in the early stages of refeeding. Zinc deficiency may cause altered

taste as well as a variety of neuropsychiatric symptoms. A significant proportion of patients are deficient in thiamin and the increase in carbohydrate metabolism which occurs during refeeding may exhaust inadequate thiamin reserves.

The early stages of refeeding are a high-risk period for biochemical, fluid balance and cardiovascular abnormalities and patients should be monitored closely. Patients at particular risk include those whose weight is very low, those who have had previous biochemical abnormalities or purge, and those with concurrent medical conditions such as diabetes, infection and major organ failure. Electrolyte disturbances are most likely to occur during the first 1–2 weeks of refeeding. There is a risk of hypophosphataemia and acute thiamin deficiency when beginning refeeding. Abnormal liver function tests can occur at presentation or during refeeding. This appears to be self-limiting but other causes of liver dysfunction should be excluded. Delayed gastric emptying results in early satiety and sensations of abdominal fullness or bloating. Use of frequent small meals may help with this; metoclopramide may be used (usually in a reduced dosage of 5 mg three times daily), but is often of only limited effectiveness.

Refeeding

In chronic starvation the energy requirement is depressed. It is therefore possible to promote weight gain with a relatively low energy intake at first and increase it gradually. An individualised approach may be best for those not being treated in a specialist eating disorders unit. In specialist units, a standardised programme can be used. A weekly weight gain of 0.5–1.0 kg is generally regarded as optimum and an intake of 2200–2500 kcal (9200–10 000 kJ) daily will achieve this in most patients. The rate of gain will slow down as weight increases, owing to an increase in metabolic rate and physical activity. Vegetarian diets can normally be accommodated without difficulty. Vegan diets present particular problems in achieving adequate energy intake and provision of sufficient phosphate.

Some patients develop peripheral oedema in the early stages of refeeding. This appears to be particularly common in those who have misused laxatives or induced vomiting prior to admission. In severe cases it can lead to rapid weight gain of several kilograms. Refeeding oedema should be distinguished from cardiac failure, of which other signs are absent. It is probable that many of the untoward consequences of refeeding can be minimised or avoided by starting the patient on relatively small amounts of food and increasing progressively. A sudden increase in the metabolic load may precipitate biochemical decompensation and unmask hidden deficiencies.

It is a common practice to set a target weight at the beginning of treatment. There is no clear consensus as to how this should be determined, but it is often set at a body mass index (BMI) of 19–20 kg/m^2. However, this represents a minimum healthy weight based on population norms and is not necessarily the optimum weight for the individual. At present, there are inadequate data on which to base recommendations about healthy weights in specific ethnic groups.

Some experts advocate using ultrasonography to assess ovarian maturity as a marker of adequate weight restoration.

Enteral feeding

Enteral feeding has a limited role but may be required in some situations. The nasogastric route is normally preferred but nasojejunal feeding may overcome problems due to delayed gastric emptying. Standard tube feed products do not contain enough phosphate to meet the needs of severely starved patients and supplements are recommended. Supplements of B and C vitamins are also recommended before feeding starts. An additional mineral supplement may be required. Hyperglycaemia may develop during enteral feeding.

Children and adolescents

Children differ from adults both physiologically and in terms of their psychosocial development. Their nutritional management cannot be separated from other aspects of treatment. Services for children and adolescents should be appropriate to the patients' age and staffed by clinicians with experience in working with young people. Prepubertal children and older adolescents should ideally be treated in separate services.

Younger patients tend to cause greater medical concern than adults. Their energy stores are low and emaciation may occur more rapidly; children dehydrate more quickly than adults. The BMI should be used with caution in children and adolescents. Despite being a valuable pointer to thinness, it is a poor reflection of a child's fat reserves. In adolescents, a change in BMI is not a reliable indicator of change in fat, protein or carbohydrate stores. When anorexia nervosa develops before growth has been completed, it will stunt growth and reduce height; weight loss will therefore be underestimated if assessment is based on the BMI alone. Anorexia nervosa can develop in adolescents without weight loss if weight is kept steady during a stage of expected growth. Body mass index norms vary with age, and assessment of BMI in this age-group should be related to BMI centiles. Assessment of expected weight is also difficult in this age-group.

Enteral feeding may be considered essential in the treatment of children and adolescents when the patient has deteriorated medically to such a degree that there is a serious risk of death. The considerations described above in relation to adults apply equally to younger patients.

Recommendations

- Patients with anorexia nervosa should have a dietary assessment.
- A formal assessment of nutritional status is recommended on admission to hospital. Units should have a clear policy specifying who will make this assessment.

- Patients should undergo a comprehensive physical assessment.
- A detailed laboratory assessment should take place at the time of initial physical assessment and again on admission to hospital. If significant abnormalities are detected, expert advice should be obtained.
- The amount of food given should be limited at first, and increased slowly.
- A weight gain of 0.5–1.0 kg per week is generally recommended for in-patients.
- Patients in the early stages of refeeding should be monitored closely for signs of biochemical, cardiovascular and fluid balance disturbance; electrocardiographic monitoring is strongly recommended in all cases of electrolyte disturbance and during intravenous replacement.
- The use of a micronutrient supplement is recommended in both in-patients and out-patients.
- The use of oral thiamin supplements is recommended for in-patients and out-patients undergoing rapid weight gain.
- Enteral feeding should be carried out by a clinical team experienced and skilled in its use.
- Patients undergoing enteral feeding should be monitored carefully; serum electrolytes should be monitored closely and deficiencies corrected promptly.
- Enteral feeding should be initiated slowly, using an isotonic 1 kcal / ml (4.2 kJ / ml) standard feed delivered through a fine-bore nasogastric tube.
- Parenteral B and C vitamins should be given before starting enteral feeding and possibly subsequently.
- Phosphate supplements are recommended before enteral feeding starts; an additional mineral supplement may also be required.
- Dietetic advice should always be sought when enteral feeding is used and it is recommended that units have a written protocol for its use.
- Weight gain of more than 0.5 kg per week is not recommended in out-patients.
- In out-patients who are gaining 0.3 kg per week or more, serum electrolytes should be monitored regularly.
- For patients with chronic illness, it may be appropriate to aim for a low but safe weight in order to prevent hospital admission and maximise quality of life.
- Religious dietary restrictions should be respected unless they present a threat to recovery. Care should be taken to ensure that drugs and nutritional supplements are consistent with the patient's religious or cultural practices.
- Children and adolescents should be treated in a service that is age-appropriate and staffed by clinicians experienced in work with this group.

- The BMI should be used with caution in children and adolescents and preferably related to BMI centiles.
- Assessment of expected weight in children and adolescents should take into account premorbid weight and height centiles, parental height and weight, and normal weight for height centiles.
- Target weights should be revised regularly during the refeeding of children and adolescents to take account of growth.
- Pubertal development should be maintained, where possible, within two standard deviations of age norms.

