Problems of Nutrition in Health Care and Human Services

Prevention and Treatment

Socialstyrelsen

With effect from 2001, the National Board of Health and Welfare classifies its publications into various types of document. This is an **Overview of Knowledge**. That means that the report is based on science and/or proven experience. Overviews of knowledge among other things are to provide support for knowledge-based care and treatment, method development and other improvement work, encourage and facilitate quality follow-up and/or encourage efficient utilisation of resources. The National Board of Health and Welfare is responsible for the contents and conclusions.

ISBN 91-7201-560-8
Art. No. 2001-110-14

Typesetting: Per-Erik Engström

Foreword

During the past two–three decades, nutrition has gained recognition as an important factor in the achievement of good results in health care. In order for various therapeutic and rehabilitation methods to be effective, it is essential for patients to be properly nourished. But despite this growing awareness, nutritional issues have often been neglected in patient care and in special residential facilities.

This problem became the focus of renewed attention in the autumn of 1997, when the Swedish National Board of Health and Welfare published the results of a study which found nutritional deficiencies in many of those being cared for in special residential facilities operated by three representative municipalities. But the report did not offer any explanation of these disturbing conditions. Previous studies in Sweden had found that many patients in surgical and internal medicine departments were undernourished, to the extent that they had lost weight during their stay in hospital.

Following discussions with the Swedish Medical Society, the National Board of Health and Welfare decided in 1998 to establish a temporary committee of experts to analyse all aspects of the problem. The committee's task was to review the scientific literature in order to identify key problem areas, and then to submit advice on the proper evaluation and treatment of malnutrition. The committee chairman was Torsten Mossberg, formerly chairman of the Swedish Medical Society's Nutrition Section.

This report is the fruit of the committee's labour, and is intended to satisfy the need for a readily accessible scientific review of the various issues that must be considered in order to achieve a satisfactory outcome for the patient or special resident.

The report consists of two parts, the first of which is primarily concerned with the practical aspects of nutrition. Part II is directed to those with special interests in the subject; it includes an evaluation of the available literature on the treatment of malnutrition in connection with various medical conditions.

Kerstin Wigzell
Director General

Nina Rehnqvist
Deputy Director General

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Summary

Good nutrition is essential for avoiding illness and regaining health.

All persons, including the healthy, the sick and the aged, are entitled to adequate nutrition suited to their individual needs and medical conditions.

Malnutrition *is defined* as a condition of imbalance between the intake and utilization of nutrients, leading to an increased risk of illness. The most common type of malnutrition in Swedish health care is caused by a combined lack of energy and protein, a condition known as *protein-energy malnutrition (PEM)*.

Nutrient deficiency is common in Swedish health care. In 25 studies covering a total of 5,120 patients, the average rate of PEM was 28 percent. The frequency among chronically ill elderly persons in care can be substantially higher.

Nutritional deficiencies usually *arise* as the result of interacting medical, psychological and socio-economic factors. Most cases involve both inadequate ingestion of food and increased utilization, resulting in breakdown of the body's reserves.

Nutritional status should be *evaluated* with a combination of BMI (body-mass index, kilograms divided by the square of the height in metres), weight loss and eating problems. A weight loss during the past six months of more than ten percent for middle-aged persons, or more than five percent for those over 65, may indicate malnutrition. Subjective Global Assessment (SGA) and Mini Nutritional Assessment (MNA) can be used to evaluate nutritional status of both hospitalized and out-patients, and for elderly persons living in their own or in special residential facilities.

In order to reduce the incidence of malnutrition, it is first of all necessary to apply *preventive measures*. "Primary prevention" involves preventing the occurrence of malnutrition in any form. With "secondary prevention", malnutrition is detected by clinical screening at an early stage, followed by treatment designed to shorten the length of an illness or prevent a relapse. The function of "tertiary prevention" is to alleviate the affects of malnutrition. The current steady increase in the ranks of the elderly (target-group perspective) means that preventive measures cannot

be restricted to the individual level (illness perspective), but must also include the personnel who look after the patient in question (arena perspective).

There is an extensive literature that documents a strong connection between illness-related malnutrition and increased morbidity, mortality and length of convalescence. Since illness accelerates the breakdown of bodily tissues, there is no guarantee that treatment will be able to rectify any associated malnutrition.

This report presents an evaluation of current literature, primarily that relating to *the effects of nutritional treatment on morbidity and mortality* in cases of malnutrition connected with various illnesses. The knowledge base is inadequate in many respects, due among other things to difficulties in conducting reliable clinical studies. The most extensive available data for evaluating the effects of nutritional treatment are those relating to emergency medicine (perioperative and intensive care), intestinal disorders and cancer. Uncertainty in the results of completed studies should not be interpreted as a reason for not supplying the patient with added nutrition.

Since the scientific basis for the treatment of malnutrition in connection with various illnesses is at present incomplete, it is very important to *encourage research related to the clinical treatment of nutritional problems*, in order to improve methods of treatment (including preventive measures) for specific conditions or combinations of illnesses.

Nutrition is an important aspect of *medical treatment*, but also of *patient care*. Active measures in both areas have great significance for preventing the development of malnutrition and the treatment of undernourished patients. Based on an evaluation of the patient's nutritional deficiencies and requirements, it is possible to plan a programme of care in consultation with the patient and relatives, doctors, nurses and dieticians. Satisfactory care requires systematic documentation of the patient's problems, any measures taken and their effects, and the transfer of information between various care providers.

It is vital that all nutritional treatment have a s*ound ethical basis*, the fundamental principles of which are: respect for the patient's integrity; make things better, not worse; be fair; and preserve the sanctity of life. The guidelines presented below may be helpful when dealing with patients who may be incapable of expressing their own wishes. It is up to the responsible physician to decide on which measures to take. The Swedish National Board of Health and Welfare has issued general guidelines on the maintenance of body fluids and nutrition during the final stage of life (Livsuppehållande åtgärder i livets slutskede, 1992:2).

There is probably great potential for *savings* of both human suffering and economic resources through efficient prevention and treatment of

undernourished patients. A cautious estimate, based on the assumption that time in care is reduced by proper nutritional treatment, suggests annual savings on the order of SEK 0.5–1 billion in Sweden. However, it is yet to be scientifically demonstrated that available methods of prevention and treatment can shorten periods of convalescence.

It would be a great advantage if clinical nutrition were *organized* and *integrated into the health-care system* in a different way than at present. Any nutritional problems of the patient should be taken into account during his or her entire passage through the system, from primary care to hospitalization and special residential facilities. It should be possible to offer specialist evaluations, either at special clinics or at clinic-associated departments of nutrition in hospitals and other facilities. Experience suggests that it is possible to greatly improve the treatment of nutritional problems if every care-providing entity organizes a group including members of all relevant occupations, a *nutritional advisory team*, which develops local guidelines for clinical nutrition and participates in the evaluation and acquisition of products and aids.

It will only be possible to achieve satisfactory identification, diagnosis and treatment of malnutrition if *training in matters of nutrition is improved*. All occupational groups that come in contact with patients and clients should receive a more systematic education in nutritional issues. A dietician with responsibility for the ongoing nutrition training of all personnel in primary care could make a significant contribution to the development and implementation of adequate treatment. It is also important to follow up such training with the establishment of an organizational structure for clinical nutrition within health care, so that all categories of students have an opportunity to combine theoretical knowledge with practical experience.

> The patient's nutritional problems must be dealt with in the same way as with any other medical treatment, with the same demands for evaluation, diagnosis, treatment plans, follow-up and documentation.

All health care and human services should include routine procedures for:

- identification and diagnosis of undernourished individuals
- treatment of malnutrition
- documentation and information transfer
- follow-up and evaluation
- co-operation between various levels of care
- basic and continuing education.

Expert Committee

Gunnar Akner, Secretary
Chief Physician
Nutrition & Pharmaceuticals Unit
Research on Ageing
North-west Gerontology

Ingvar Bosaeus
Professor and Chief Physician
Clinical Nutrition Section
Sahlgrenska Hospital
Göteborg

Tommy Cederholm
Assoc. Professor and Chief Physician
Geriatric Clinic
University Hospital
Huddinge

Ingemar Eckerlund
Chief Economist and Licentiate
of Philosophy in Health Care
Economic Secretariat
Swedish National Board of Health
and Welfare
Stockholm

Sölve Elmståhl
Professor, Centre for Geriatric
Development
Dept. of Social Medicine
University Hospital
Malmö

Ingegerd Johansson
Assoc. Professor and Chief Dentist
Institute of Odontology & Cariology
Dept. of Medicine and Odontology
Umeå University
Umeå

Torsten Mossberg, Chairman
Medical Advisor
Swedish National Board of Health
and Welfare
Stockholm

Elisabet Rothenberg
Chief Dietician
Clinical Nutrition Section, Dept. of
Geriatrics
Sahlgrenska Hospital 6
Göteborg University
Göteborg

Lars Steen, Vice-chairman
Assoc. Professor and Medical
Advisor
Swedish National Board of Health
and Welfare
Stockholm

Kristina Stig
Social Worker and Economist
Ekonomic Secretariat
Swedish National Board of Health
and Welfare
Stockholm

Per-Olof Sandman
Professor, Dept. of Human Services
Geriatric Centre
Norrland University Hospital
Umeå

Mitra Unosson
Doctor of Medical Science
& university lecturer
Institute of Medicine and Human
Services
Department of Human Services
University of Health Care
Linköping

Part I

1. Nutrition terminology

Tommy Cederholm & Torsten Mossberg

In this report, the term <169>malnutrition<170> refers to a condition of imbalance between the intake and utilization of nutrients. The most common type of malnutrition in Swedish health care is caused by a combined lack of energy and protein, a condition known as *protein-energy malnutrition or PEM.*

EGood nutrition is a basic requirement of good health. An imbalance between the intake and utilization of nutrients leads to nutritional disturbances. Internationally, malnutrition is often defined as "any disorder of nutrition status, including disorders resulting from deficiency of nutrient intake, impaired nutrient metabolism or overnutrition" (1). The concept of *malnutrition* may thus refer to both a lack of nutrients resulting in loss of weight and an excess of nutrients leading to overweight. However, the concept is usually associated with the first alternative, i.e. weight loss and nutrient deficiency.

It has proven difficult to formulate a concept which unequivocally describes a condition of energy-nutrient imbalance. The Swedish term for undernourishment tends to emphasize inadequate intake of nutrients. It therefore tends to be associated with conditions of hunger, as in underdeveloped countries, and to poverty and inadequate care. An imbalance between intake and utilization may also be caused by illnesses which activate biochemical mechanisms and increase the metabolic rate.

Thus, the term "undernourishment" is not entirely adequate. A lack of nutrients caused by illness can seldom be remedied merely by supplying additional nutrients. Some authors maintain that the concept of undernourishment schooled only be applied to conditions that can be reversed by nutritional treatment. The term *malnutrition*, which in everyday speech refers to conditions of undernourishment regardless of the cause, may therefore be preferable. Both terms are used interchangeably in this report. Traditionally, the classification of malnutrition in its various forms is usually based on the intake of energy (calories) and protein:

- *Protein-energy malnutrition (PEM)* is a combination of energy and protein deficiency which occurs primarily among the chronically ill

elderly. PEM can be defined as a condition arising from changes in the intake and utilization of nutrients, resulting in loss of body mass and changes in organ function which lead to increased risk of illness (2). PEM is by far the most common form of malnutrition in Swedish health care.

- *Marasmus* is caused by energy deficiency and is characterized by low body weight due to loss of fat and muscle tissue (3). Serum proteins are usually normal. The cause may be slow starvation, often linked to chronic illness.
- *Kwashiorkor* is a condition distinguished by the formation of clearly visible edemata, especially in the abdomen (ascites), and characterized by extensive loss of visceral protein. Fat and muscle tissues remain relatively intact (3). Cellular immunity is weakened, and extra-cellular volume increases. The syndrome is observed primarily among children in underdeveloped countries. The traditional view is that it is caused by an unbalanced diet rich in carbohydrates but poor in protein. The edemata are probably caused by the extreme hypoalbuminemia. Kwashiorkor is often associated with infection. In recent years, there has been some discussion as to whether infection and inflammation might be factors that trigger kwashiorkor, rather than consequences of the condition (4,5).

The Anglo-Saxon literature of recent years includes attempts to describe changes in physical constitution under conditions of malnutrition, within the framework of a treatment orientation (6).

- It has been proposed that the English-language concept of “wasting”, closely related to the Swedish term for starvation, should be applied to involuntary weight-loss due to inadequate intake of nutrients. The primary treatment for wasting is to increase the intake of food.
- It has been proposed that the term *cachexia* as hould be applied to loss of body mass connected with hypermetabolism and hypercatabolism. Cachexia is dealt with primarily by treating the underlying illness or inflammation.
- *Sarcopenia* refers to the involuntary loss of (primarily) muscle tissue that occurs as a natural part of the ageing process. The principal treatment is physical training.

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2. Evaluating the patient's nutritional status

Mitra Unosson & Elisabeth Rothenberg

Malnutrition is common among various patient categories (1–4). It is the result of a process that begins when the individual's intake of nutrients starts to be less than required. Bodily functions deteriorate, and the total amount of fat and muscle tissue decreases. Although malnutrition is common, nutritional status is seldom diagnosed or documented in patient journals (3). In order to prevent or treat malnutrition, it is necessary to identify patients with such problems. This requires sensitive and specific methods for assessing nutritional status. Such methods must also be inexpensive, easy to apply, and replicable in order to monitor the effects of nutrition therapy. Despite many attempts to develop one, there is still no generally accepted method of measurement or simple indicator for identifying and diagnosing malnutrition.

The purpose of assessing nutritional status and nutrient intake is to identify patients who are undernourished or at risk of becoming so, and to establish their nutritional requirements. The evaluation shall also provide a basis for the planning of care and treatment, making prognoses (with or without intervention), evaluating the effects of any measures taken, and instructions to patients and/or relatives.

In addition to the interpretation of clinical data, the methods used to assess nutritional status include: evaluation of diet and energy-nutrient intake; assessment of physical constitution; biochemical analyses; and evaluation of physiological functions, e.g. immune system and musculature (5). Results obtained with these methods have been shown to agree well with more subjective methods suitable to the clinical environment (6,7).

Evaluation of diet and energy-nutrient intake

In order to get some idea of the patient's dietary intake, dining patterns, preferences.and other significant factors related to nutritional status, a dietary anamnesis is documented. This may have to be supplemented with a more detailed analysis of energy-nutrient intake. Records of liquid intake are common in health care, but they contain no information about energy-

nutrient intake. In order to develop a complete picture of energy balance, it is also necessary to record the intake of solid food. That can be measured with a variety of methods (8,9), including the following:

The food frequency method is based on a list of certain foods; which and how many depends on the issues being addressed. The list may include a limited number of foods, e.g. dairy products, in order to determine the patient's calcium intake. Another list might be designed to estimate total energy-nutrient intake during a specific period, such as the past month or three months. The form can be filled in by an interviewer or self-administered by the patient. This method provides information on what, how much and how often the patient eats.

The dietary history interview is based on a list of foods taken with every meal. The data is always collected by an interviewer, and the objective is to record the entire normal intake of energy and nutrients during a specific period. Foods, recipes and portions must be described with great precision in order to achieve useful results.

The purpose of *the 24-hour interview* is to record total energy-nutrient intake during the past 24 hours. The same requirement of precision applies as with the dietary history interview.

The most common method used in clinical situations is the diet journal which documents everything that the patient eats and drinks. On the basis of this data, total nutritional value is calculated. There is a variety of different forms for food and liquids which facilitate the collection of data. A distinction is made between *measured* and *estimated* intake. With the former, everything the patient eats and drinks is measured, which of course is time-consuming. It is therefore more common to estimate the amount of food and liquid the patient ingests, which naturally yields less certain results. It should be underlined that a diet journal can never be exact. Regardless of the method used, great precision is required. Everything the patient eats and drinks must be noted and accurately described. For example, it is important to record whether the patient has eaten whole-grain or white bread, baked or creamed potatoes, etc. Someone with good knowledge of nutrition should be present to ensure that the information is properly documented and analysed.

The number of days recorded also influences the accuracy of the data, given that eating behaviour varies from day to day. The more days for which data is collected, the more reliable they are likely to be. This may vary for different nutritional components: For energy, a period of 5–7 days may suffice, while it may take up to a month in order to obtain accurate data on certain vitamins and minerals. Despite such limitations, it is essential to develop some idea of the patient's energy-nutrient intake in order to compare it with basic requirements.

Assessment of physical constitution

Physical constitution has great significance for the evaluation of nutritional status and the effects of treatment. Height, weight, upper-arm circumference, thickness of the skinfold, and the upper-arm muscle circumference are all used as indirect measures of the body's energy-protein supply, and thus of nutritional status.

Height

Height and weight are the main factors in assessing nutritional status. When height is measured, the individual should be lightly dressed and shoeless, stand erect with feet close together, arms hanging at the side, shoulder relaxed, and looking straight ahead. The heels, shoulder blades and head should be in contact with a vertical surface. Height can also be measured in a prone position with a sliding calliper rule that has supports for the head and feet (Figure 1).

For individuals with hunchback, brittle bones (osteoporosis) and spinal compression, dystonia (severely contracted muscles) or amputations, estimates can be made of current or previous height by measuring armspan, half the armspan, arm length or knee height (10–13).

Armspan

Armspan is measured from the fingertips of the outstretched hands. The individual stands against a wall, or sits straight, with the arms stretched out to the sides at shoulder-level. Up to age 40–50, the height of most individuals is nearly the same as armspan. After age 50, armspan may be greater than height due to age-related shrinking (10).

Figur 1. *Measuring height in prone position.*
(Photography Dept., University Hospital, Linköping.)

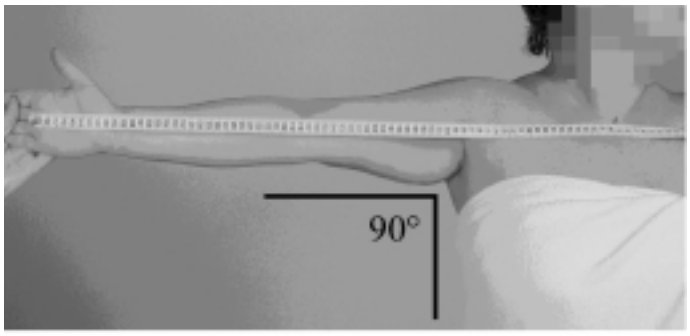

Figure 2. *Measurement of demi-armspan.*
(Photography Dept., University Hospital, Linköping.)

Demi-armspan
Half of the armspan is measured from the centre of the sternum to the base of the gap between the middle and ring fingers of one outstretched hand (Figure 2). Height is estimated with the following equation (11):

Women: Height in cm = (1.35 x demi-armspan in cm) + 60.1
Men: Height in cm = (1.40 x demi-armspan in cm) + 57.8

Total arm length
Total arm length is measured from the tip of the acromion to the end of the ulnar styloid process with the arms at the side of the body (12) (Figure 3).

Figure 3. *Measurement of total arm length.*
(Photography Dept., University Hospital, Linköping.)

Height is estimated with the following equation:

Height in cm = 90.55 + 5.26 x gender factor + 1.240 x total arm length in cm.
(Gender factor: 1 for male, 0 for female)

Knee height
Knee height is measured on the left leg, with the knee bent and the foot at a 90-degree angle (13). The individual can be either prone or sitting. One jaw of the calliper is placed under the sole of the foot, and the other against the front of the femur above the ankle, approximately on the patella, with a light pressure that compresses the soft tissue. At least two measurements are taken, and the results must not differ by more than 5 mm. Height is estimated with the following equation:

Men: Height = (2.03 x knee height in cm) – (0.04 x age) + 64.19
Women: Height = (1.83 x knee height in cm) – (0.24 x age) + 84.88

Weight

Body weight is measured to the nearest ±0.1 kg on a calibrated scale, in the morning before breakfast. The individual is unclothed or lightly dressed, with an empty bladder. For the bedridden or physically handicapped, there are scales that can be used in combination with hoists (Figure 4).

Weight can be related to height with the Body Mass Index (BMI), i.e. weight in kilograms divided by the square of the height in metres. BMI is an accepted index for grading under- and overweight, and to distinguish normal body weight from altered weight due to chronic energy deficiency

Figure 4. *Measurement of body weight in prone position. (Viola scale, KEBO Care AB).*

Body Mass Index = weight in kg divided by the square of the height in m.

(14–16). Among both men and women aged 20–70, a BMI of less than 20 is regarded as underweight, more than 25 as overweight, and above 30 as obesity.

Individuals with a BMI of less than 18.5 kg/m^2 should be regarded as undernourished and evaluated for possible treatment (16). Since both height and weight tend to decrease in old age, the BMI of elderly persons may increase despite reduced weight (17). For those 65 and older, a BMI of 24–29 has recently been proposed as the normal range, and a BMI of less than 22 as indicating underweight (18–19). Longitudinal studies in Sweden have shown that BMI decreases significantly after age 70 (20).

BMI is a simple, easily-applied and inexpensive measure. The disadvantage is that it is static and rather insensitive to small changes in weight. It is not possible to tell if high values are the result of excessive fat, muscle or liquid. Also, individuals who have lost a great deal of weight, but at the time of measurement have a BMI within or above the normal range, may be evaluated as well-nourished.

Height and weight can also be evaluated in relation to healthy members of the population (ref. 21; Table 1).

Weight reduction

Repeated measurements of body weight can be the best way to detect changes of nutritional status. Weight loss is strongly correlated with complications related to care and treatment (22). Involuntary weight loss of more than five percent within one month, or more than ten percent within six months, indicates slight malnutrition (23). A reduction of more than twenty percent within six months indicates severe malnutrition, with a great risk that the function of various organs and systems may be impaired (24). Older persons have smaller reserves and are more sensitive to weight loss than young people.

Epidemiological studies have found that a weight loss of more than ten percent during the past ten years is associated with a heightened risk of illness (25). For the elderly, a weight loss of more than five percent during the past six months or ten percent during the past ten years is regarded as a risk factor for malnutrition (18). For individuals suffering from edema or obesity, it is difficult to determine what kind of tissue is primarily being lost merely by monitoring weight; therefore, other methods should also be used in such cases.

Table 1. *Average weights in kg of men and women of various heights, ages 50–80, and both plus and minus deviations of 10 and 20 percent from the average.*

Males						Females					
Length in cm	–20 %	–10%	Ave-rage weght	+10%	+20%	Length in cm	–20%	–10%	Ave-rage weght	+10%	+20%
155	51	58	64	70	77	145	46	51	57	63	68
156	2	59	65	72	78	146	46	52	58	64	70
157	53	59	66	73	79	147	47	53	59	65	71
158	54	60	67	74	80	148	47	53	59	65	71
159	54	60	67	74	80	149	48	54	60	66	72
160	54	61	68	75	82	150	49	55	61	67	73
161	55	62	69	76	83	151	49	55	61	67	73
162	56	63	70	77	84	152	50	56	62	68	74
163	57	64	71	78	85	153	50	57	63	69	76
164	57	64	71	78	85	154	50	57	63	69	76
165	58	65	72	79	86	155	51	58	64	70	77
166	58	66	73	80	88	156	52	59	65	72	78
167	59	67	74	81	89	157	52	59	65	72	78
168	60	68	75	83	90	158	53	59	66	73	79
169	61	68	76	84	91	159	54	60	67	74	80
170	61	68	76	84	91	160	54	60	67	74	80
171	62	69	77	85	92	161	54	61	68	75	82
172	62	70	78	86	94	162	54	61	68	75	82
173	63	71	79	87	95	163	55	62	69	76	83
174	64	72	80	88	96	164	56	63	70	77	84
175	64	72	80	88	96	165	56	63	70	77	84
176	65	73	81	89	97	166	57	64	71	78	85
177	66	74	82	90	98	167	58	65	72	79	86
178	66	75	83	91	100	168	58	65	72	79	86
179	67	76	84	92	101	169	58	66	73	80	88
180	67	76	84	92	101	170	59	67	74	81	89
181	68	77	85	94	102	171	59	67	74	81	89
182	69	77	86	95	103	172	60	68	75	83	90
183	70	78	87	96	104	173	61	68	76	84	91
184	70	79	88	97	106	174	61	68	76	84	91
185	71	80	89	98	107	175	62	69	77	85	92
186	71	80	89	98	107	176	62	70	78	86	94
187	72	81	90	99	108	177	62	70	78	86	94
188	73	82	91	100	109	178	63	71	79	87	95
189	74	83	92	101	110	179	63	71	79	87	95
190	74	84	93	102	112	180	64	72	80	88	96

Source: Björkelund C., et al. Läkartidningen 1997:94 [5]:332–335

Body fat and muscle mass

The thickness of subcutaneous fat provides an indirect measure of the body's total fat mass. This can be obtained by measuring the skinfold at one or more places on the body.

Upper-arm skinfold

The most common technique for estimating the body's fat mass is to measure the triceps skinfold (TSF), using a calliper on the back of the upper arm (Figure 5). The subcutaneous fat is pinched with the fingers one centimetre above the midpoint, between the olecranon and the tip of the acromion, with arms relaxed and hanging at the sides. The skinfold should be parallel with the arm's length. The calliper is applied so that only the subcutaneous fat is measured. The average of three successive measurements is recorded (26). A measured value below the tenth percentile of the distribution for the general population indicates moderate malnutrition; below the fifth percentile indicates severe malnutrition (26) (Table 2).

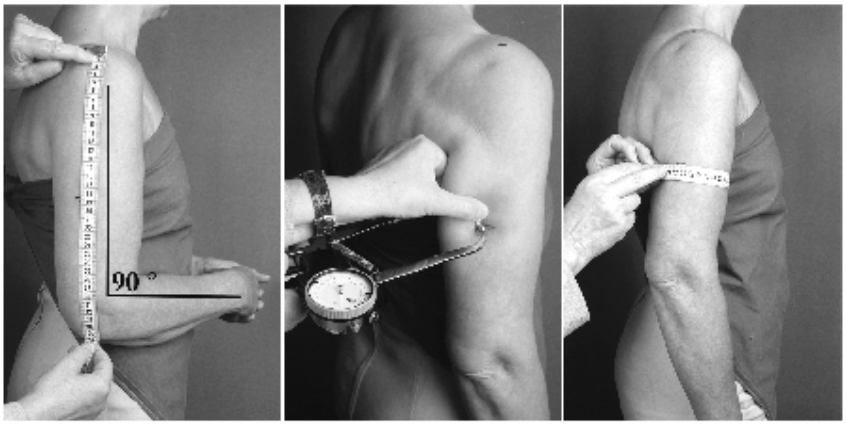

Figure 5. *Measurements of the point between the obecranon and the acromion's tip (left), the triceps skinfold (centre), and upper-arm circumference (right). (Photography Dept., University Hospital, Linköping.)*

Table 2. *Tenth and fifth percentiles for triceps skinfold (TSF) in mm, for males and females in Swedish reference sample (26).*

Ages	TSF percentiles – females		TSF percentiles – males	
	10th	5th	10th	5th
20 – 29	11	10	5	5
30 – 39	13	12	5	5
40 – 49	13	11	6	5
50 – 59	16	15	7	7
60 – 69	16	14	7	6
70 – 79	13	9	6	6
80 – 89	10	9	6	5
≥ 90	7	5	4	4

Upper-arm circumference

Mid-arm circumference (MAC) can be used as the sole measure for malnutrition screening in connection with major hunger disasters. It can serve as a complement to BMI for assessing loss of peripheral fat and muscle mass (27), or for measuring the upper-arm muscle circumference. It is measured to the nearest millimetre from the same point as the skinfold, with a non-elastic soft measuring tape and with the arm hanging completely relaxed at the side. The measuring tape is laid around the arm without compressing any tissue (Figure 5). The measurement may also be taken in a prone position with the elbow resting on a cushion. There are no reference data for the Swedish population.

Upper-arm muscle circumference

Arm muscle circumference (AMC) yields an approximate measure of the body's muscle mass, and is calculated with the following formula:

$$\text{AMC cm} = \text{MAC} - 0{,}1\ (\pi \times \text{TSF})$$

Since TSF and AMC vary with age and gender, reference values adjusted for those two factors are used (ref. 26; Table 3). The disadvantage with these measures is that they are difficult to standardize. Training is needed to achieve an acceptable level of consistency for and among individuals. Since changes due to nutritional treatment occur slowly, these measures are most appropriate for establishing baseline values to be monitored over a lengthy period of time.

Table 3. *Tenth and fifth percentiles for upper-arm muscle circumference (AMC) in cm among males and females in Swedish reference sample (2b).*

Ages	AMC percentiles – females		AMC percentiles – males	
	10th	5th	10th	5th
20 – 29	19	18	23	22
30 – 39	19	18	23	22
40 – 49	19	19	23	23
50 – 59	19	19	23	22
60 – 69	19	19	23	22
70 – 79	19	18	22	21
80 – 89	18	17	21	20
≥ 90	17	17	20	20

Bioelectric impedance (BIA)

The total amount of water in the body is determined with bioelectric impedance analysis (BIA). The technique measures the impedance of body tissues by means of a weak electric current (800 μA; 50KHz) which passes between two electrodes attached to the backs of one hand and foot (28). The operative principle is that fat-free parts of the body are better conductors than those containing fat. The fat-free portion of the body is calculated on the basis of total water volume with the use of various regression analyses. Body fat consists of the difference between total weight and the fat-free mass. BIA is regarded as a reliable technique for assessing the physical constitution of healthy individuals, but is less reliable for those with altered liquid and electrolyte balance, ascites, peripheral edema or serious illness (29).