1 Introduction

Good nutritional management of patients with anorexia nervosa requires attention to a number of areas. Careful assessment of the patient's diet and supervision of the refeeding programme – within the context of the patient's cultural, ethnic and religious background – are essential. Medical monitoring is also important. However any nutritional intervention will inevitably carry a psychological meaning for the patient; management of the patient's nutritional state must therefore always be considered within a wider psychological context. Nutritional interventions that do not take the psychological context into account are unlikely to be successful. As with other aspects of the management of anorexia nervosa, a complex negotiation may need to take place with the patient, and issues of motivation are paramount. Close collaboration is necessary between the professionals providing psychological therapy and those responsible for the patient's nutritional and medical care.

Correcting body composition is clearly an ultimate objective of nutritional treatment, but can only take place if there is competent cellular function. In the severely malnourished patient, two separate but linked processes occur. First, inadequate food consumption leads to wasting and functional changes in all tissues. Second, the general metabolic response to infection, trauma or other stress results in further specific nutrient losses and cellular damage. Ultimately the objective of treatment must be to return body composition to normal, but this requires competent metabolic machinery. Therefore, the first step has to be to repair the machinery, with tissue repletion being a secondary consideration during the early phase of treatment. The nutritional management of severe anorexia nervosa may be considered in terms of three consecutive phases: resuscitation, repair and repletion.

Resuscitation

Severe malnutrition is a medical emergency, and there is an urgent need to correct hypothermia, hypoglycaemia and electrolyte disturbance. Dehydration should be corrected cautiously and cardiovascular function stabilised as far as possible. Infections (some of which may not be clinically obvious) should be identified and treated.

Repair

Tissue function cannot be restored unless the cellular machinery has been repaired. This requires the correction of multiple specific nutrient deficiencies, which may not be detected by standard biochemical tests.

Repletion

Abnormal body composition can only be corrected safely when the cellular machinery has been adequately repaired. Aggressive attempts to drive weight gain at an early stage of treatment are therefore potentially dangerous. A simplistic approach to the correction of abnormal blood biochemistry is also hazardous, for example treating a low plasma albumin level with a high-protein diet or treating anaemia with supplemental iron.

2 Nutritional assessment

Some form of dietary assessment should be part of the overall assessment of patients with anorexia nervosa, and a formal assessment of nutritional status is good practice on their admission to hospital. We recommend that units treating patients with anorexia nervosa have a clear policy on nutritional assessment, which specifies who will carry it out. However, it is not necessary to address all nutritional issues at the beginning of treatment. The initial assessment should follow the local protocol and needs to cover only those aspects essential to immediate management decisions. These include:

- recent change in eating habit
- rate of weight loss
- binge eating
- vomiting and laxative misuse
- gastrointestinal function
- hydration
- restrictions on the variety of acceptable foods
- other conditions that may require dietary management (such as diabetes)
- presence of conditions that may affect nutritional requirements (such as infection or growth)
- use of alcohol.

Diet history

A dietary history taken by a dietician is a reliable tool for assessing habitual dietary intake in patients with anorexia nervosa (Hadigan *et al*, 2000). It can be used to identify specific deficiencies of protein, fatty acids and micronutrients. Although patients characteristically overestimate their energy intake, body weight is an easily measured indicator of energy deficiency. As well as food intake, the diet history should include information on the following factors, which may influence dietary management.

Fluid intake

Excessive consumption of fluid is common and may be used to facilitate vomiting or manipulate body weight. Fluid restriction may be used to reduce weight (Lowinger *et al*, 1999).

Caffeine consumption

The consumption of large amounts of caffeine in the form of coffee, tea and low-energy fizzy drinks is common in anorexia nervosa, because caffeine has an

appetite-suppressant and weight-reducing effect. Limiting access to these drinks can result in symptoms of caffeine withdrawal.

Use of alcohol

Heavy use of alcohol increases the requirement for B vitamins, which should be provided as supplements (Department of Health, 1991).

Smoking

Smoking increases the requirement for antioxidant vitamins, especially vitamin C (Department of Health, 1991); advice on food sources of vitamin C should be given. If the diet does not provide adequate amounts of vitamin C (as may be the case in hospital diets), supplements should be provided.

Use of vitamin supplements

Care should be taken to prevent the risk of vitamin A and D toxicity from excessive use of supplements (Department of Health, 1991).

Measurement of weight and height

Weight and height should be measured (in kilograms and metres, respectively), and BMI (in kg/m^2) calculated as an indicator of the severity of starvation. Weighing should be as consistent as possible, taking place at the same time of day and under the same conditions. People under 20 years old with a long history of restricted eating may gain height during refeeding; increasing height increases the healthy weight to be reached.

3 Clinical assessment and monitoring

Patients should undergo a comprehensive physical assessment. Examination should pay particular attention to the patient's degree of hydration, cardiovascular status, muscle wasting and skin integrity. Postural hypotension is common; it is usually secondary to hypovolaemia and in some cases to reduced cardiac output. A core temperature (taken, for example, with a tympanic thermometer) should be recorded, because hypothermia is common in severe anorexia nervosa. The 'sit up, squat, stand' (SUSS) test (see Appendix 2) gives a clinical indication of muscle power and may be used to monitor progress.

Prolonged self-induced vomiting can erode tooth enamel, leading to pain, and there may be associated caries or even abscesses; vomiting can also produce soreness in the mouth and throat. Severe starvation can lead to shrinking of gum tissue and loosening of teeth. Riboflavin deficiency may cause fissures of the lips, especially in the corners of the mouth, and iron and zinc deficiencies cause glossitis and loss of taste sensation. Vitamin C deficiency can cause bleeding gums (Newton & Travess, 2000). These problems may need specific nutritional supplementation.

4 Laboratory assessment and monitoring

A detailed laboratory assessment is recommended at the time of initial assessment and again on admission to hospital. Recommended initial screening investigations are given in Appendix 3; further investigations may be required, depending on the patient's condition. If significant abnormalities are detected, expert advice may be needed from an appropriate specialist. The early stages of refeeding are a high-risk period for biochemical abnormalities and monitoring should reflect this. Patients whose weight is very low, those with previous biochemical abnormalities and those who purge are at particular risk.