Dual x-ray absorbtiometry (DEXA)

DEXA involves the use of X-rays to determine the total amount of three bodily components: fat, fat-free mass and skeletal minerals (30). The method is based on the differential absorption of radiation by various types of body tissue, and has been validated against previously established methods. Both BIA and DEXA are certified for clinical use.

Biochemical analyses

Serum concentrations of albumin, prealbumin (transtyretin), transferrin and retinol-binding proteins have been used as biochemical markers for evaluating nutritional status (1, 2, 4, 31). However, their value in this context has been questioned, as serum concentrations are influenced by

many other factors (32). Normally, the level of s-albumin reflects the balance between synthesis, distribution and decay (33). In simple cases of starvation, the rate of synthesis declines, but serum concentrations remain normal due to lowered catabolism and redistribution of fluid from extra- to intravasal space (34). In cases of stress caused by infection, chronic illness or physical injury, hypoalbuminemia is a consequence of several independent mechanisms, including reduced synthesis, increased catabolism, and increased vascular permeability with redistribution to extravasal space or greater losses of albumin(33, 35). Hypoalbuminemia is associated with catabolic processes rather than with malnutrition. To exclude the effects of catabolism, C-reactive protein (CRP) or some other acute-phase reactant can be included in the evaluation of nutritional status (35–36).

The above-noted reservation regarding s-albumin also applies to prealbumin (transtyretin), transferrin and retinol-binding proteins. The advantage of their use is that they have shorter half-lives (especially prealbumin), and react more rapidly in cases of low protein and energy intake or during recovery with nutritional therapy (37). Low levels of s-albumin and prealbumin predict for the development of complications, and for increased morbidity and mortality (37–39).

Plasma concentration of insulin-like growth factor I (IGF-I) has proven to be a useful marker for assessing nutritional status and nutrient intake (40). Due to its short half-life (circa 15 hours) and responsiveness to energy-protein intake, IGF-I has greater sensitivity to and specificity for nutritional improvements than do other serum proteins. The disadvantage is that serum concentrations may be reduced under catabolic conditions.

Changes in physiological function

Malnutrition and inadequate energy intake are associated with impairment of the immune system and muscular function (41–42). Delayed Cutaneous Hypersensitivity (DCH) and the lymphocyte count have been used as functional measures of immune function, as they have been found to predict for morbidity and mortality (43–45). DCH is determined by measuring inflammation reactivity of the skin following intracutaneous injection of antigen. For the Swedish population, three antigens are recommended: PPD (Purified Protein Derivate) candida and mumps (43). The size of the inflammation is measured after 24–72 hours as the sum, in millimetres, of the infiltration's largest diameter and the dimension at right angles. Any skin reaction larger than 10 mm is defined as positive, less than 10 mm as negative. Interpretation of DCH is difficult for individuals with suppressed immune function, trauma, infection, cancer or following general anaesthetic and surgery.

Lymphopenia (< 1500/mm) has been found to correlate with morbidity (44). However, the lymphocyte count is affected by both acute and chronic illness, and by various pharmaceuticals. Due to limited specificity, both of these tests are usually *not* used for assessing nutritional status in clinical situations.

Structural, metabolic and functional changes in skeletal musculature have been observedin connection with low energy intake (44, 48). These changes occur at a much faster rate than can be detected with anthropometry. The functional level of the skeletal musculature can be evaluated with several different methods. One is to test handgrip strength, using a device such as the Jamar Hand Dynamometer. Grip strength predicts for post-operative morbidity and mortality (47). The individual being tested can be sitting, or standing erect with the shoulders adducted and neutrally rotated, the elbow bent at 90 degrees and both the lower arm and the wrist in a neutral position. With the dynamometer held comfortably in the hand, the subject is asked to squeeze it with maximum strength. The test is repeated three times and the average score is recorded. In addition to malnutrition, handgrip strength can be affected by fatigue, pain and neuromuscular impairment. The method also requires the full co-operation of the subject.

Respiratory-muscle function can be assessed by asking the individual to take a deep breath and blow forcefully onto a sheet of paper held ten centimetres from the lips. If the chest does not expand upon inhaling or the paper does not move when blown upon, the individual's respiratory-muscle function is judged to be severely impaired (48). It can also be assessed by measuring Peak Expiratory Flow (PEF).

Another method of testing muscle function is based on the measurement of contraction, relaxation and fatigue of the adductor pollicis muscle when the ulnar nerve is stimulated by an electric current (42). This method is sensitive to nutritional changes, regardless of the patient's level of co-operation, but requires an elaborate apparatus.

Subjective methods

Due to the limited utility of many objective measures of nutritional status, a variety of subjective and multi-factor methods have been developed for diagnosing malnutrition and evaluating the risk of complications.

Nutrition Screening Initiative (NSI), a procedure developed in the United States, is intended for use with older persons (19, 49). There are three parts to the procedure: self-assessment, level I and level II. In the self-assessment, the individual answers a set of questions relating to risk factors for the development of malnutrition. If the results indicate such risk, the subject is urged to contact appropriate health professionals. Level I includes questions on BMI, dietary habits, living conditions and physical

function. Individuals judged to be at great risk are referred to a physician or dietician for further diagnosis or for counselling. Level II, which is administered by a physician or other qualified professional, includes anthropometry, biochemical analyses and clinical data. As far as is known, this procedure has yet to be translated into Swedish or used in Sweden.

Subjective Global Assessment (SGA) is a clinical procedure for assessing nutritional status which is based on anamnesis and physical examination (6).

The anamnesis includes information on weight loss, changes in food intake, gastrointestinal problems, physical function and medical history. The physical examination includes the examiner's subjective impressions regarding loss of muscle mass and subcutaneous fat, and the presence of edema. On the basis of this information, the subject is classified as well-nourished, possibly undernourished or severely undernourished. The emphasis is placed on indications of weight loss, reduced nutrient intake, and loss of fat tissue or muscle mass. SGA has been used with several categories of patient and has been found to have high validity, reliability between assessors and accuracy in prognoses of complications (50–53). The method's reliability is very dependent on the assessor's knowledge and experience of the causes, signs and symptoms of malnutrition (52). SGA can be administered by physicians, nurses and dieticians.

Mini Nutritional Assessment (MNA) is a questionnaire that is specifically designed for screening and evaluation of the nutritional status of older persons, both in hospital and at home (7, 54–55). It includes eighteen graded questions which comprise a synthesis of anthropometric measures (BMI, weight loss, and circumference of both calf and upper arm), general issues (life style, medication and mobility), dietary habits (number of meals, food and liquid intake, and need of assistance when eating), and the individual's subjective self -assessment of health and nutrition. The first six questions are used for screening, and the rest for the assessment. The maximum number of points is 30, and a score of 24 or higher indicates that the subject is well-nourished. Those with scores of 17–23.5 are at risk of malnutrition, and those with less than 17 are undernourished. This method has been validated against clinical status as the reference standard (7).

Modified Subjective Global Assessment (SGA)

Date _____

Anamnesis:

1. Weight change during past 6 months

☐ Loss ____ kg ____ percent
1. Slight, under 5 procent
2. Moderate, 5–10 percent
3. Substantial, over 10 percent

☐ Unchanged

☐ Gain _____ kg

2. Weight change during past 2 months

☐ Loss _____ kg ____ percent

☐ Unchanged

☐ Gain _____ kg

3. Consumption of food and drink during past month compared with normal consumption

☐ Unchanged

☐ Increase

☐ Decrease ☐ Ate less than usual
☐ Ate only liquid cheese
☐ Drank only clear liquids
☐ Starved

4. Problems/symptoms during past two weeks

☐ Poor appetite ☐ Pain in mouth

☐ Difficulty chewing/swallowing

☐ Nausea ☐ Vomiting ☐ Diarrhoea

☐ Constipation ☐ No problems

☐ Other _____

5. Physical function during past month

☐ Normal for age ☐ Inprovement

☐ Deterioration
1. Slight (less than normal capacity)
2. Moderate (up and about half the day)
3. Substantial (sitting/lying most of the time)

6. Diagnosis(-es)

_____

_____

7. Metabolic effects of significance for nutritional status

☐ None ☐ Slight

☐ Moderate ☐ Serious

B. Physical examination

(0= none, 1= slight, 2= moderate, 3= serious)

1. Loss of

☐ subcutaneous fat (triceps/breast)

☐ muscle mass (m. quadriceps, deltoideus)

2. Presence of

☐ ankle edema ☐ sacral edema

☐ ascites

Assessment: ☐ Well-nourished
☐ Possibly malnourished
☐ Seriously malnourished

Ref. Detsky AS, et al. JPEN,1987;11:8–13
Ulander K, Grahn G, Jepsson B. Clin Nutr 1993;12:15-9.
Ottery F.D. Sem in Oncol 1995;2(suppl 3):98–111

NESTLÉ NUTRITION SERVICES

Mini Nutritional Assessment
MNA®

Last name: First name: Sex: Date:

Age: Weight, kg: Height, cm: I.D. Number:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a MalnutritionIndicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe loss of appetite
1 = moderate loss of appetite
2 = no loss of appetite ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed/chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F Body Mass Index (BMI) (weight in kg) / (height in m)²
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

Screening score (subtotal max. 14 points) ☐☐
12 points or greater Normal – not at risk – no need to complete assessment
11 points or below Possible malnutrition – continue assessment

Assessment

G Lives independently (not in a nursing home or hospital)
0 = no 1 = yes ☐

H Takes more than 3 prescription drugs per day
0 = yes 1 = no ☐

I Pressure sores or skin ulcers
0 = yes 1 = no ☐

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals ☐

K Selected consumption markers for protein intake
- At least one serving of dairy products (milk, cheese, yogurt) per day? yes ☐ no ☐
- Two or more servings of legumes or eggs per week? yes ☐ no ☐
- Meat, fish or poultry every day yes ☐ no ☐

0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes ☐.☐

L Consumes two or more servings of fruits or vegetables per day?
0 = no 1 = yes ☐

M How much fluid (water, juice, coffee, tea, milk…) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups ☐.☐

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem ☐

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem ☐

P In comparison with other people of the same age, how does the patient consider his/her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better ☐.☐

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC 22 or greater ☐.☐

R Calf circumference (CC) in cm
0 = CC less than 31 1 = CC 31 or greater ☐

Assessment (max. 16 points) ☐☐.☐
Screening score ☐☐
Total Assessment (max. 30 points) ☐☐.☐

MalnutritionIndicator Score
17 to 23.5 points at risk of malnutrition ☐
Less than 17 points malnourished ☐

Ref.: Guigoz Y, Vellas B and Garry PJ. 1994. Mini Nutritional Assessment: A practical assessment tool for grading the nutritional state of elderly patients. *Facts and Research in Gerontology.* Supplement #2:15-59.
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Criteria for definition of malnutrition

Many objective nutrition variables have been used, alone or in combination, to diagnosis malnutrition or predict nutrition-related complications. At present, however, there is no consensus on which variable(s) should serve as the "golden standard". Some variables have been called into question because they can be influenced by other factors than nutritional status (32). For objective variables used in the assessment of nutritional status, there are reference values derived from a healthy sample (26). Sensitivity and specificity are affected by the way in which the normal limits are defined (percentile, or 1–2 standard deviations). This also affects decisions regarding treatment. In determining malnutrition, efforts should be made to ensure that the criteria are highly sensitive (57). Several Swedish studies have used a combination of anthropometry, serum proteins and skin tests in defining malnutrition (Table 4).

In order to prevent or treat malnutrition, it is essential that sick or elderly persons who come in contact with caring services undergo a screening-like nutritional evaluation. As a minimum, BMI is measured; also, weight loss, mouth and eating problems are assessed and documented. The evaluation can serve as the base of measures such as counselling, and contact with a dietician, social-service personnel, dentists or physicians. If the primary evaluation indicates possible malnutrition, nutritional status should be assessed by a physician.

Table 4. *Reference values for anthropometry, serum proteins and skin tests used in Swedish evaluations.*

	Males	Females	Reference
Antropometry			
Weight index %	<80	<80	1, 2, 4, 31, 38, 45, 52, 57
TSF mm	≤ 6	≤ 12	1, 2, 4, 38, 45, 52,
TSF percentiles	<10	<10	31, 57,
AMC cm ≤79 yrs.	≤ 23	≤ 19	1, 2, 4, 38, 45, 52,
>79 yrs.	≤ 21	≤ 18	1, 2, 4, 38, 45, 52
AMC percentiles	<10	<10	31, 57
Serumproteins			
S-albumin g/l	<36	<36	1, 2, 4, 38, 45, 52, 57
S-prealbumin g/l	<0.26	<0.20	1, 36, 38, 45
S-transthyretin g/l	<0.20	<0.18	2, 4, 52
Skin test (mm)	<10	<10	1, 38, 45, 57

Summary

There is a great need for sensitive and specific methods for assessing nutritional status, both in research and in the provision of care. The information used in the assessment of nutritional status includes clinical data, dietary evaluations, data on physical constitution, biochemical analyses and assessment of physiological functions such as those of the muscles and the immune system.

There are several different methods for evaluating diet and energy-nutrient intake. The diet register is the most common for clinical use. Anthropometry, bioelectric impedance measurements (BIA) and Dual Energy X-ray Absorptiometry (DEXA) are available for clinical use in the assessment of physical constitution. Anthropometric variables such as height, weight, body mass index and weight loss are useful indicators for the initial assessment of the body's fat and muscle masses, but they are not suitable for short-term follow-up. Weight loss during the past six months that is greater than ten percent for middle-aged persons or five percent for those over 65 indicates malnutrition. BIA is based on variations in electrical conductivity for the determination of total body liquids and, indirectly, of physical constitution as well. DEXA involves the use of X-rays for determining the amount of fat, fat-free mass and skeletal minerals.

The most commonly used biochemical variables in the assessment of nutritional status are s-albumin and s-prealbumin (transtyretin). Since these proteins are more often affected by inflammatory processes than by malnutrition, they are uncertain indicators in the latter context. For that reason, concentrations of s-proteins should be evaluated in relation to C-reactive protein (CRP) or some other acute-phase reactant. Prealbumin (transtyretin) and Insulin-like growth factor-I (IGF-I) can be sensitive markers for energy and protein intake.

As measures of immunological function, delayed skin hypersensitivity have low specificity for nutritional status. Muscle function can be evaluated with such measures as handgrip strength and peak expiratory flow (PEF).

Mini-Nutritional Assessment (MNA) and Subjective Global Assessment (SGA) are two subjective, multi-factor methods for assessing nutritional status. MNA consists of eighteen graded questions that are specifically designed for older persons. SGA is a clinical method based on anamnesis and physical examination. There is an urgent need to develop more specific methods for the assessment of nutritional status.

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3. Practical issues in the treatment of malnutrition

Alternative methods of supplying nutrition

Elisabet Rothenberg

Regular diet

The foundation of nutritional treatment consists of the energy and nutrients contained in the regular diet. The food normally served in hospitals provides an adequate supply of energy and nutrients, as specified by Nordic recommendations (1). With some illnesses, however, it may be necessary to alter the basic diet in order to mitigate symptoms and reduce the risk of complications. This may involve diets that are suitable for diabetics, contain less energy, are energy- and protein-enriched, contain less protein for cases of uraemia or less fat for cases of fat malabsorption. The nutritional ingredients of such diets deviate from the Nordic recommendations.

Enriched energy-protein diets

It is recommended that the protein ingested by healthy persons provide 10–15 percent of total energy requirements. In cases of very low energy intake, a larger proportion of protein is required. Since the energy intake of hospital patients is often reduced, it is recommended that their food contain enough protein to supply about 15 percent of energy needs. Stress and injury typically lead to increased loss of protein. The extent of the loss and the possibility of counteracting it depend primarily on the body's reactions.

Illness, stress and injury usually have the effect of reducing the appetite, while at the same time increasing the use of energy and loss of protein. In such cases, the amount of food must be reduced; but the objective should be to maintain the necessary level of energy and protein intake. Net losses of protein can often be compensated, and always reduced, by supplying proteins in excess of the amounts recommended for healthy persons. This is accomplished with an energy- and protein-enriched diet, a half-portion of which contains about as much energy as a whole portion of the normal

diet. The portion of total energy needs supplied by protein is increased to 18–20 percent.

In order to achieve this, fibre-rich and other foods with large volume and comparatively low energy must be used sparingly. Instead, energy-intensive foods such as high-fat dairy products are used to a greater extent than in the normal diet. An energy- and protein-enriched diet usually has a fat content that supplies 35 percent of energy needs thus exceeding the 30-percent upper limit of the Nordic recommendations. The supply of essential fatty acids should follow the recommendations, which means that vegetable fats such as those in cooking oil should be included. In addition to generous amounts of protein-rich foods, dietary and liquid-food supplements are usually required in order to supply the desired protein levels (2).

Dietary supplements

Dietary supplements add nutrition to the regular diet, and consist of three basic types:

- readily soluble powdered carbohydrates, usually of hydrolized maize starch, which increase the energy content of sweet drinks, desert creams and soups
- powders, usually made from skim milk, which increase protein content
- readily soluble powder that provides a well-balanced supply of additional energy, protein, fat, carbohydrates, vitamins and minerals which increase the nutritional concentration of the diet.

Liquid dietary supplements

Liquid dietary supplements are available in a variety of brands and tastes. Their composition usually varies from very protein-rich (30–35 percent of energy content) to a normal balance of fat, carbohydrates and protein. They are intended for use between meals, but also as supplements to regular meals. As with tube feeding which has the same nutritional composition, balanced dietary supplements can supply all dietary needs if the amounts are sufficient. Energy-rich supplements include 1.5 kcal/ml, compared with the usual 1.0 or 1.2 kcal/ml.

There are also dietary supplements in the form of clear juices which contain proteins and carbohydrates, but no fat. Thus, they have a lower energy content (0.85 kcal/ml) than other liquid supplements, and are meant to be taken primarily with meals or as substitutes for other liquids.

Enteral nutrition

Nutrition can be delivered directly to the digestive system via a nasogastric tube, Witzel fistula or percutaneous endoscopic gastrostomy (PEG). Enteral nutrition may be used to provide all dietary needs, or in combination with peroral or intravenous nutrition. The Swedish handbook, Metodbok i enteral nutrition, describes various methods for supplying nutrition enterally (3). The treatment can be adapted to the patient's individual needs, as there are several different types of preparation that contain specific ingredients, e.g. energy-intensive, low-fat and high fibre.

Parenteral nutrition

Parenteral nutrition involves the supply of nutrients via intravenous infusion. It can be used to supply all dietary needs (total parenteral nutrition, TPN) or only a portion (partial parenteral nutrition, PPN). Parenteral solutions with various ingredients are available, and a balanced combination of these can satisfy all nutritional requirements. Parenteral nutrition may be combined with both enteral nutrition and normal ingestion via the mouth.

Vitamin and mineral supplements

In order to increase the concentration of nutrients, vitamins and minerals may be added in tablet or liquid form.

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Diagnosis, treatment and follow-up

Tommy Cederholm & Elisabet Rothenberg

As there is wide variation in the care provided at hospital clinics and group homes, diagnosis and treatment must be adjusted accordingly.

Responsibility for the individual's nutrition assumes that there are clearly defined areas of responsibility for all relevant care-providers.

The patient's *physician* has overall responsibility, including that for a medical examination which may lead to prescribed treatment. The physician must determine if emaciation or loss of weight is due to medical

Responsibility

The patient's or resident's nutrition must be dealt with in the same way as any other medical treatment, and is therefore subject to the same requirements for evaluation, diagnosis, the planning of treatment, follow-up and documentation.

factors that need to be further investigated or can be counteracted with specific medical treatment. In consultation with other personnel, such as registered and practical nurses, dieticians and audiologists, the physician prescribes appropriate nutritional treatment.

The registered *nurse* has responsibility for the patient's nutritional care. Among other things, this includes identifying any problems with the intake of food and drink, and ensuring that the patient receives prescribed nutrition and medicines. Together with other personal, the R.N. is also responsible for ensuring that food is served in a pleasant and appetizing manner, and that patients receive any necessary assistance in eating.

The *dietician* is responsible for individual nutritional treatment, in consultation with the patient's physician. The dietician has the main responsibility for developing and following up treatment and, together with the registered nurse responsible for patient care, for documenting and initiating adjustments to treatment.

The physician, registered nurse and dietician are jointly responsible for evaluating the patent's nutritional status, as well as for documenting relevant nutritional information and forwarding it to the next care-provider.

The *chief dietician* is responsible for the menu, food preparation, conformance with national food-quality requirements regarding nutritional content (ESS committee's recommendations), and for ensuring that each department receives what it has ordered.

An *audiologist* is a valuable resource in the care of patients with difficulty in swallowing. Both national and international experience suggests that a *nutrition team* consisting of a physician, registered nurse, dietician and other professionals can play a significant role in improving the patient's nutritional care (1, 2).

Diagnosis and evaluation

All patients who come in contact with the health-care system, at both the local and regional levels, should undergo a basic evaluation of their nutritional status. Regardless of the method(s) used, there should be a combined assessment of body mass index (BMI), weight loss and current eating problems. (For a detailed description, see Part I, Chapter 2: "Evaluating the patient's nutritional status".)

Individualized nutritional treatment is based on an evaluation of the patient's specific problems and needs. In order to determine what measures must be taken, the following factors need to be evaluated:

- reduced appetite
- difficulty chewing or swallowing
- stomach or intestinal complaints
- physical handicaps which may interfere with eating
- eating schedule, with particular attention to length of nightly fast
- need of food with unusual consistency, e.g. liquid or gelatinous food
- recent or imminent operation, or other demanding treatment such as chemo- or radiation therapy
- conditions that lead to reduced appetite, functional impediment or increased energy demand, e.g. cancer or other chronic illnesses such as heart ailments, obstructive lung disease and Parkinson's disease
- medicinal side effects that influence appetite, gastrointestinal function and/or nutritional intake.

For certain patients in hospitals and convalescent centres, it can be very useful to record food and liquid intake during a specific time-period. Such data can be used to calculate energy-nutrient intake. (See Part II, Chapter 1: "Nutritional Theory".) The measured intake should be in appropriate proportion to calculated energy needs. Where needed, dieticians should take more detailed anamaneses.

Treatment

After the evaluation and diagnosis have been completed, an individualized programme of treatment can be devised, including suggestions regarding: energy level

- nutrition sources
- special diet
- special consistency requirements
- eating schedule.

If nutrition is to be supplied with regular food, it should also be determined whether it needs to be supplemented with:

- liquid dietary supplements
- enteral nutrition
- parenteral nutrition.

The individualized nutritional programme should include instructions regarding the eating schedule. It is usually advisable to spread the main meal over a large portion of the day, and serve lesser meals at the intervals in order to supplement energy and nutrient content.

For scientific documentation of nutritional treatment and its effects, see Part II, chapters 5–8.

Follow-up, evaluation and documentation

There should be continual follow-up, and weight should be taken at regular intervals. Hospital patients should be weighed before admission and discharge. During extended periods of care, patients should be weighed at least once a week.

Many chronically ill individuals have brief periods of care in hospital. In order to facilitate long-term nutritional follow-up of this subgroup, it would be useful to develop an overview by improving the journal system so that it documents such factors as weight, appetite, and nutritional measures at various times when care is given.

For individuals who have regular contacts with the health-care system or reside in a group home, it would be appropriate to offer weight checks several times a year. Their energy requirements and eating ability should also be evaluated on a regular basis. Treatment, follow-up and results should be documented continuously.

Information transfer

With short periods of care in hospital, the patient may be properly treated from a medical standpoint, but still require active nutritional measures. Malnutrition often develops gradually over a long period of time, and patients often lose weight during their time in hospital. Nutritional treatment should therefore be provided over a lengthy period, and must be included in the entire sequence of care. Especially for patients who are losing weight, it is vitally important to underscore the need for continued nutritional rehabilitation when journals are passed on to the next care-provider.

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4. Issues of Care in the Prevention and Treatment of Malnutrition

Mitra Unosson

The quality and type of care provided to patients has great significance for preventing and restricting the development of malnutrition, and in the treatment of those who are already malnourished. The basis for the proper planning of care for patients with nutritional problems is the correct assessment of those problems, in order to provide adequate amounts of liquids and energy, and a sense of well-being at mealtimes. An individualized programme is planned in consultation with the patient, relatives and relevant care professionals.

The measures applied may include: assistance in obtaining and eating good food that is suited to individual needs, conditions and preferences; the arrangement of a dining atmosphere that stimulates the appetite; and training and instruction for the patient and/or relatives. Needless to say, patients must always be treated with empathy and respect. Good care requires routine documentation of the patient's problems, measures taken and their outcomes, and the transfer of information between various care-providers.

Background

The main objectives of care are to satisfy basic needs, and to enable or help the patient to perform daily activities. One basic need is for sufficient energy and nutrition via food and drink to maintain or improve nutritional status. Food and drink also satisfy many psychological, social and cultural needs (1).

Eating is a complex activity which is part of basic human competence. One of five patients in geriatric care, and one of three elderly hospitalized patients, is partially or entirely dependent on assistance with their meals (2). Patients who need help with their food eat less than half the amount normally served (3).

In nursing homes for the elderly, eating problems occur primarily among residents diagnosed with dementia, cerebrovascular disease and Parkin-

son's disease (4, 5). Those with dementia have a variety of problems, ranging from disinterest in food at the start of the illness to difficulty in eating and, eventually, inability to feed oneself (6). In the final stage of illness, the patient's behaviour resembles a hunger strike, and this may pose ethical problems for care personnel (7, 8).

Many stroke victims also have eating problems (9, 10). Mealtime observations have disclosed that these individuals have many problems, for example with chewing, swallowing, and food leaking from the mouth or collecting in the mouth and remaining there after meals. They also eat small quantities of food, and have trouble finding it on the plate or table (11). In addition, stroke victims may have difficulty feeding themselves due to problems in sitting upright, inability to concentrate, spilling food during transfer from plate to mouth, etc. (12). Patients experience such problems as psychologically and socially very distressing (12, 13).

Individuals with Parkinson's disease may have similar difficulties, including problems with chewing and swallowing, managing food on the plate and transferring it to the mouth. Meals may take a long time to complete (14). Victims of Parkinson's disease are usually able to concentrate on only one thing at a time and find it difficult to communicate during meals.

Assessment of patient problems

Professional care requires the systematic assessment of patient problems. In order to devise a suitable individualized programme, it is therefore necessary to evaluate the patient's ability to take food, the psychological experience of eating, dietary status, condition of the mouth, state of mind, and intake of liquids and energy. Special attention should be given to individuals from other cultures who may have different food habits, and to those who have difficulty communicating their wishes and opinions.

Starting directly with the initial interview, it is important to gather information about food preferences, dislikes, allergies, and dietary habits in the home. Eating ability can be evaluated by observing the patient at regular mealtimes or special test meals (12). A test meal may include various types of food of different consistencies. The evaluation includes the way in which the food is managed on the plate, transferred to the mouth, chewed and swallowed. The psychological experience of food and dining can be evaluated with interviews or conversations with the patient, relatives and care-providers. The evaluation should include the situation prior to illness, and how the illness and dining atmosphere affect eating (15). The oral cavity may be evaluated by inspection, and mental status with the Mini-Mental State test (16, 17). Intake of liquids and nutrients can be monitored with a food and liquid journal (18). Treatment is followed up with repeated evaluations, and adjusted accordingly.

Special measures

In caring for patients, very complex situations may arise. Standard solutions are not always available, in which case problems must be solved with special measures. This requires an assessment of appropriate treatment based on ethical principles, scientific knowledge and proven experience.

Right diet for the right patient

One goal of care is to prevent malnutrition and dehydration. It is therefore vital to ensure that the patient is provided with a proper diet or other prescribed nutritional therapy. Diet is part of treatment, and must be suited to the patient's energy and nutrition needs, eating ability and preferences. The food served to the elderly often does not conform with their habits and expectations (13). This may help to explain why it has been found that 20–36 percent of those receiving care and treatment do not ingest enough food (2). Among older geriatric patients, 84 percent received less energy than they used, and 30 percent received less than basic needs (19).

The amount of food that patients eat is decisive for energy intake (20). Those who eat small amounts require food that is rich in energy and nutrition. Patients who are served half-portions of normal food usually receive less energy than they require (21). It has been shown that this can be remedied by providing elderly patients with food that has been enriched with extra energy or both energy and protein (20, 21).

Patients who eat small amounts of food should be encouraged and helped to eat several smaller meals of good quality between major meals – sandwiches or fruit, for example (22). Another alternative is provided by dietary supplements. Studies have shown that daily supplements containing 400–500 kcal served between meals resulted in an increase of plasma proteins, improved functional capacity, fewer cases of malnutrition and bedsores, and a higher rate of healed sores (23, 26). A test of individualized meals, to ensure that malnourished patients ate sufficient food to meet their energy needs, resulted in improved nutritional status, as well as increased activity levels and vitality (27). High-energy foods have been shown to help severely anorectic and undernourished patients to regain their appetites (28).

Water supply

A common cause of dehydration in the elderly is an inadequate supply of water (29). Patients at risk should be given the opportunity to drink at regular intervals during the day and encouraged to do so. Their fluid balance should be monitored and documented.