A low haemoglobin concentration may indicate iron deficiency. However the haemoglobin level may be elevated artificially by the effect of dehydration, and apparent anaemia early in treatment may be the result of fluid retention and haemodilution; results therefore need to be interpreted with care. Furthermore as lean body mass decreases there is an associated fall in red cell mass. The iron derived from the reduced red cell mass cannot be excreted and is therefore stored, bound to ferritin. There is an increased risk of unbound iron, which acts as a centre for free radical generation and hence cell damage. Thus, in severely undernourished individuals there is an effective block on iron utilisation, and any dietary supplementation cannot be used to good effect in this situation. Dietary supplements of iron during the early refeeding of malnourished patients have been associated with increased mortality rates. Once the acute metabolic disorders are corrected and cellular metabolism repaired, there is a return of the capacity for the repletion of tissue and red cell mass. In the first instance iron is taken out of storage to meet the demand for cellular repair and increased red cell mass, but at some stage this reserve is likely to become depleted and dietary supplements of iron may then be required. Folic acid deficiency also occurs and those who have been avoiding animal foods may be deficient in vitamin B_{12}.

Hypokalaemia is usually the result of self-induced vomiting and/or laxative misuse. Supplementation will probably be required, although advice on high-potassium foods (for example, all fruit and vegetables, milk and coffee) may be enough in some cases (Connan *et al*, 2000). Refractory hypokalaemia may be the result of underlying hypomagnesaemia or hypocalcaemia. Hyponatraemia may result from diarrhoea and vomiting, misuse of diuretics or excessive intake of water (Cuesta *et al*, 1992; Santonastaso *et al*, 1998). It can cause confusion and, in extreme cases, cerebral oedema and convulsions. The management of hyponatraemia depends on the cause: salt and water replacement may be required in cases of dehydration, whereas dilutional hyponatraemia should be treated with fluid restriction. Appropriate medical or biochemical advice should be sought. Rapid correction of hyponatraemia and the use of hypertonic fluids are

hazardous owing to the risk of cardiac failure and central pontine myelinolysis (Steckler, 1995; Laureno & Karp, 1997). The serum albumin is more affected by factors other than protein intake and should be interpreted with care.

5 Nutritional care of in-patients

Energy requirements

Energy intake during refeeding must achieve a compromise between the need to restore normal nutrition as quickly as possible and the patient's limited physical and psychological ability to tolerate eating. In chronic starvation the energy requirement is depressed because body cell mass is depleted and there is a conservative metabolic response to starvation. It is therefore possible to promote weight gain with a relatively low energy intake at first and increase it gradually; this allows the patient some time to adapt to an increasing intake (Strober *et al*, 1997). The rate of increase in intake depends on the patient's motivation, and the level of support and supervision that can be provided.

An individualised approach may be best for those not being treated in a specialist eating disorders unit (Salisbury *et al*, 1995). In specialist units a standardised programme can be used, with appropriate flexibility for individual needs. If dental disease is severe, dietary modification may be required: initial feeds may need to be fluid and replaced by soft food until the mouth is comfortable. Fruit juice and other acidic drinks can be diluted; vinegar, very salty foods and foods at extreme temperatures should be avoided.

A guide to energy requirements is given in Appendix 1. The amount of food given should be limited at first, and increased slowly. Initial intake should be sufficient at least to prevent further weight loss. For most patients weighing less than 45 kg, in the absence of excessive exercise, 1400 kcal (5900 kJ) daily will achieve this. This is a reasonable starting level for hospital refeeding for all but the most severely ill. This level of intake should be continued until it can be confirmed that gut function is normal (i.e. bowel sounds are present) and that water overload, if present, is beginning to resolve. The latter is indicated by weight stabilisation and normally occurs within 7–10 days. Thereafter food intake can be increased as quickly as the level of supervision and support will allow.

A weekly weight gain of 0.5–1.0 kg is generally regarded as optimum. There is some preliminary research evidence that a minimum weight gain of 0.5 kg per week results in greater weight gain at discharge than use of a higher minimum (Herzog *et al*, 2004). A gain of 1 kg per week requires an energy intake of 1000 kcal (4200 kJ) daily above the maintenance requirement. An intake of 2200–2500 kcal (9200–10 500 kJ) daily will promote weight gain of 0.5–1.0 kg per week in most patients. The rate of gain will slow down as weight increases, owing to an increase in metabolic rate and physical activity. It may be appropriate to increase energy intake to compensate for this or to allow a slower rate of weight gain in order to facilitate stopping at the agreed maintenance figure.

Target weight

It is a common practice in many units to set a target weight at the beginning of treatment. This gives definition to the treatment programme and may help to allay the patient's anxiety about being allowed to become overweight. There is no clear consensus as to how the target weight should be determined. A reasonably common practice is to base it on a low normal body weight, such as a BMI of 19 kg/m^2 or 20 kg/m^2. This may have to be modified in the light of individual circumstances, for example if the patient's premorbid stable weight was significantly higher or lower than this. It may sometimes be appropriate to agree a lower target weight, for example as part of a specialised treatment plan or in intractable cases where the patient has repeatedly failed to attain a normal weight. In some units a target weight range is used in preference to a single weight.

A BMI range of 19–25 kg/m^2 is accepted as 'healthy' in European and North American populations but there is uncertainty as to whether this range should be applied to other ethnic groups. Unfortunately the lower limit of the normal BMI range is not well established for such groups. Clinical experience suggests that women of Asian origin may resume menstruation at lower weights than women of European or North American origin. It should be pointed out that, although menstruation is often taken as a marker of adequate weight restoration, it does not necessarily indicate the optimum weight in terms of long-term health. At present there are inadequate data on which to base recommendations about healthy weights in specific ethnic groups.

Although setting the target at a normal weight results in lengthy admissions, clinical experience suggests that discharge before this point may allow the patient to avoid the difficult psychological transition to a normal weight. There is limited research evidence that discharge at a low weight is associated with a poorer outcome and a higher readmission rate (Baran *et al*, 1995; Howard *et al*, 1999). It should be emphasised that the target represents a minimum healthy weight rather than an ideal. The return of menstruation may be used as a physiological marker of adequate weight restoration, although patients should be informed that this may be delayed for several months after attaining a normal weight. An alternative approach is to ask the patient to attain a BMI of 19 kg/m^2 and then begin sequential ovarian ultrasound examinations; weight gain is then continued until a dominant follicle is observed. This approach may avoid the arguments with patients which often occur when professionals define the 'healthy' weight.

Enteral feeding

Enteral feeding has a limited role in the treatment of anorexia nervosa; however there are some situations in which it may be required. If enteral feeding is considered necessary, the nasogastric route is normally preferred. It reinforces the view that enteral feeding is a short-term measure, and there is less medical risk involved than with other procedures. In exceptional circumstances a gastrostomy or jejunostomy may be considered, but these procedures are more

invasive and the stoma must be managed carefully to minimise the risk of infection (Neiderman *et al,* 2000). Feeding through a nasojejunal tube is a less invasive alternative which may overcome problems due to delayed gastric emptying and gastric reflux. However, insertion of a nasojejunal tube is more complex than that of a nasogastric tube and should be performed by a gastroenterologist. The use of enteral feeding requires a clinical team experienced and skilled in its use. Teams responsible for enteral feeding are advised to familiarise themselves with the guidelines published by the British Society of Gastroenterology (Stroud *et al,* 2003), which contain detailed advice. Dietetic advice should always be sought when enteral feeding is used, and it is recommended that units have a written protocol in place for its use.