Oral hygiene

Mouth care is essential. Studies of the oral cavity indicate that dryness, yeast infections and changes in the mucous membranes are common in older patients (30). Dry mouth is often followed by the rapid spread of caries and tooth decay. This is further aggravated among the elderly, in whom the more vulnerable dental-root surfaces are exposed and facial mobility is reduced. Also, there has been a dramatic change in the dental conditions of the entire population: Previously, many older persons had extensive dental prostheses; but today the majority have most of their teeth remaining, often with expensive and complicated repairs. With the above-noted treatment with dietary supplements, etc., the teeth are often exposed to abundant carbohydrates, with oral-health problems as a result. The sick, the old and the undernourished often secrete very low quantities of saliva and are not able to reverse the process of decay, among other things because food residues remain in the mouth. If prophylactic measures are not taken, the health of the oral cavity and the ability to eat are greatly endangered.

The mouth is important not only for the intake and processing of food, but also for the experience of taste, consistency and general well-being. For a great many patients, good oral hygiene, fluoride treatment and saliva substitutes can prevent some problems. For others, more remedial treatment may be necessary in order to eliminate pain or restore the ability to chew and swallow (30). Lack of knowledge among personnel concerning oral hygiene and threats to oral health have been reported, which may mean that adequate measures have not been applied (31). Therefore, examinations and the correction of acute problems should be supplemented with an individual "prophylaxis programme that includes oral hygiene, fluoride treatment, and symptom alleviation in cases of dry mouth". Fortunately, it has been reported that education of care personnel leads to knowledge and attitude changes among them, and improvements in the oral hygiene of those who receive care (16).

Training

Another important function of care is to train patients who have difficulty eating regular food or feeding themselves. The objective is to make meals enjoyable to the patient, while preventing disturbance to others. The most effective measures are those which help the patient to become as independent as possible. This bolsters self-esteem and facilitates readjustment to family and society (32). There have been several published reports which indicate that patients afflicted with serious eating problems following a stroke can be treated with individualized training programmes (12,

33, 34). After being treated, several patients were able to eat regular food, and some no longer required a feeding tube or fistula.

Companionship and seclusion

In addition to satisfying bodily needs, mealtimes have the social function of providing psychological satisfaction and an occasion for companionship, facilitating social contacts, and expressing cultural themes. Dining with others can be stimulating for both the spirit and the appetite (35). It also requires observance of cultural norms and values regarding, for example, table manners (36). In our culture, spilling liquids and not being able to keep food in the mouth are violations of dining etiquette. Deviant behaviour at the dining table can evoke feelings of embarrassment and discomfort (12, 36). The individual's enjoyment of the meal can be disturbed. It is therefore necessary to respect the individual patient's wishes regarding companionship and seclusion.

Atmosphere

Dining room atmosphere, food-service routines and the organization of mealtimes have been shown to have great significance for the nutritional intake of older patients. In one study, the dining room of a nursing home was altered to create a "home-like atmosphere" during a trial period of four months. Service was changed so that the patients could themselves take their food from the serving tray in any desired quantity. The changes resulted in a circa 25-percent increase in energy intake (37). Patients with eating problems need to concentrate on their eating, and do better if they are not distracted by their surroundings (12, 34).

Empathy, trust and confidence

It is important to establish empathy, trust and confidence between patients and care-providers in eating situations (33, 38). For this, it is necessary for the care-provider to be aware of the patient's history, problems and preferences. It is also necessary for the "care team" to observe the same principles and to strive toward common objectives. This means, for example, that the team agrees that slow eaters should be allowed sufficient time, and that appropriate help is provided to those who need it.

The reality can be quite different, however. It may happen that patients who need help in eating have to deal with 16–20 different people (4). One study found that, for 94 percent of patients who were fed by personnel, the time allocated for feeding was no more than twenty minutes. Assistance at mealtimes is often task-oriented, resulting in stress for both patients and personnel (39). Those who feed patients may require education and practical experience, as well as enough time to demonstrate empathy and build

trust. It may take 30–45 minutes to feed patients who are completely dependent on assistance (40). The minimum quality requirement of any care-providing organization should be that no patient is denied sufficient food due to time pressures on personnel.

Co-operation

Co-operation between various care professionals can improve conditions for patients with eating problems. For many patients, it may be necessary to consult a dietician, occupational therapist or physical therapist. Patients with eating problems can receive advice and support in the planning of meals, sitting comfortably, and the adaptation of eating utensils. dishes and cups.

Instruction

Preparing the patient to return home after a stay in hospital is another important function of care. Today, a growing number of patients are cared for in their homes, which means that relatives need to be involved in preparation for long-term rehabilitation. By means of instructions and demonstrations, patients and relatives can learn more about the purchase of food, the planning and preparation of meals, and the importance of diet for rehabilitation. Relatives also need to be informed about the patient's problems, and how they can provide support in the home environment.

Positive attitudes

The attitudes of care personnel can influence the nutritional intake of patients with eating problems. One study of care-providers to the elderly found that their idea of the "ideal patient" was one who had minor problems with eating (41). "Difficult" patients were those who were over- or underweight, mentally confused, had difficulty eating or had medically prescribed diets. Those who were underweight were seldom encouraged to eat more. The personnel also found it difficult to respect patients' wishes.

Documentation

Assessment of patient problems, measures taken, follow-up, and evaluation of treatment should be documented to the extent required by the Swedish law on patient journals (1985:562). Documentation shall be readily accessible by all relevant care personnel, which requires co-ordination in the management of patient journals. Nutrition and eating may form a combined heading in the journal. Studies of care-related documentation have found wide variations in classification and content (42).

The documentation of nutritional problems and treatment has not been studied to any great extent in Sweden. In other countries, it has been found that nutritional problems are more frequently documented in connection with longer periods of care (43). But even in such cases, there was little documentation of treatment and its effects. Good care requires good communication among care personnel. The regulations and general guidelines of the Swedish National Board of Health and Welfare (*Informationsöverföring och samordnad vårdplanering*, SOSFS 1996:32), underline the importance of efficient routines in the transfer of information when patients move from one care setting to another (44).

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5. Ethical Considerations

PO Sandman

Satisfying the patient's hunger and thirst, and providing nutrition that promotes recovery are usually not the only functions of hospital meals. There are also social, psychological and spiritual considerations that must be understood and addressed in order for the patient's own resources to be mobilized for healing and recovery.

Basic principles

A fundamental ethical principle of care is that its providers should continually reflect on whether their actions and behaviour contribute to the patient's sense of independence and respect. With regard to hospital meals, this is a matter of arranging and serving them in such a way that patients feel they are respected and have been given an opportunity to maintain their independence. The physical setting, the food served, and the personnel must all support the patient's self-determination.

Traditionally , the tasks of the nurse have included responsibility for ensuring that the patient ingests adequate food and drink. When nurses arrange meals in such a way that invalids are able to feed themselves, it is not only a question of practical solutions. It also has to do with creating mealtime conditions that do not threaten patients' independence.

In other words, the nurse must try to do what is right and good for the patient, and avoid or correct anything that is negative. If those providing care to the patient feel that it is right and good to preserve the ability to feed oneself, that can have consequences for the way in which meals are arranged and served. A "good meal" not only satisfies nutritional requirements, but also the patient's social and cultural needs, as well. This perspective has implications for the nurse's practical behaviour in relation to the patient's eating.

Ethics and eating

There are a number of ethical dilemmas associated with food and eating. Such a dilemma arises when two or more ethical principles are in conflict with each other, so that there is no self-evident action to be taken. In such cases, it is necessary to make a decision based on what is perceived to be

best for the patient. One way to resolve dilemmas is to shift the focus from the concrete situation and seek guidance in general principles. The most fundamental ethical principles are to preserve the individual's autonomy, to make things better rather than worse, and to preserve the sanctity of life by keeping the patient alive.

Jansson *et al.* interviewed twenty nurses experienced in the care of patients with dementia, to find out how they would react in a hypothetical case of a severely demented woman who refused to eat (1). All of the respondents rejected the use of force to feed the woman. Sixteen replied that they would respect the woman's refusal and not attempt to feed her.

But fifteen of the nurses said that they might consider changing their standpoint if the conditions on which they based their original position were to change. For example, eight could consider changing their minds if the patient's family appealed to them to feed her; but they would first discuss the matter with family members so that they might better understand the patient's situation. The four nurses who could consider force-feeding the patient were prepared to change their standpoint under certain conditions, for example if the family had a different view in the matter.

It is important to consult the closest relatives of those who are unable to make decisions for themselves, as in cases of dementia, or who are unable to express their wishes due to some medical condition – for example when it is necessary to prolong life by means of a feeding tube or some other procedure. Relatives are likely to be aware of the invalid's values and life history, and thus able to offer suggestions concerning the kind of treatment he or she would have requested if able to communicate. However, such suggestions can never be more than advisory. Ultimately, it is the responsible medical professional who must decide which measures to implement. Sometimes, this means putting the individual's autonomy before the treatment regarded as medically most appropriate.

In another study, nurses caring for cancer patients were interviewed (2). As with their colleagues caring for dementia patients, the study found that they regard themselves as advocates of their patients; but the nature of that advocacy varies with the patient's condition (3). For oncological nurses, this means, above all, supporting and encouraging the patient to speak for oneself. In contrast, those dealing with dementia describe how difficult it is to interpret their patients' wishes and how they often must speak on their behalf. Both categories of nurses try to "put themselves in the other person's shoes" in order to understand what their patients' want and what is best for them, based on previous experience.

An article of Carl Johan Fürst presents guidelines developed by an expert committee of the European Association for Palliative Care regarding decisions on nutritional or fluid treatment of cancer patients in advanced stages of the disease (4). First, all information upon which deci-

sions are based must be thoroughly reviewed. Questions relating to the patient's clinical situation, current symptoms. prognosis, current fluid and nutritional status, and spontaneous food intake must be answered.

Along with the patient's own attitude, more practical matters relating to the possibility of receiving enteral or parenteral treatment must be medically analysed. The practical question of whether or not it is possible to administer treatment in the home must also be considered. The basis of any decision must be discussed and confirmed by the care team looking after the patient.

A preliminary decision is made. It should be emphasized that it is important to inform the patient and relatives concerning the basis of the decision and provide them with an opportunity to actively participate in the decision-making process. It is then decided whether or not to commence treatment with liquids and enteral or parenteral nutrition. That decision is evaluated and possibly reconsidered when the patient's situation calls for a new assessment.

Eating problems are common

Surveys of group-home residents have found that a relative large proportion of the elderly are dependent on staff for ingesting their meals. A 1993 survey of the elderly in the municipality of Örnsköldsvik found that 35 percent were partially or entirely dependent on such assistance (5). The largest proportion, 55 percent, was noted among the residents of nursing homes. The corresponding figure for those living in communal homes for the elderly was 14 percent.

Of those not suffering from dementia, ninety percent were able to feed themselves, compared with 57 percent of dementia patients. Compared with previous surveys conducted in the municipality of Umeå in 1988 and 1982, there was a sharp increase in the percentage requiring assistance. Again, the largest proportion was among residents of nursing homes: Only 45 percent could feed themselves in 1993, compared with 59 percent in 1982.

Losing the ability to feed oneself is often associated with other major care requirements. A study by Sandman *et al*. found that patients who were dependent on assistance for eating were also ADL-dependent (ADL = Activities of Daily Living) with regard to other functions, and more often afflicted with dementia. The study also found evidence of a hierarchic sequence in the loss of ADL functions, and that eating was the function which persisted the longest. Loss of ability to feed oneself is therefore something that occurs in later stages of dementia.

To feed another person is a complex and time-consuming process. When a patient becomes dependent on assistance, it places great demands

on care-providers. The lives of those who cannot feed themselves are literally in the hands of others. Care-providers may be required to deal with difficult situations, for example with patients who have difficulty swallowing. But they are also responsible for ensuring that patients ingest food which meets their needs, wishes, habits, values and cultures. For patients who are not able to communicate their needs, relatives are important sources of information.

Activities connected with eating and with emptying the bladder and bowel are time-consuming. One study of a hospice found that such activities demanded about six percent of care-providers' time (7). Observations of patients' daily schedules disclose that those same activities consume a large portion of their waking hours. For patients with dementia, it was the largest single type of activity – about ten percent. Among patients at another hospice, the corresponding figure was fifteen percent (8).

The organization of care also has significance for the way in patients with eating problems are helped. A study by Athlin and Norberg found that care-providers perceived eating problems to be less when patients were always fed by the same person (9). Care-providers found it easier to interpret patients' eating behaviour, and developed a more positive attitude to their charges. Thus, it is important to organize care in accordance with its primary objectives, and to create an atmosphere that encourages patients to ingest the nutrition they need – but also to have enough personnel so that they have a reasonable chance of providing help to all those who require it. It may be assumed that some situations that are experienced as dilemmas may be related to poor organization, a cheerless dining atmosphere and/or inadequate staffing.

Parenteral treatment at life's end

The purpose of parenteral treatment in the final stages of life should be clearly specified. Is it to improve the patient's body cell mass, or the quality of life? If primarily the latter, care-providers should carefully weigh the usefulness of treatment and be alert to possible side effects. A severely ill cancer patient may experience the intravenous feeding of complete nutritional needs as extremely unpleasant if it has the effect of aggravating nausea. When parenteral treatment is discontinued, the patient may feel great relief when body temperature approaches normal and nausea is alleviated.

There is a strong tendency for chronically ill cancer patients with hypoalbuminemia to develop edema. That tendency may be further strengthened by intravenous nutritional treatment., especially if it involves large quantities of sodium or the total amount of energy, protein and liquid is large in relation to body weight.

If side effects cause discomfort, intravenous treatment should be limited to electrolytes and clear liquids containing glucose. The Swedish National Board of Health and Welfare has issued guidelines for treatment in the final stages of life (10). The guidelines emphasize the importance of respect for the patient's wishes, the physician's responsibility for basing decisions on scientific knowledge and proven experience, and the need for the physician to be decisive in both starting and terminating treatment.

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6. Medical-economic Issues

Ingemar Eckerlund & Kristina Stig

It is well-documented that malnutrition increases the risk of medical complications that can delay recovery, lengthen time in hospital (including intensive care and specialized treatment), and prolong occupational sick leave. Conversely, illness can lead to malnutrition by influencing nutritional intake, digestion, etc. In addition to its negative impact on life quality, frequency of complications and treatment outcomes, malnutrition obviously has a variety of economic consequences.

The economic consequences of malnutrition can be roughly divided into direct and indirect costs. The former are directly related to increased needs for and costs of health care. Indirect costs are those related to loss of production due to illness. Together, they comprise the total economic costs of ill health to society; in theory, they would be eliminated if all illness were to be wiped out. However, such figures are only of interest for describing the size of the problem. They say nothing about the most interesting questions in this context, namely the cost-efficiency of alternative diagnostic, preventive, and therapeutic measures, various types of care, etc.

The reason for paying attention to the economic aspects of health care is that its resources are and will remain limited. The value of treatment in one area, malnutrition for example, must be weighed against the benefits of allocating resources to other areas. It is a matter of utilizing available resources as efficiently as possible, i.e. where they yield the greatest benefits for patients and society as a whole.