The decision to institute enteral feeding is a difficult and complex one and should always be considered carefully. It may be required as a life-saving measure but should be used for the minimum length of time. Occasionally, patients find an artificial means of feeding preferable as it takes away the sense of responsibility for eating (Niederman *et al,* 2000). In critically ill patients, enteral feeding may allow a greater degree of control over the patient's nutritional intake. However nasogastric feeding may be distressing to the patient and may reactivate feelings associated with sexual abuse. Although enteral feeding may be helpful in restoring weight in the short term, it does not require the patient to play an active part in the recovery process and so probably has a limited role in the long term. It is therefore advisable to employ it until the patient is reasonably medically safe (e.g. has a BMI of 14 kg/m^2), rather than continuing until a normal weight is achieved.

Patients undergoing enteral feeding need careful medical monitoring because of the potential risks involved, in particular fluid and electrolyte disturbances. In order to minimise complications, it is recommended that enteral feeding be initiated slowly. Electrolyte disturbances are most likely to occur during the first 1–2 weeks of enteral feeding. Serum electrolytes should be monitored at least daily and deficiencies corrected promptly. Liver function tests and a full blood count should be done weekly until the patient is stable. Blood glucose concentrations should be checked every 4–6 h initially. Fluid balance should be charted carefully.

There is a risk of hypophosphataemia and acute thiamin deficiency at the outset of enteral feeding. Standard tube feed products do not contain enough phosphate to meet the needs of severely starved patients; it is therefore recommended that such patients are given phosphate supplements before feeding starts (Birmingham *et al,* 1996). An additional mineral supplement may be required. It is recommended that patients are given intravenous B and C vitamins prior to starting enteral feeding. There are few empirical data on which to base recommendations about continued parenteral vitamin supplementation, but the British Society of Gastroenterology (Stroud *et al,* 2003) recommends supplementation for at least the first 3 days of refeeding. The Committee on Safety of Medicines advises that there is a risk of potentially seroius allergic adverse

reactions to parenteral thiamine (Pabrinex). This can be minimised by giving it diluted through an infusion pump (for example in 100 ml of 0.9% sodium chloride or 5% dextrose over 30 min); facilities for treating anaphylaxis should be immediately available. Hyperglycaemia may develop during enteral feeding and patients should be monitored closely for this.

Enteral feed should be administered through a fine-bore nasogastric tube (5–8 French gauge). Long-term nasogastric and nasojejunal tubes should be changed every 4–6 weeks and swapped to the other nostril. The position of the tube must be checked every time it is used by reference to external length and confirmed by pH measurement or X-ray. An isotonic 1 kcal / ml (4.2 kJ / ml) standard feed should be used. Concentrated feeds are unnecessary; they impose an excessive osmotic load on the gut and an excessive solute load on the kidneys.

A number of regimens are possible. Enteral feeding may take place continuously for 20 h out of 24 h, with a 4-h rest overnight. Alternatively, the feed may be stopped at mealtimes to allow the patient to continue eating. Occasionally, a supplemental feed may be used overnight only. Feeding should begin at a low rate to minimise the risk of complications. The British Society of Gastroenterology recommends starting at 20 kcal (84 kJ) / kg of body weight per day, or even 10 kcal / kg (42 kJ / kg) per day or less in severely malnourished patients (Stroud *et al*, 2003).

It is important that the patient receives encouragement to eat despite nasogastric feeding, if physically able to tolerate it. Staff should ensure that the constituents of the feed are acceptable to the patient in terms of long-standing dietary practice (for example, vegetarianism) and religious or cultural dietary restrictions. During the early phase of enteral feeding, patients will often feel worse rather than better. It is helpful to provide the patient with explanation and reassurance concerning the discomfort (e.g. stomach bloating, fluid retention, rapid weight gain) that may be experienced. Information about the feeding regimen and when increments will be made can provide an incentive for the patient to increase the oral intake, with the understanding that enteral feeding will be reduced as weight increases. Planning for the restoration of eating should begin as soon as enteral feeding is established. It is important to explain the plan to the patient and, if appropriate, the family. When transferring to an oral diet, it is advisable to decrease the enteral feeding gradually to prevent sharp decreases in weight and enable the patient to compensate with increases in food intake.

6 Complications of refeeding

A number of complications may occur during the course of refeeding, some of them serious, and medical monitoring is strongly recommended. Patients most at risk include those with a very low BMI (e.g. below 12 kg / m^2); those with a history of severe dietary restraint, vomiting, laxative misuse or bingeing; and those with concurrent medical conditions such as diabetes, infection or major organ failure. Clinical experience suggests that many of the untoward consequences of refeeding can be minimised or avoided by starting the patient on relatively small amounts of food and increasing the quantities progressively. A sudden increase in the metabolic load may precipitate biochemical decompensation, and an excessive protein intake can be hazardous in patients with underlying renal or hepatic impairment.

Electrolyte disturbances

A range of electrolyte disturbances can occur during refeeding, which are sometimes referred to collectively as the 'refeeding syndrome'. It should be borne in mind that serum measurements of electrolytes may be misleading as they may mask a significant total body deficit (Powers *et al*, 1995). The metabolic demands of refeeding can unmask hidden deficiencies, and complex shifts of electrolytes between intracellular and extracellular compartments may further complicate the biochemical picture (Solomon & Kirby, 1990). The use of intravenous fluids may compound the problem. Hypokalaemia, hypocalcaemia and hypomagnesaemia may occur (Palla & Litt, 1988; Koh *et al*, 1989; Greenfield *et al*, 1995; Connan *et al*, 2000). Electrolyte deficiencies may require oral or intravenous replacement depending on their severity (see Appendix 4). Intravenous replacement should take place under the supervision of a physician. Electrocardiographic monitoring is strongly recommended in all cases of electrolyte disturbance and during intravenous replacement.

Hypokalaemia

Hypokalaemia may be due to potassium loss secondary to laxative misuse or metabolic alkalosis secondary to vomiting. A good potassium intake (minimum 65 mmol daily) is necessary from the beginning of refeeding. This can be achieved by including in the diet at least 600 ml of milk per day, diluted fruit juice, potatoes and vegetables. Some patients may have been drinking excessive amounts of coffee, which contains high levels of potassium. If the level of coffee intake is reduced, care is needed to protect potassium

status by reducing purging behaviour and supplying dietary potassium from alternative sources.