It is therefore necessary to justify the investment of resources in nutrition, compared with alternative uses. Of course, this does not mean that nutritional therapy should be questioned when it is clearly indicated and a need exists. What is relevant to study and analyse within an economic framework is the category of “borderline cases”, i.e. those in which it is not possible to clearly establish the value of nutritional therapy. This medical-economic approach does not conflict with the quality objectives of care; on the contrary, it is essential in order to enable the achievement of those objectives. This is because inefficiency leads to situations in which it is necessary to abstain from measures that are both feasible and desirable.

The purpose of this chapter is to analyse the economic consequences of malnutrition. Based on a review of the literature, it reviews certain facts about the costs of malnutrition, and both the costs and effects of alternative forms of nutritional therapy. Also presented are sample calculations for the costs of malnutrition in Swedish health care.

Search of the literature

This chapter is based on a review of the literature on the economic consequences of malnutrition. The search was conducted primarily in the Medline data base with the following key words: malnutrition, deficiency diseases, health services, cost, and economic consequences. The list of references cited below includes only a selection of sources judged to be most relevant in this context, and is by no means exhaustive.

Cost of illness

Calculating the costs of malnutrition requires knowledge of the problem's extent. But although there are many studies on the incidence of malnutrition, they do not provide a clear picture. By current definitions, the observed frequency of malnutrition among acute and chronically ill patients is between 10–60 percent (ref. 1; see also Part II, Chapter 3: "Incidence of Malnutrition"). Regarding care of the elderly, Swedish studies have detected even higher rates of malnutrition: Among those in group homes for the aged, 36 percent have been assessed as undernourished, and another 48 percent at risk of becoming so (2).

Available research indicates that undernourished patients are hospitalized for longer periods and use more societal resources than other categories (3 9). Several studies have found that periods of care are often up to fifty percent longer for undernourished than for well-nourished patients. The former have a much higher risk of complications, which leads to higher health-care costs. A frequently cited retrospective study found that the average costs for an undernourished patient with complications were four times greater than for a well-nourished patient without complications (10).

However, a review of the current state of knowledge has found that there are comparatively few investigations of exactly how unsatisfactory treatment results and prolonged hospitalization for illness-related malnutrition have affected health-care costs (6). But the few studies which have addressed this issue have detected significant cost increases. According to those who conducted the inventory of current knowledge, a definite answer to the question of costs for illness-related malnutrition can only be provided by prospective randomized controlled studies (RCT) of nutri-

tional treatment compared with no treatment, including the prospective evaluation of both costs and clinical results.

Cost-effectiveness

The most cost-effective method for treating malnutrition is to encourage patients to eat more normal food. This is not always effective, however, and in such cases it is necessary to use alternative methods of supplying nourishment such as oral supplements and enteral or parenteral nutrition.

The cost of enteral nutritional treatment (EN) is about one-tenth that of parenteral treatment (PN). However, the cost difference between EN and PN is expected to diminish as new PN techniques become more widely available. Both methods are of equal therapeutic value, but EN is generally preferred if practicable, while PN is usually reserved for patients with gastrointestinal illness.

Cost-efficiency analyses of nutritional treatment have emphasized the importance of reducing the frequency of complications, and thus time spent in and daily costs of care (11).

Estimates made in England suggest potential savings of up to £450 per care episode merely from the use of post-operative nutritional supplements. At the national level, the potential savings from nutritional treatment of undernourished hospital patients have been estimated at £266 million (12). That estimate is based on the assumptions that time in care can be shortened by five days for ten percent of all patients, which corresponds to 540,000 for Great Britain as a whole, and that they are provided with nutritional supplements for fourteen days following discharge.

There have been few prospective studies of the cost-effectiveness of nutritional treatment. Several economic analyses of total parenteral nutrition (TPN) indicate that, although there have been positive results for some seriously malnourished patients, it is not likely that the treatment resulted in any cost savings. Retrospective analyses provide support for early intervention as a means of improving the results of care and reducing costs (6, 13).

Economic consequences of malnutrition: sample calculations

As far as is known, there are no published calculations of malnutrition-related costs in Swedish health care. We have therefore chosen to construct some rough sample calculations, based on the above-noted studies of prevalence and prolonged care, and on official statistics on the number of care episodes, average length of time in care, and daily costs.

In 1996, the number of hospital admissions in Sweden for short-term somatic health care was about 1.4 million (14). The average length of time was five days. We have assumed a frequency of malnutrition on the order of 10–15 percent, which corresponds to 140,000–200,000 care episodes. The average time in care for undernourished patients is assumed to be 10–25 percent longer than for other categories. It is also assumed that half of the undernourished have complications so severe as to require continued care, while the remaining half can be transferred to other, less expensive types of care.

Given the assumptions of 15 percent undernourished patients in short-term somatic care, and 25-percent longer time in care, it would mean that the average time in care for 210,000 patients is six days, or 1.2 days longer than the average of 4.8 for all other categories. To calculate the additional costs for hospital care, we have multiplied the total number of extra days in care (105,000 x 1.2 days) by the average daily cost of short-term somatic care (SEK 3,700), and half the total number of extra days in less expensive care by a lower daily cost factor (SEK 1.850). This yields a total extra cost due to malnutrition of SEK 699 million per annum.

The number of care episodes in long-term (geriatric) somatic health care and psychiatric hospitals during 1996 was SEK 176,000, with am average time in care of 23 days (14). In this case, a higher frequency of 25–30 is assumed, corresponding to 40,000–52,800 care episodes. For these patients, as well, the average time in care is assumed to be 10–25 percent longer.

If we assume a frequency of 30 percent among these patients, and a 25-percent longer average time in care, it would mean that 52,800 patients had an average time in care of 26.7 days, or 5.3 days longer than the average of 21.4 for all other categories. To calculate the extra cost, the total number of extra days in care (52,800 x 5.3) is multiplied by the average daily cost for long-term somatic care and psychiatric hospitalization (SEK 2,000), yielding a total extra cost of SEK 560 million per annum.

These calculations are summarized in Table 1.

These figures do not include any costs for treatment of undernourished patients. However, the marginal cost of an extra day in care is in most cases substantially lower than the average daily cost. Thus, the underlying assumption is that treatment cost is equal to the difference between average cost and marginal cost.

To summarize, this sample calculation of annual extra costs due to malnutrition in short-term somatic hospital care yields a figure of SEK 195–699 million, depending on which assumptions are used. The corresponding figure for long-term somatic and psychiatric care is SEK 202–560 million.

Table 1. *Sample calculation of extra costs due to malnutrition, in millions SEK.*

Prolonged time in care (percent)	Percent undernourished	
	10%	25%
Short-term care		
10%	195	466
15%	291	699
Long-term care		
25%	202	484
30%	243	560
Annual total	397–534	950–1,259

It should be noted that this refers to the direct costs referred to above, and does not include indirect costs due to illness-related production losses, etc. Further, we have not included any costs associated with care of the elderly, where the prevalence of malnutrition is almost certainly higher. Of the 120,000 elderly in Swedish group homes, fully one-third may be assumed to be undernourished (2). However, there is a lack of data on which to base even a rough estimate of associated extra costs.

Costs of prevention and treatment

A cost-efficiency analysis of the treatment of sixteen cancer patients found that it may be possible to achieve both economic and humanitarian benefits with enteral nutritional treatment during treatment for cancer and prior to operations (15). The results of the study indicated that the extra costs for those who did not receive such treatment totalled SEK 244,000 (1986 price levels), due primarily to the difference in the number of days in care.

Another study investigated whether parenteral nutrition is a better alternative than, for example, oral methods, enteral nutrition, or no supply of nutrition at all (11). The study's finding was that no general conclusion was possible due, among other factors, to frequency of complications, treatment strategy, sensitivity and specificity of testing methods, and costs of treatment for both nutritional problems and related complications.

Conclusion

Although there is an evident lack of useful data on the cost-efficiency of nutritional treatment, there is an obvious potential for savings of both human suffering and economic resources with effective prevention and treatment of undernourished patients. Our sample calculations are admittedly crude; but they are relatively cautious, and indicate total potential savings on the order of SEK 0.5–1 billion per annum in Sweden.

Unfortunately, there is at present no clear-cut scientific evidence that available methods of prevention and treatment of malnutrition make it possible to realize that potential. Therefore, it cannot be assumed that such measures can shorten time in care. Much remains to be done in analysing the economic consequences of malnutrition in Swedish health care. Several prospective studies are needed in order to establish the cost-efficiency of nutritional treatment. It is therefore vital that future studies in the area of nutrition consider medical-economic aspects, as well as the costs of necessary investments in programme development, training, etc.

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7. Nutritional Theory: Organization and Structure

Gunnar Akner

Nutritional theory is taught at six Swedish universities, as follows:

- *Göteborg University* has a department of clinical nutrition which focuses on clinical practice (see below).
- *Linköping University* of Health Care includes a department of nutrition headed by an associate professor. Its principal focus is on metabolism during pregnancy and nursing.
- *Lund University* has, in addition to a department of clinical nutrition, an institute of industrial nutrition and food chemistry with a professor and several associate professors.
- *Stockholm University's* affiliate at Huddinge Regional Hospital includes a department of medical nutrition, headed by a professor, which conducts extensive preclinical research with an emphasis on nutrition-related biochemistry and molecular biology. The affiliate, called Novum, also has a section for the theory of preventive nutrition which is primarily concerned with community nutrition.
- *Umeå University* has a section for nutrition research headed by an assistant professor, which is primarily concerned with preventive nutrition and biomarkers for epidemiological studies.
- *Uppsala University* has, in addition to the assistant professorship noted below, a department of nutrition headed by a professor. Areas of special interest include sports physiology, metabolism, and nutrition in underdeveloped countries.

Current organization of the subject "clinical nutrition"

Clinical nutrition has been a medical speciality in Sweden since 1992. It is referred to unofficially as a "secondary speciality" whose practitioners require a primary speciality within a broader clinical area such as internal medicine, geriatrics, general medicine, surgery, anaesthesiology, intensive

care, clinical chemistry, paediatrics, etc. A guide to special training in clinical nutrition ("Utbildningsbok") was published in 1999 and can be ordered from the Swedish Medical Society, or downloaded from the Internet web site, *www.sls.se.*

Only the universities of Göteborg and Lund have special departments for clinical nutrition. At Göteborg there is a position for a professor/chief physician and for several associate professors, including one chief physician; altogether there are places for three physicians. At Lund there are 1.5 positions for physicians, including one chief physician; there are no university positions. In Malmö, there is a position for an associate professor/chief physician specializing in geriatric nutrition at the Geriatric Development Centre of Malmö General Hospital. In Uppsala there is a chief physician/assistant professor in clinical nutrition associated with the metabolism unit at the geriatric clinic of Samariterhemmet Hospital. In Stockholm there is a nutrition unit at the geriatric clinic of the north-west health-care district. There are no clinical units of any kind in Linköping and Umeå.

In Sweden as a whole, there are some five positions for physicians in clinical nutrition and nine medical specialists in clinical nutrition. In addition, there are a number of physicians with various other specialities who are also involved in research and development within the area of clinical nutrition. For the past thirty years, they have been at the leading edge of basic and clinical research on nutrition. Their research has thus far concentrated primarily on the area of surgery, where clinical applications have improved the results of surgical procedures.

The small number of positions for physicians and the lack of hospital beds of one's own contrast sharply with the extent of nutritional problems in health care (see Part II, Chapter 3: "Incidence of Malnutrition"). As a result, nutrition clinics have developed ad hoc, leading to division into nutrition teams, dysphagia teams, PEG teams, dietician units, diet sections, etc. The consequence has been that, for the most part, there are no entities which can provide second opinions in cases of severe nutritional problems, or assume responsibility for research and development in the area of clinical nutrition.

Interest in nutritional issues has increased in recent years, which is reflected in the diversity of educational activities within various parts of the health-care system. However, due to the present organizational structure described above, the effects of various personnel-training initiatives are often transitory. Theoretical knowledge is a necessary, but not sufficient, precondition for positive effects. There also has to be a clinical structure within which such knowledge can be applied.

Development of clinical nutrition

It has been argued here that the scientific basis for the treatment of malnutrition related to various types of illness is not adequate at present. It is therefore very urgent to encourage treatment-oriented research on nutrition, in order to improve the knowledge base for the treatment (including prevention) of various types and degrees of malnutrition associated with specific illnesses and combinations of illnesses.

One way to improve the situation would be to establish clinical nutrition units at university hospitals, preferably linked to individual clinics with large numbers of patients, and with an interest in and suitable conditions for developing the organization. Such units should be staffed with physicians, nurses and dieticians in adequate numbers, and should also be able to offer postgraduate education at various levels.

There should be a clear description of the organization and its purpose, including its functions with regard to:

- *Clinical health care* (consulting, and in- vs. outpatient care). Evidence-based treatment of existing malnutrition, together with other clinical problems. Development of (a) a system of risk-markers to identify patients with high risk of malnutrition, and (b) administrative routines.
- *Research and development*. Development of criteria for diagnosing malnutrition. Randomized, controlled longitudinal studies (preferably including placebos) on the effects of nutritional treatment for existing malnutrition. In addition to standard nutritional markers, the evaluation should include clinically relevant end-points such as functional capacity, health-related quality of life, morbidity and mortality.
- *Education* in clinical nutrition for medical students, dieticians, nutritionists, nurses, dentists and other professions.

The situation of clinical nutrition has many similarities with that of the speciality, pain mitigation. A 1994 report of the Swedish National Board of Health and Welfare offers suggestions, regarding organization and the management of malnutrition, which can also be applied within the area of clinical nutrition (see chapter entitled "*Förslag och rekommendationer*" in the report, *Behandling av långvarig smärta*. Socialstyrelsen 1994:4).

In conclusion, it may be observed that developing the structure and organization of the subject, clinical nutrition in health care, would facilitate important clinical research projects in this area. The greatest need is for randomized, controlled studies of treatment which focus on clinically relevant measures of treatment effects.

8. Treatment of Malnutrition in Old-age Care

Gunnar Akner, Tommy Cederholm, Torsten Mossberg & Elisabet Rothenberg

Fully seventeen percent of Sweden's population is above the age of 65. For the present, that figure is not increasing; but the proportion above 80 is growing. In connection with a major reform in 1992, old-age care became the responsibility of Sweden's municipalities, to which capacity for some 30,000 care recipients was transferred from regional facilities. Since then, the total number of places for acute medical care and geriatric care has decreased from ca. 90,000 to about 35,000. Average time spent in hospital has been significantly reduced, resulting in the transfer of a large health-care burden to municipal old-age care (1).

The majority of those subject to the greatest risk of becoming undernourished, the infirm elderly and the chronically ill, reside in municipal facilities, increasing the need for effective nutritional regimes in old-age care. In 1997 there were about 135,000 individuals living in various kinds of group home for the elderly, and some 165,000 of those 65 and older received personal assistance and/or health care in their homes.