Hypophosphataemia

Hypophosphataemia may develop rapidly during refeeding; if severe, it can cause cardiac and respiratory failure, delirium and fits. Malnourished patients are likely to be phosphate-deficient. When refeeding begins, metabolism of carbohydrate increases and phosphate reserves may be exhausted. Ingestion of large quantities of carbohydrates, such as occurs during refeeding, may result in a precipitate drop in serum phosphate levels (Solomon & Kirby, 1990; Fisher *et al*, 2000; Winston & Wells, 2002; Hearing, 2004). Adequate amounts of phosphate should be supplied from the diet. A high phosphate to carbohydrate ratio can be achieved by including at least 600 ml of milk per day, and avoiding the use of sugar and high-sugar foods for the first week or so of refeeding. The use of prophylactic phosphate supplements has been advocated (Fisher *et al,* 2000) but has not been subjected to evaluation.

Hypomagnesaemia and hypocalcaemia

Hypomagnesaemia may develop during the course of refeeding and oral supplements may be required. However, these should be used with caution because of the risk of inducing diarrhoea, which may compound other fluid and electrolyte problems. Hypocalcaemia is unusual but has been reported.

Abnormal liver function

Abnormal liver function tests, with high levels of aspartate aminotransferase, can occur at presentation or during refeeding (Jones *et al*, 1999). The cause of this is obscure, but it may represent fatty infiltration of the liver. It appears to be benign, but other causes of liver dysfunction should be excluded.

Delayed gastric emptying

Delayed gastric emptying results in early satiety and sensations of abdominal fullness or bloating in a significant number of patients. Rarely it may result in gastric dilatation or even rupture, especially if the gut wall is thin or previously traumatised (Robinson, 2000). Although it may be necessary to set time limits on eating meals, these should be generous enough to allow eating at a fairly slow pace. It is also more comfortable for the patient to divide the day's food into six meals and snacks rather than fewer, larger meals. Metoclopramide may be used (usually in a reduced dosage of 5 mg three times daily) but is often of only limited effectiveness. Many patients complain of colicky abdominal pain; this rarely responds to antispasmodic drugs and is generally best managed with explanation and reassurance.

Constipation

Constipation may be a problem in some patients, particularly those who have misused laxatives. It can usually be managed adequately with a combination of sufficient fluid and dietary fibre, together (if necessary) with stool-softening agents or bulk laxatives. Normal dietary treatment may help, in particular liberal amounts of fluid, regular eating and (once it is safe) adequate dietary fibre. The use of stimulant laxatives is not recommended.

Osmotic stress

Severe starvation is thought to damage the integrity of the gut wall and allow increased osmotic movement of water into the gut after eating. This can cause symptoms such as nausea, bloating, diarrhoea and faintness, particularly if the patient is given large quantities of carbohydrate. Limiting the osmotic load of the food can help control symptoms. The amount of sodium in the diet can be limited by the use of a 'no-added-salt' diet (60–70 mmol sodium per day). Fruit juices should be given at 50% dilution in water, and other high-sugar drinks should be avoided or diluted well. The use of large amounts of sugar or artificial sweeteners should be avoided and any nutritional supplements should be isotonic.

Refeeding oedema

Some patients develop peripheral oedema in the early stages of refeeding. It appears to be particularly common in those who have misused laxatives or induced vomiting prior to admission. In severe cases it can lead to rapid weight gain of several kilograms, but usually begins to resolve in 7–10 days. Refeeding oedema should be distinguished from cardiac failure, of which other signs are absent. Cardiac failure does occasionally occur and is most likely when patients are fed artificially, particularly parenterally. The aetiology of refeeding oedema is at present obscure: dysregulation of vasopressin and/or aldosterone secretion may be implicated. Hypoalbuminaemia does not appear to be a major factor in most cases.

The problem can usually be managed with explanation and reassurance; diuretics should be avoided if possible as they may exacerbate the problem. It may be helpful to ensure adequate protein intake. Sodium restriction has been advocated to prevent or treat refeeding oedema, although there is no research evidence to support this practice. Some patients may in fact be suffering from salt and water depletion, particularly those who have recently been admitted and have a history of purging. In these patients, sodium depletion may lead to secondary hyperaldosteronism and renal potassium loss with consequent hypokalaemia. Restoration of circulating volume and cautious sodium replacement may therefore be required in this group.

7 Nutritional care of out-patients

Many of the principles of in-patient refeeding can also be applied to out-patients. However, out-patients are a heterogeneous group and an individualised approach to refeeding may be best. The optimum rate of weight gain will be determined by a number of factors, including current weight, level of motivation, frequency of contact and facilities for medical monitoring. In view of the risk of complications if weight gain is too rapid, weight gain of more than 0.5 kg per week is probably unwise. In patients who are gaining significant amounts of weight (0.3 kg per week or more), regular monitoring of serum electrolytes is recommended. We also recommend prescription of a complete micronutrient supplement. The patient should be monitored clinically for evidence of oedema and other complications of refeeding.

8 Nutritional care of patients with chronic anorexia

If a restricted diet appears to be a permanent feature of the patient's lifestyle, education in achieving good nutrition should form part of treatment. The aim is to ensure that the patient knows how to meet nutritional needs using foods that are acceptable. Particular attention should be given to energy, protein, calcium, iron, zinc, vitamin B_{12} and vitamin D. The long-term use of nutritional supplements should be considered, including calcium and vitamin D for those with low bone mineral density and iron for those who are menstruating.

For some patients with a long history of anorexia nervosa, the best option may be to maintain a weight safe enough to allow some quality of life and prevent hospital admission. This normally requires a BMI of at least 15 kg/m^2. Maintaining a low body weight requires a low energy intake, but the requirement for most essential nutrients is at least as high as that recommended for healthy people (in the absence of menstruation, iron is an exception). Achieving an adequate dietary intake of all nutrients therefore requires a diet with a high nutrient density overall. This can be planned in discussion with the patient, using foods that the individual feels able to tolerate and which are acceptable within the context of cultural and religious practice. Planning the diet should include particular attention to the following:

- regular, stable intake of carbohydrate, to prevent erratic weight changes;
- adequate intake of protein, especially for vegetarians, those who avoid dairy products and those with increased protein requirements (e.g. in infection);
- adequate intake of essential fatty acids;
- adequate intake of nutrients necessary to support bone mineral density (calcium, vitamin D, magnesium);
- iron and zinc for those who do not eat red meat;
- fat-soluble vitamins;
- the need for long-term, well-balanced vitamin and mineral supplementation;
- the need for supplementation with specific nutrients that are difficult to provide in adequate amounts from the diet, especially where there are increased requirements.

Managing hunger should be addressed in planning. For most people, it is not possible to abolish hunger while at a low body weight, although some deny it or appear not to experience it. A number of approaches may help the patient to manage hunger and prevent overwhelming craving. They include regular, frequent meals and snacks; eating slowly; including adequate amounts of starchy carbohydrate and, if possible, some fat in the diet; and constructing meals with a variety of foods. Some individuals may appreciate including controlled amounts of foods which they like but find difficult to allow themselves.

9 Nutritional supplements

Micronutrient deficiencies

A number of micronutrient deficiencies have been identified in anorexia nervosa (Casper *et al*, 1980; Thibault & Roberge, 1987; Philipp *et al*, 1988; Rock & Vasantharajan, 1995; Hadigan *et al*, 2000). Although the clinical significance of many of these is unclear, we recommend the prescription of a multivitamin/multimineral supplement in oral form.

Zinc deficiency may cause altered taste as well as a variety of neuropsychiatric symptoms. It has been suggested that the use of zinc supplements increases the rate of weight gain (Birmingham *et al*, 1994), but this finding has yet to be confirmed; the routine use of zinc supplements cannot currently be recommended. A significant proportion of patients with anorexia nervosa are deficient in thiamin (Winston *et al*, 2000), and the increase in carbohydrate metabolism that occurs during refeeding may exhaust inadequate thiamin reserves. The use of prophylactic thiamin supplements in oral form is recommended for in-patients and those undergoing rapid weight gain. In the absence of data on the appropriate dose of thiamin, we recommend 25 mg per day; in cases of confirmed deficiency, higher dosages may be required. Thiamin deficiency can be confirmed biochemically (see Appendix 3).

Riboflavin deficiency may cause angular stomatitis and iron deficiency causes glossitis. Vitamin C deficiency can cause bleeding gums (Newton & Travess, 2000). These problems may need specific nutritional supplementation. Vitamin D requirements are higher than average in anorexia nervosa, owing to the risk of osteoporosis (Zipfel *et al*, 2000), and there is an argument for giving vitamin D supplements as part of refeeding.

Liquid supplements

The use of liquid nutritional supplements in place of food is not generally recommended because they interfere with the normalisation of diet and the return of normal gastrointestinal function. However, they may be used in certain specific circumstances. They may be used to supply additional energy intake so that the patient can learn to eat normal quantities, rather than having to eat an abnormally large amount of food. Occasionally, liquid supplements may be perceived as 'medicine' rather than food and thus be more acceptable to the patient; they may therefore have a short-term role in out-patient treatment.

Low-energy products

Patients with anorexia nervosa often use large quantities of low-energy and low-fat products. In a hospital refeeding programme the inclusion of such products

is difficult to justify, as it appears to accept the patient's perception of the need for them. For out-patients, gradually replacing low-energy products with more appropriate alternatives should be an aim of treatment. However, once a healthy weight has been achieved, it may be appropriate for the recovering patient to use foods that are shared with other members of the household, even if these include low-fat or low-energy products.

10 Vegetarian and vegan diets

Vegetarianism

The major question in the treatment of vegetarians is whether changing this aspect of the diet should be an aim of treatment. A vegetarian diet may be socially normal, in which case it is inappropriate to challenge it. However, vegetarianism is found much more commonly among people with anorexia nervosa than in the general population. When it develops alongside the eating disorder, it may justifiably be considered as part of the psychopathology (Sullivan & Damani, 2000). Where appropriate, a careful history of the development of vegetarianism, the detail of its practice and its place in the individual's social, cultural and religious environment is necessary. Every effort should be made to respect an individual's personal beliefs. This information gives a basis for providing appropriate treatment.

In the average UK diet, meat and fish provide a high proportion of some essential nutrients. It is clearly necessary to ensure that these nutrients are adequately replaced. A multivitamin / multimineral supplement will supply many of the required micronutrients. Care should be taken to ensure that any drugs and nutritional supplements administered are consistent with the patient's diet: for example, gelatine capsules are unacceptable to strict vegetarians and vegans.

Veganism

Vegan diets have a lower energy density than the average diet (Langley, 1995). Achieving an energy intake high enough to promote adequate weight gain in a severely underweight person on a vegan diet would require a very large total volume of food. This would be difficult to tolerate for a person physically and physiologically compromised by starvation. In particular, there is a risk of acute gastric dilatation (Robinson, 2000). Iron is not as well absorbed from vegetable as from animal foodstuffs, and the high phytate content of plants impairs absorption of minerals, in particular iron, zinc and calcium. Calcium intake may be lower than recommended in vegan diets (Lightowler & Davies, 2000). Provision of enough phosphate to prevent hypophosphataemia in the early stages of refeeding is difficult without milk in the diet, and phosphate supplements may be required.

11 Religious and cultural issues

Many religions, including Judaism, Christianity, Hinduism, Buddhism and Islam, include some dietary exclusion or periods of fasting as part of religious observance (Collins *et al*, 1993). Advice from an appropriate minister of religion or cultural adviser may be needed. If an individual excludes some foods from the diet as part of religious observance, and belongs to a religious community whose members all share such a diet, it is clearly normal to continue with it and the patient should be allowed to do so. Even recently acquired religious dietary restriction, not observed by the patient's family and social circle, should normally be respected. Challenges to religiously based dietary restrictions should be made only on very clear grounds, and with sensitivity.

Religious dietary requirements should be respected during hospital treatment, as they would be for any other patient. Although many religions permit relaxation of dietary restrictions during illness, many individuals prefer to continue them. This should generally be respected unless it presents a threat to treatment and recovery. The support of a minister of the religion can be invaluable. It is possible to restore nutrition from low weight without infringing normal religious observance, although it may present practical challenges. Fasting, and extreme diets which exclude a very large number of foods (such as Zen macrobiotic diets), are not compatible with safe recovery from very low weight.

Frozen or chilled meals for kosher, halal and Hindu vegetarian diets are available to hospital caterers if the meals cannot be prepared locally. These can be used to provide a normal and adequate diet, although foods may need to be selected with care for those refeeding from a very low weight. It may be necessary to supplement the diet to increase the energy content and promote weight gain. Foods that may be useful for such supplementation include breakfast cereal, biscuits (some may need to be provided by an acceptable supplier), soya milk and soya desserts. If necessary, a proprietary energy supplement may be acceptable; these include oligosaccharide powders and liquids, and fat and oligosaccharide mixtures. However, care should be taken to ensure that any nutritional supplements and drugs administered are consistent with the patient's religious or cultural practices: for example, gelatine capsules may be unacceptable to certain religions.

12 Special requirements of children and adolescents

The nutritional management of children and adolescents with anorexia nervosa cannot be separated from other aspects of their management. It must always be remembered that children are not merely small adults, either physiologically or in terms of their psychosocial development. Whether nutritional management takes place in an in-patient, out-patient or day-patient setting, the service should be age-appropriate and staffed by clinicians experienced in work with children and adolescents. Prepubertal children and older adolescents are at very different stages of development and should ideally be treated in separate services. In the UK, children's psychiatric in-patient services generally treat children up to the age of around 13 years, with adolescent services managing those aged 13–16 years. Young people aged 16–18 years are frequently treated within adult services, but their social, family and educational needs would often be met more fully within an adolescent service.