The Swedish National Board of Health and Welfare has in recent years studied nutritional conditions in the health-care system (2–7). Some 1300 individuals have been examined in different types of community, in every part of the country. All were recipients of care in group homes, or of health care and personal assistance in their own homes. A surprisingly large proportion, ranging from 49–100 percent, were found to be or suspected of being undernourished when evaluated with MNA, Mini Nutritional Assessment (see Part I, Chapter 2: "Evaluating the Patient's Nutritional Status") . The figures for various categories are presented in Table 1.

MNA has been criticized for lack of specificity. It is strongly influenced by cases requiring extensive care, which probably increases the likelihood that malnutrition or suspected malnutrition will be found in all nursing homes evaluated with MNA. But heavy care requirements are, in themselves, a risk factor. The MNA results summarized in Table 1 are supported by the fact that a large proportion of those examined were underweight (for an evaluation of BMI, see Part I, Chapter 2).

Table 1. *Percent undernourished in municipal old-age care, according to Mini Nutritional Assessment (MNA) and low Body Mass Index (BMI).*

Type of care	Under-nourished	In risk zone	BMI ≤20	BMI ≤23
Home assistance (356)	6	43	15	35
Home health care (80)	3	62	34	64
Service flats (349)	21	49	18	48
Old-age home (261)	33	57	25	55
Group home for dementia patients (96)	39	51	19	54
Nursing home(166)	71	29	33	70

Goals of nutritional care and treatment

The overriding goal for nutritional treatment of the elderly is to achieve the best possible quality of life and human function. This differs from the goal of nutritional guidelines for younger persons, where the emphasis is on preventing future illness. Food and mealtimes also have a social aspect.

Quality regulations and guidelines. Need of special competence in municipal old-age care

According to the National Board of Health and Welfare's regulations and general guidelines (SOSFS 1996:24), all health care shall include systems for the planning, implementation, follow-up and development of high-quality care. Further, all personnel shall participate in systematic, continual development of quality. The Board has also developed general guidelines for quality-enhancing systems which specify that care of the elderly and the handicapped should include systems for the establishment of quality objectives, and for the planning, implementation, follow-up and development of high-quality care. The purpose of quality-enhancing systems is to ensure that the individual's needs for care and service are satisfied. To accomplish that purpose within the area of nutrition, various types of special medical competence are required. Co-operation between such specialities is a basic precondition of high quality, according to a report of the Swedish Association of Local Authorities' Committee on Ageing (16).

Responsibility

Care-providers are responsible for supplying food to the infirm elderly. The need for various kinds of special competencies should be clearly defined. In order for care-providers to be able to properly perform their function in this regard, the allocation of responsibility between various specialities must be clearly defined. Presented below are suggestions in that regard.

Political responsibility

The basic principle of political responsibility in this context is that the relevant authorities understand and support nutritional treatment as part of the total care process, and therefore initiate efforts to maximize quality. For that purpose, it is important to identify work flows and processes in, for example, regional hospitals, between hospitals and municipalities, and within municipalities. Quality-enhancing efforts that focus on the infirm elderly must therefore involve various authorities, medical specialities and social services.

Co-ordination of hospitals and municipalities

Nutritional treatment must be taken into account during the entire care process. The treatment of many older persons may be complete from a medical standpoint when they leave hospital after brief periods of care; but they may still be in need of active, long-term nutritional treatment when they are transferred to municipal old-age care.

The National Board of Health and Welfare's regulations and general guidelines on transfer of information and co-ordinated planning of care (SOSFS 1996:32) indicate what is to be done after the hospital phase of the patient's treatment is judged to be complete. Among other things, it is stressed that the patient's physician shall determine if the health care offered by the relevant county council is adequate to the patient's needs. Thus, it must be clearly established that there is an adequate programme of nutrition before the patient is transferred. That assessment is made jointly by the physician, the public assistance officer, the nurse in charge and/or personnel at the receiving residence or institution.

Municipal allocation of responsibility for nutritional treatment

For elderly persons living at home, the public assistance officer is primarily responsible. He or she also plays a key role in specifying and deciding upon the kind of assistance required. Home-assistance personnel are responsible for assessing any need for health care.

It is desirable that every municipality have at least one dietician responsible for nutrition in old-age care, just as there is a medically responsible nurse. The dietician should assume the primary responsibility for the education and training of other personnel in nutritional matters, and be available for consultation by those providing home assistance and health care. Together with the physician and the medically responsible nurse, the dietician should also be responsible for establishing routines for the diets and nutrition of elderly persons in care. In addition, the dietician should initiate and suggest supplementary nutrition (liquid supplements, enriched food, etc.) and enteral nutritional treatment, as needed.

The patient's physician is responsible for assessment, prescription and treatment, and shall also ensure that various kinds of treatment are co-ordinated, followed up and evaluated on a regular basis.

Responsibility for diet and food preparation

It is necessary to be aware of patients' specific problems in order to supply food which is suited to their needs. Those responsible for preparing food for the elderly should therefore be trained dietary chefs. They are responsible for the menu, food preparation, compliance with national quality norms (ESS committee's recommendations), and ensuring that the food delivered matches what is ordered. Care personnel are responsible for ordering food, and must therefore have sufficient knowledge to do so. Preparing food so that it meets the needs of the individual patient should be the responsibility of a nurse or dietician. In this connection, it should be emphasized that nurses in municipal old-age care should receive training in nutritional matters.

When contracting for food services, it is necessary that specifications are formulated by someone with knowledge of nutrition, and that due consideration is given to the issues noted below. It is also important that the allocation of responsibility between the entrepreneur and care personnel be clearly specified. Further, the competence of the entrepreneur's personnel, and their eventual need of additional training, should be established beforehand.

Guidelines for quality documentation and contract specifications

Municipalities should develop dietary programmes for the elderly in their care. Such programmes should provide guidelines for the organization of meals, including timing and types of meals, the ingredients of various meals, and the number of meals per day. The maximum time of the nightly fast should be no more than eleven hours. Programmes should also specify

demands for nutritional content, warm-up times, and what kinds of special diets and food consistencies can be offered.

Food preparation often takes place near or within the care facility. In other cases, it is possible to ensure the quality of food served to the elderly in municipal care by entering a contract with an entrepreneur. This requires a clear set of specifications, systematic follow-up (with questionnaire surveys of patients and personnel, for example), spot checks, and reviews of legally required self-administered inspections and statistics on food service. The same specifications included in contracts with entrepreneurs can also be applied to the municipality's own food service.

A study of health and food service for the elderly that was conducted in Stockholm County in 1995 found that no municipality could present a written decision by local government on the goals and specifications of food service (17). This unhappy state of affairs stimulated the municipality of Sundbyberg to develop a set of quality requirements for food served to the elderly, in co-operation with a local nursing home and the North-west Geriatric Clinic (18). After an extensive review by all interested parties, a revised proposal for suitable requirements was adopted unanimously by Sundbyberg's Committee on Old-age Care in May of 1997. This was the first formal decision on quality requirements for food in municipal old-age care in Stockholm County. The document has been published in its entirety in a book published by the Swedish Association of Local Authorities (19).

These quality requirements are now applied in all contracts for the provision of food service to old-age care in Sundbyberg. They are included as an appendix to all contractual agreements, and are also used in the municipality's own food service. Similar procedures have now been adopted by several other municipalities in Stockholm County, and also in Göteborg (20), Uppsala (21), and other locations.

The Sundbyberg study also found that providing food to the elderly is a very resource-demanding component of their care (17). Personnel spent at least five hours daily between 7:00 a.m. and 7:00 p.m. on food-related activities, which means that over forty percent of working time was devoted to the elderly's food and dining.

Needed: competence, education and better routines

The level of knowledge concerning nutritional theory and practice within municipal old-age care varies widely, and is often inadequate. Dieticians should therefore be given responsibility for continuing education of all care personnel, in accordance with a definite teaching plan.

Recommended measures

It is recommended that municipalities:

- develop a dietary programme for old-age care in every municipality
- acquire nutritional competence
- educate personnel in such matters as
  - how to identify individuals at risk
  - nutritional theory, especially in regard to nutritional needs of the elderly
  - proper treatment of nutritional problems
  - documentation of nutritional treatment
- develop regulations that specify tasks and areas of responsibility
- establish contractual specifications that include essential quality requirements
- develop routines for the transfer of information between various care facilities
- ensure the quality of the elderly's food intake, that dietary programmes are followed, and that food is properly supplied to the patient
- provide personnel with enough time and opportunity to carry out the practical tasks associated with between-meal snacks and enriched food.

Realistic goals

During the last days of life, many elderly persons are ill, lack appetite and lose weight. To some extent, this is unavoidable, and it is unrealistic to believe that it is always possible to restore a normal state of nutrition. In the terminal phase of life, food is often of minor interest. Good oral hygiene, pain mitigation and general care may then be more important.

However, most of those in old-age care still have many years of life remaining. For them, adequate nutrition is a precondition of functional ability and high quality of life. Much remains to be done. With one of the world's oldest populations, Sweden can take the lead in developing satisfactory routines for maximum prevention of malnutrition in the elderly.

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9. Education in Clinical Nutrition

Education of Physicians

Gunnar Akner

Basic education

In 1995, the Nutrition Section of the Swedish Medical Society approved a "Basic National Curriculum for Clinical Nutrition" to be included in medical education (1). The curriculum is organized under four main headings:

1. Basic physiology and pathophysiology
2. Diagnosis
3. Treatment
4. Prevention.

The headings and terminology correspond to those used in other areas of medicine, so that medical students and licensed doctors will feel at home and find it relatively easy to orient themselves within the large interdisciplinary field of nutrition.

The Nutrition Section also recommended that every medical school appoint a co-ordinator of clinical nutrition to participate in the Section's co-ordinating committee which has regular discussions on how to implement the basic curriculum at various schools of medicine.

The basic curriculum covers all aspects of the nutritional competence which, in the judgement of the Nutrition Section, all medical students should have acquired after 5.5 years of education. But it does not stipulate any detailed knowledge within the various subareas, since requirements differ among medical faculties in relation to local conditions. Also, the intention was to recommend a set of objectives – not to specify the exact contents of the curriculum, which would require something on the order of a textbook.

For the past several years, work has been in progress at Sweden's six medical schools to adapt the national objectives to local conditions. The medical schools at Lund and Stockholm have progressed the farthest, and have submitted proposals for local objectives in clinical nutrition to the National Board of Education and the Medical Education Programme Committee.

I. Basal Physiology & Pathophysiology	***II. Diagnosis***	***III. Treatment***	***IV. Prevention***
Physical constitution Methods for determining constitution Normal body constitution Regulation of appetite, hunger and satiation Energy and nutrients Definitions, chemical properties Functions and cellular/molecular mechanisms Body's reaction to starvation, excess nutrition, trauma, illness Knowledge of basal diet and foods Amounts of nutrients in food Effects of process Toxins/foreign substances in food Energy-nutrient requirements Methods for determining energy use Principles for establishing energy-nutrient requirements Needs in various normal physiological states Adaptive mechanisms with various levels of nutrient intake	*Nutrition anamnesis* Previous food and nutrient intake Weight and height changes Social situation of meals Eating function (e.g. appetite, chewing, swallowing) Digestive tract symptoms (e.g. nausea, vomiting, diarrhoea Other appropriate details *Co-operation between physician, dietician and other occupations* *Nutritional status* Height and weight Physical constitution Energy use (established with, for example, indirect calorimetry) Fluids balance Functional ability, e.g. mobility, muscle strength General physical status *Biochemical status and relevance for nutrition* Lipids: s-triglycerides, s-cholesterol Proteins: serum proteins, N balance Vitamins and electrolytes/trace elements (e.g. s-B_{12}, s-folate, s-Na, s-K, s-Mg, s-Ca, iron status)	*Peroral nutrition* Food types Adjusting diet Dietary supplements Enriched foods *Enteral and parenteral nutrition* Complications Techniques Quality control *Nutritional problems and treatment in connection with:* • diabetes mellitus • allergies • circulatory illness (e.g. heart disease, arteriosclerosis with associated risk factors) • congenital errors of metabolism • lung disease (e.g. chronic pulmonary disease) • diseases of the digestive tract (e.g. malabsorption syndrome, dysphagia, liver-pancreas disease) • malnutrition (e.g. in connection with geriatrics, malignancies) • kidney disease (e.g. kidney failure) • obesity	**Relationship between food and health, national and international** *Food as risk factor and protective factor re. development of illness* (e.g. anti-oxidants/pro-oxidants, dietary fibre, lipids, mealtime arrangements) *Preventive intervention:* indications, potential, ethics *Dietary messages to various target groups,* e.g. children, youth, pregnant/nursing women, elderly *Diet's significance for optimizing health* *Physician's role in,* for example, paediatrics, school health programmes, dental care, old-age care

I. Basal Physiology & Pathophysiology	***II. Diagnosis***	***III. Treatment***	***IV. Prevention***
Energy-nutrient recommendations Food intake Methods of study Distribution and average intake of food in Sweden International comparisons Energy-nutrient intake Conversion of food intake to energy-nutrient intake Distribution and average intake of energy and nutrients in Sweden International comparisons	Endocrine status (e.g. B-glucose, HbAlc, thyroid status) Coagulation status pH status Immune function (e.g. skin test for food allergies or malnutrition) *Integrated nutrition assessment* Evaluation of nutrition anamnesis, nutritional status and biochemical status in relation to calculated energy-nutrient requirements and other influences, e.g.: • current age and stage of life (paediatric, geriatric) • current metabolic state (anabolic-catabolic) • current pathophysiological processes • current living conditions (tobacco, alcohol, physical activity, psycho-social factors) • current treatment (pharmaceuticals, surgery, radiation therapy)	• specific deficiencies (e.g. sideropenia, cobalimin, folic acid) • trauma, surgery • feeding problems in children • eating disturbances (e.g. anorexia, bulimia) *Interaction between nutrients and pharmaceuticals* *Co-operation between physician, dietician and other occupations*	

N-rated education

In order to evaluate the breadth and extent of nutrition education acquired by medical students at Karolinska Institute near Stockholm, a survey was conducted in 1996 with the co-operation with the medical students association (2). One student in each of the eleven half-year terms of study kept a prospective daily record of all the nutrition-related incidents of any kind that she or he experienced during the term.

When the results were compiled and analysed, it turned out that the total time devoted to nutritional matters during the entire course of study amounted to 132 hours of real time (176 academic "hours"), which were distributed unevenly over the various terms. This corresponds to nine weeks of full-time instruction.

Described in this manner, clinical nutrition is one of most extensive courses of medical education. Nevertheless, many medical students have the impression that they receive hardly any training in clinical nutrition during their basic education. One of the most important reasons for this is probably the previous absence of a co-ordinated basic curriculum in the subject, an "N-rated" medical education.

A corresponding study of faculty members' experience of nutrition education has also been conducted at Karolinska Institute. The observations of students and teachers have been compared, and will serve to guide the future development of medical education at the Institute.