The management plan should always be presented clearly to the patient and, where possible, cooperation elicited. Explanations of the treatment plan need to be presented in a manner appropriate to the patient's age and level of comprehension. In terms of nutritional management, young people are likely to be ignorant of their nutritional needs and the range of normal growth during the teenage years. The involvement of parents (or substitute carers) is vital in the nutritional management of children and adolescents, both because they have parental rights and because they will have a shared role in determining food intake at home. Parents therefore need to be included in any dietary education and meal planning; their own beliefs and attitudes will also need to be addressed.

Physiological considerations

Physiological differences from adults

The literature on medical complications in younger patients is relatively limited. Although mortality rates in this group are low, younger people tend to cause greater medical concern than adults. Their energy stores are low, emaciation may occur more rapidly, and children dehydrate more quickly than adults. Although the BMI is widely used as an indicator of body fat stores in adults, it should be used with caution in children and adolescents. Despite being a valuable pointer to thinness, the BMI is a poor reflection of a child's fat reserves. In adolescents, a change in BMI is not a reliable indicator of change in fat, protein or carbohydrate stores (Trocki & Shepherd, 2000). When anorexia nervosa has developed before growth has been completed, it will stunt growth and reduce height; weight loss will therefore be underestimated if assessment is based on

the BMI alone. It is arguable that a more accurate assessment of weight loss may be obtained by calculating the BMI on the basis of predicted height for age rather than actual height.

Body mass index norms vary with age and we therefore recommend that any assessment of BMI in this age-group be related to BMI centiles (Cole *et al*, 1995). Centile charts are available from the Child Growth Foundation (http://www.healthforallchildren.co.uk) and we recommend their use to monitor progress in adolescents. The charts should be used for patients up to the age of 20 years, to take account of the possibility of developmental delay with a late-adolescent growth spurt. However, there is no consensus as to how these charts should be used to diagnose anorexia nervosa. As a provisional measure, we therefore propose use of the second centile as a cut-off point to suggest that an adolescent (girl or boy) may have anorexia nervosa. This is a pragmatic suggestion, given the lack of evidence on which to base a recommendation, and the issue will need to be reviewed in the light of future research. However, this measure is consistent with the Child Growth Foundation's definition of 'significant underweight' as being below the second centile. On the BMI centile chart for girls produced by the Child Growth Foundation, the second centile line gives a BMI of 15.5 kg/m^2 at age 14 years, 16.3 kg/m^2 at age 16 years, 16.9 kg/m^2 at age 18 years and 17.4 kg/m^2 at age 20 years; the figures for boys are slightly different. However, clinicians will need to apply other international diagnostic criteria to confirm the diagnosis, such as failure to make an expected weight gain during a period of growth.

Effect of growth

Whereas average weights are stable from year to year in adults, normal (and therefore expected) weights increase each year during development. Growth is especially rapid during puberty, with girls' mean weight increasing from 34 kg at age 11 years to 48 kg at age 13 years; this represents a 41% increase in 2 years. Boys grow on average from 41 kg at age 13 years to 57 kg at age 15 years, a weight gain of 39% (Tanner & Whitehouse, 1966*a*,*b*). In healthy children this growth requires a positive daily energy balance of around 170 kcal (715 kJ) daily.

Role of puberty

Younger patients will comprise a mix of prepubertal children, those in pubescence and post-pubertal adolescents. Assessment of pubertal development should employ the Tanner Staging Norms (Tanner, 1978). Pelvic ultrasonography can be useful in assessing menarche and the monitoring of recovery. In planning target weights, the relationship between weight and completion of puberty should be addressed. Menarche is usually triggered at a weight of around 45 kg and thus puberty is unlikely to be completed below this weight.

Assessment of expected weight

Because of high rates of expected growth in early adolescence and the impact of energy restriction on skeletal growth, assessment of expected weight is much more difficult in this age-group. Anorexia nervosa can develop in adolescents without weight loss if weight is kept steady during a stage of expected growth. On occasions even a slow increase in weight may result in the child crossing centile lines – and hence becoming thinner – if this increase is less than expected.

Assessment of expected weight should take into account premorbid weight and height centiles, parental height and weight, and normal weight for height centiles. The calculation of target weights needs constant revision during refeeding as a growth spurt may be initiated. Pubertal development should be maintained where possible within two standard deviations of age norms; pelvic ultrasonography may assist with the assessment of developmental stage.

Oral feeding requirements

The estimated average energy requirement in the UK for healthy girls aged 11–18 years ranges from 1845 kcal to 2110 kcal (7750–8860 kJ) per day; for boys of the same age the range is 2220 kcal to 2755 kcal (9325–11 570 kJ) per day (Department of Health, 1991). As with adults, children and adolescents with anorexia require hypercaloric diets in order to gain weight, especially when approaching a minimum healthy level. Most authorities suggest that teenage girls who are anorexic require an energy intake in excess of 3000 kcal (12 600 kJ) daily to achieve full weight restoration, whereas the American Psychiatric Association (Anonymous, 2000) recommends 70–100 kcal/kg (295–420 kJ/kg) per day. Energy needs are obviously greater in young, growing adolescents and it often becomes difficult for those with anorexia to ingest enough energy to gain weight.

Increased energy needs continue into the maintenance period. Kaye *et al* (1986) have shown that people with anorexia require an extra 200–400 kcal (840–1680 kJ) a day for up to 6 months after reaching maintenance weight. Weltzin *et al* (1991) reported that recovering patients required 45–50 kcal/kg (190–210 kJ/kg) per day to maintain 95% average weight for height, compared with 30 kcal/kg (125 kJ/kg) per day in a healthy control group. The American Psychiatric Association (Anonymous, 2000) suggests using 40–60 kcal/kg (170–250 kJ/kg) per day during the weight maintenance period. It has also been demonstrated that people with restricting anorexia require significantly more energy than those with the binge/purging subtype (Kaye *et al*, 1986; Weltzin *et al*, 1991).

Enteral feeding

Enteral feeding may be considered essential in the treatment of children and adolescents when the patient has deteriorated medically to such a degree that there is a serious risk of death. The considerations described above in relation to

adults apply equally to younger patients. A nutritionally complete, isotonic 1 kcal/ml (4.2 kJ/ml) enteral feed should be used when initiating feeding. The rate and volume of feed to be delivered depends on the oral intake of the individual patient. Generally, it is safe to deliver an amount equivalent to the amount of energy currently being ingested by the patient. The rate should be slow at first (e.g. 20 ml/h) and gradually increased by 10 ml/h increments to a rate of 120 ml/h depending on tolerance. A rate of 20 ml/h may not be sufficient to maintain body weight and additional fluids may be required (see Table 3). It is recommended that increments of 200–300 kcal (840–1260 kJ) be made once or twice weekly to achieve a weight gain of 0.5–1.0 kg per week. Higher-energy feeds may be required as energy requirements approach 2000 kcal (8500 kJ) daily. Young people should be encouraged to eat normally so that enteral feeding is viewed as supplementing the diet rather than replacing it. Enteral feeding may be delivered overnight, with the expectation that the patient normalises oral intake during the day.

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Appendix 1: Nutritional requirements

The data in Tables 1–4 are reproduced with permission from *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom* (Department of Health, 1991).

Table 1 Reference nutrient intake for protein

	Protein intake per day, g	
Age, years	Female	Male
15–18	45.0	55.2
19–50	45.0	55.5

Table 2 Energy: estimated average requirements

	Energy intake per day, kcal (kJ)	
Age, years	Female	Male
15–18	2110 (8860)	2755 (11 570)
19–50	1940 (8150)	2550 (10 710)

Table 3 Fluid requirements (female and male)

Age, years	Fluid intake per day, ml/kg ABW
15–18	50
19–50	30–35

ABW, actual body weight.

Table 4 Reference nutrient intakes for vitamins and minerals: females

Vitamin or mineral	Intake per day		
	Age 11–14 years	Age 15–18 years	Age 19–50 years
Thiamin, mg	0.7	0.8	0.8
Riboflavin, mg	1.1	1.1	1.1
Niacin, mg	12	14	13
Vitamin B_6, mg	1.0	1.2	1.2
Vitamin B_{12}, µg	1.2	1.5	1.5
Folate, µg	200	200	200
Vitamin C, mg	35	40	40
Vitamin A, µg	600	600	600
Calcium, mg (mmol)	800 (20)	800 (20)	700 (17.5)
Phosphorus, mg (mmol)[1]	625 (20.0)	625 (20.0)	550 (17.5)
Magnesium, mg (mmol)	280 (11.5)	300 (12.3)	270 (10.9)
Sodium, mg (mmol)[2]	1600 (70)	1600 (70)	1600 (70)
Potassium, mg (mmol)[3]	3100 (80)	3500 (90)	3500 (90)
Chloride, mg (mmol)[4]	2500 (70)	2500 (70)	2500 (70)
Iron, mg (µmol)	14.8 (260)	14.8 (260)	14.8 (260)
Zinc, mg (µmol)	9.0 (140)	7.0 (110)	7.0 (110)
Copper, µg (µmol)	0.8 (13)	1.0 (16)	1.2 (19)
Selenium, µg (µmol)	45 (0.6)	60 (0.8)	60 (0.8)
Iodine, µg (µmol)	130 (1.0)	140 (1.1)	140 (1.1)

1. Reference nutrient intake for phosphorus is set equal to calcium in molar terms.
2. Sodium 1 mmol=23 mg.
3. Potassium 1 mmol=39 mg.
4. Corresponds to sodium; 1 mmol=35.5 mg.

Appendix 2: The sit up, squat, stand (SUSS) test

Sit up

The patient is asked to sit up from lying supine on a flat surface without using the hands, if possible.

Squat

The patient is asked to squat and to rise without using the hands, if possible.

Rating

The scale used for rating both squatting and sitting is as follows:

0 completely unable to rise
1 able to rise only with use of hands
2 able to rise with noticeable difficulty
3 able to rise without difficulty.

Appendix 3: Laboratory assessment and monitoring

Recommended investigations on admission

Essential investigations:

- full blood count
- urea and electrolytes
- calcium
- magnesium
- phosphate
- glucose
- serum proteins
- liver function tests
- electrocardiogram
- vitamin B_{12}, folate
- thyroid function tests.

Additional investigations:

- creatine kinase
- erythrocyte transketolase / serum thiamin
- dual-energy X-ray absorptiometry (DEXA) scan
- plasma zinc.

Recommended biochemical monitoring during early refeeding

Daily:

- urea and electrolytes
- calcium
- magnesium
- phosphate
- glucose.

Weekly:

- liver function tests
- serum proteins
- full blood count.

Less frequently:

- folate
- ferritin.

Appendix 4: Electrolyte replacement therapy

Guidelines on the use of electrolyte replacement formulations in adults are given in Table 5.

Notes on intravenous electrolyte replacement

- Intravenous electrolyte infusions should always be given via an electronic infusion pump.
- Electrocardiographic monitoring is strongly recommended.
- All serum electrolytes should be measured at least daily in patients receiving intravenous replacement and dosages adjusted accordingly.
- Intravenous replacement should usually be carried out under the supervision of a physician / paediatrician.
- Specialist medical or biochemical advice may be required in cases of severe electrolyte depletion.

Table 5 Guidelines for therapy in adults[1]

	Oral	Intravenous
Hypokalaemia	Sando-K 4–8 tablets daily	Potassium chloride 20–40 mmol in sodium chloride 0.9% 1000 ml, as required. Minimum potassium requirement (including that obtained from enteral / oral feeding) is 60 mmol per 24 h if renal function is normal. Many patients will require more in the early stages of refeeding. Aim to keep plasma level within normal range. *In severe cases only, under supervision of a physician and with ECG monitoring:* potassium chloride in sodium chloride 0.9% 20 mmol over 2–3 h.
Hypophosphataemia[2]	Phosphate-Sandoz[3] 4–6 tablets daily	Monobasic potassium phosphate[4] 9 mmol per 12 h OR Addiphos[5] 10–20 mmol per 12 h
Hypomagnesaemia	Co-magaldrox suspension 195 / 220 (Maalox) 10–20 ml daily	Magnesium sulphate 10–20 mmol per day
Hypocalcaemia	Calcichew 1–3 tablets daily	(10%) 10 ml followed by infusion of 40 ml daily

ECG, electrocardiographic.
1. Doses are given for adults only. Some products are not recommended for use in children. Advice should be sought on the treatment of electrolyte problems in children and younger adolescents. Prescribers are advised to check all drugs and doses in the *British National Formulary*.
2. The serum calcium level may drop during phosphate supplementation.
3. This product contains 468.8 mg (20.4 mmol) of sodium and 123 mg (3.1 mmol) of potassium per tablet, as well as bicarbonate.
4. Compatible with sodium chloride 0.9% and dextrose 5%.
5. Added to intravenous glucose solution.
Proprietary preparations: Addiphos, Fresenius Kabi Ltd, Runcorn, Cheshire, UK; Calcichew, Shire Pharmaceutical Ltd, Basingstoke, UK; Maalox, Rhône-Poulenc Rorer, West Malling, UK; Phosphate-Sandoz, Sando-K, HK Pharma Ltd, Hitchin, UK.