Test of knowledge

In co-operation with the medical students association, an anonymous written diagnostic exam in clinical nutrition was administered during the final term at Karolinska Institute in 1996 (2). A total of 103 students were enrolled during that term. Of these, 87 answered the questions, which were based on the Basic National Curriculum and devised by a committee of three clinical nutrition co-ordinators. Questions on all four main areas (see above) were included. It should be noted that the students did not receive any forewarning of the exam, and that their basic medical education did not include an integrated set of objectives.

The average score was 16.5 points out of a possible 37, or 44 percent. Several important knowledge gaps could be identified, and those issues will be emphasized in future medical education in Stockholm. Another diagnostic test was administered during the winter of 1998–1999 at Linköping, Lund and Stockholm. The results were published in the autumn 2000 edition of the Swedish medical journal, *Läkartidningen.*

Specialist training in clinical nutrition

In 1998, the Nutrition Section of the Swedish Medical Society approved a set of objectives for specialist training in clinical nutrition (3). Those objectives proceed from the Basic National Curriculum for medical edu-

cation in clinical nutrition (see below), and are significantly more detailed in all areas. The purpose is to equip doctors with a broad education in clinical nutrition so that they develop a competence in the subject which can be related to their main speciality. The fully-trained specialist may then bear the title of, for example, "specialist in clinical nutrition with internal medicine orientation. . . . geriatric orientation", etc. The revised basic curriculum also provides the outline of a specialist training in clinical nutrition.

It is important to make the subject of clinical nutrition more interesting and attractive to doctors and medical students, so that analysis of nutrition is integrated with more general medical analysis and with the evaluation of treatment outcomes. It is also important for education in clinical nutrition to be followed by the development of suitable organizational structures in health care, so that various categories of student have the opportunity to apply their theoretical knowledge in practical situations (see the chapter, "*Struktur och organisation*", in reference 3).

The widespread nutritional problems in health and old-age care, along with the great interest in nutrition among the general public and in the media, are good reasons to integrate the study of clinical nutrition with medical education, in terms of both analysis and organization.

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Nursing Education

Mitra Unosson

The extent and contents of education in nutrition vary among nursing education programmes in Sweden. Since prevention and treatment of malnutrition are included in the nurse's care-providing responsibility, a well-conceived basic curriculum in nutrition can raise the competence levels of trained nurses. Nursing education in Sweden normally takes three years, and includes a wide variety of subjects. In order to further develop competence in this area, it is important to provide continuing education and specialist training in nutrition to a greater extent than is the case today.

Nursing education takes place at the university college level, leading to a University Diploma in Nursing or a Bachelor of Science in Nursing, depending on the institution and its particular programme. Certification qualifies the nurse for employment in a number of areas, including primary care, hospitals, and municipal health care. In all of these contexts, there are nutritional problems related to the significance of diet for health, and to the prevention and treatment of malnutrition. Since universities and university colleges decide on the contents of their own courses and programmes, there are no overarching national objectives or course plans for nutritional theory and practice in nursing education.

In order to document the contents, breadth and methods of education and examination on the subject of nutrition in the basic education of nurses, a questionnaire survey was conducted among all schools of nursing during the autumn term of 1999. The survey also included a question on the availability of separate nutrition courses for nurses after their basic education. Of the 25 schools of nursing in Sweden, 23 replied to the questionnaire.

The results disclosed that nutrition education occurs primarily as an integrated part of education in other subjects. Only five nursing schools offered separate courses on the specific subject of nutrition.

The relationship between diet and health was found to be an important aspect of nursing education, and was included in the curricula of most nursing schools (21 of the 23 respondents). Knowledge of nutritional status, digestion, absorption and metabolism is necessary for an understanding of health and ill health. These issues were addressed at nineteen of the schools. Nutritional recommendations were taught at all 23.

It is part of the nurse's responsibility to ensure that the patient receives medically prescribed food and nutrition, either enterally or parenterally. The survey found that training in enteral nutrition was lacking at two of the schools, and parenteral nutrition at four. Three-fourths of the schools included education on preventive and curative dietary treatment, for example in cases of cardiovascular disease, kidney and intestinal ailments, diabetes, cancer, respiratory insufficiency and neurological illness. Equivalent education on starvation, overweight, alcoholism, infection and osteoporosis was offered at about half. Three-fourths reported that they offered training in the assessment, follow-up and documentation of oral and dental health, appetite, eating ability, feeding, dining atmosphere, energy-nutrient intake, liquid intake and gastrointestinal problems. Sixteen of the schools offered education on ethics and nutrition, and the assessment and monitoring of nutritional status.

Teaching methods include lectures, independent studies, seminars and skills training, all of which are employed throughout the entire six-term course of study. Few nursing schools were able to quantify their pro-

grammes in terms of hours. There were examinations on individual subjects at half of the schools; the most common formats were written exams, seminars,written assignments and combinations of these.

Dietician Education

Elisabeth Rothenberg

Three Swedish universities have programmes of dietician education, those at Uppsala, Göteborg and Umeå. Uppsala University offers a Master of Science degree; Umeå and Göteborg universities offer Bachelor of Science degrees, with the possibility of continuing on toward an M.S.

The education of dieticians has been lengthened since it was introduced in 1977, because their occupational role has changed significantly since that time. Today, dieticians are responsible for independently designing, following up and evaluating nutritional treatment, in accordance with medical prescriptions and in consultation with physicians. They are also responsible for educating other personnel in nutritional matters. Further, they are expected to be capable of conducting research, and to assume responsibility for the planning, implementation and analysis of dietary research in connection with various projects and studies.

To be certified as a dietician, students must have:

- acquired the necessary skills and knowledge to work independently as a dietician
- acquired knowledge of, and the ability to study and evaluate, nutritional intake and status
- the ability to plan and manage dietary needs of people in general and to educate the public abut diet and health
- the ability to study and treat problems, symptoms and illnesses related to diet and nutrition
- an understanding of the dietician's role that is well-suited to teamwork and co-operation with other occupations, self-awareness and empathy, and thereby the capacity to safeguard the interests of patients and their close relations, with due consideration of ethical requirements and with a holistic conception of humankind.

Following advanced education in clinical nutrition, the dietician shall also have:

- acquired further knowledge of human physiology, biochemistry and nutrition
- acquired a good knowledge of research methodology

- met the formal qualifications for postgraduate education at a school of medicine.

The dietician's education includes the following subjects:

- Introduction to clinical nutrition
- Biochemistry with organic chemistry
- Human physiology and anatomy
- Basic nutrition; nutrients in food and their physiological functions
- Health occupations and clinical orientation
- Dietary habits and nutritional status of groups and individuals
- Food science and culture
- Communication and learning
- Psychology and the art of conversation
- Scientific method and statistics
- Prevention and treatment of diet-related conditions and illnesses
- Medical treatment of malnutrition
- Clinical nutrition in practice.

Dietary research methods with nutritional epidemiology

Special studies in clinical nutrition

Specialist training

Today, all three universities offer separate courses for continuing education which, in combination with special studies can lead to a Master of Science. However, there is no specialist training, per se. It would be desirable if, at some time in the future, it were possible to be certified as a dietician with special competence in various areas. Qualification for such a degree should be based on additional medical training and a review of the literature within the area in question.

Part II

1. Nutritional Theory

Elisabet Rothenberg

This chapter provides a brief introduction to the subject of nutritional theory, along with some observations on current nutritional recommendations. The primary references are *Näringslära för högskolan* ("*Nutritional Theory for Higher Education*"; ref. 1) which is a general introduction to the subject, and the Encyclopedia of Human Nutrition (2) which provides more thorough knowledge.

The Swedish nutritional recommendations (4) are based on those for all of the Nordic countries (3), which are derived from data on current nutritional conditions in the region and are intended to provide a foundation for dietary planning which:

- Satisfies basic nutritional requirements, including the individual's need for growth and functional ability
- Ensures basic conditions for general good health, and limits the risk of diet-related illness.

The Nordic recommendations apply mainly to healthy individuals whose level of physical activity is low to moderate. It is important to distinguish between nutritional needs and recommendations. The latter exceed the basic needs of the average individual, and should also account for individual variations among a large majority of the population (see Figures 1 and 2).

During illness, the composition of the diet must be adjusted. This may involve changes in energy and nutrition requirements, compared with those of healthy individuals. Energy needs often decrease due to reduced physical activity. The reverse may also occur with illnesses that increase the rate of metabolism. Other conditions may stimulate muscular activity, and thereby the use of energy. A number of somatic illnesses lead to changes in metabolism, and in some cases to increased losses of energy, protein, minerals and vitamins.

If appetite and/or energy needs decline, it is necessary to provide the invalid with food that is highly concentrated, i.e. which contains high levels of nutrients per unit of energy. This means that the energy component is different than in a diet for healthy persons.

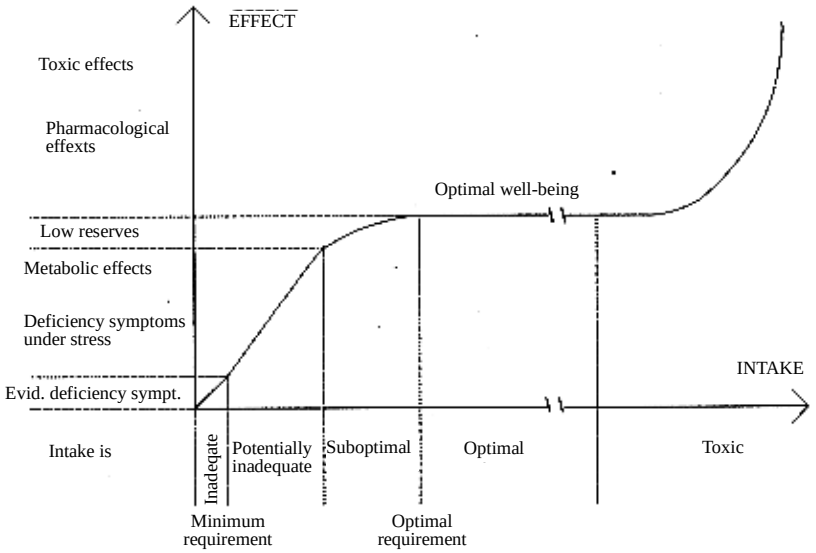

Figure 1. *Schematic diagram of relationship between intake of a nutrient and its effect on the organism. Normally, there is a gradual transition between deficiency-related illness, optimal conditions, and toxic effects due to excessively high intake.*

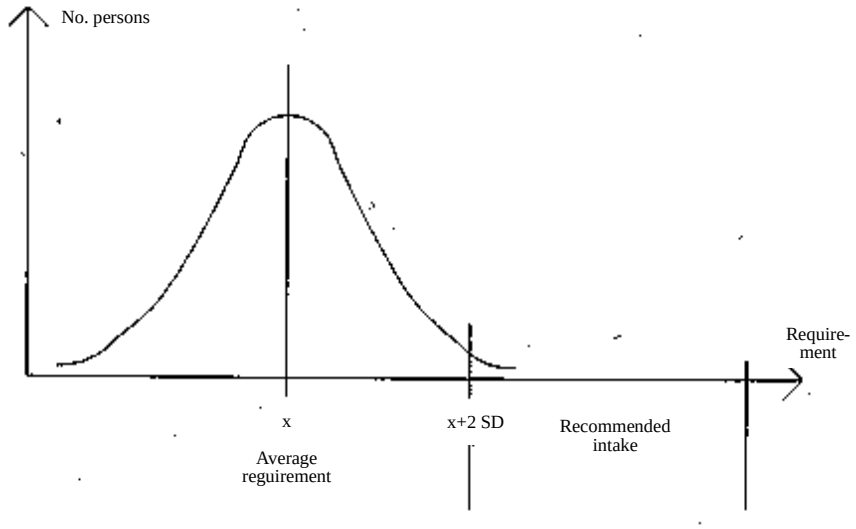

Figure 2. *The recommended intake of a nutrient usually corresponds to the average needs of a group of individuals, plus a safety margin of two or more standard deviations.*

Energy

Energy is indestructible, and can only be converted into different forms. Only 30–40 percent of the available energy in food is converted into adenosine triphosphate (ATP) and other energy-rich compounds that are used in metabolic processes or physical work. The remainder is used to maintain body temperature.

In nutritional theory, energy is quantified according to the SI system in joules (J). One J is equivalent to the amount of energy need to move one kilogram one metre with a force of one Newton (N). However, the calorie concept is still in use, and many find it easier to understand energy if it is expressed in terms of that measure. In the following discussion, energy is referred to in terms of both kilojoules (kJ) and kilocalories (kcal). The conversion factor from kJ to kcal is 4.184.

The Nordic nutritional recommendations define the energy needs of an adult human as the amount needed to fuel metabolism when the individual has a weight, build and level of physical activity that is compatible with good health.

The Total Metabolic Rate (TMR) can be analysed into three components (5, 6):

- Basal Metabolic Rate (BMR) is the rate after 12–18 hours' fasting. with the subject awake, mentally and physically at rest, and with a comfortable ambient temperature. BMR usually accounts for around 50–70 percent of total energy use during a 24-hour day. For individuals with normal metabolism, the basal portion is about 84 kJ/kg body weight (20 kcal/kg).
- Physical activity. This portion of total metabolism varies widely among individuals, depending on type of work and recreational activity.
- Thermogenetic effect of food. The increase in metabolism resulting from food intake comprises roughly ten percent of the total.

Knowledge of human metabolism has increased substantially during the past decade, primarily through use of the Double Labelled Water (DLW) method (7, 8). This involves determining total metabolism with the use of oxygen (^{18}O) and stable isotopes of hydrogen (deuterium). BMR is established by measuring oxygen consumption while at rest under standard conditions.

Several years ago, the available data on measured values for TMR, BMR and the Activity Metabolic Rate (AMR) were compiled; both the ages of the subjects and their levels of physical activity varied. Summarized below are the values for Physical Activity Level (PAL = TMR/BMR). These are not recommendations, but are based on the values

recorded among various subgroups. The number of individuals in many of the studies was low, due to the very high cost of the DLW method.

PAL is a measure of physical activity. The minimum level for energy intake is twenty percent over BMR, i.e. PAL = 1.2 BMR (5, 10). This safety margin assumes a more or less complete lack of physical activity. For individuals who are largely bed-ridden, PAL is set at 1.3. For those who are up and about, but do not exert themselves, PAL is set at 1.5. For cases involving significant physical activity, a value between 1.8–2.0 is used.

There may be dramatic changes in metabolism during illness. Total metabolism usually decreases, due to a decline in physical activity. Under certain conditions – in connection with physical activity or metabolically active illness, for example – basal metabolism increases. Other conditions may lead to an increase in AMR, due to the effort of breathing during physical activity. The relationship between metabolism and various types of diagnosis has been studied with the DLW method, and the results indicate that, for example, individuals with chronic obstructive lung disease have a heightened rate due to increased AMR (11).

Fats

When one gram of fat is burned, 38 kJ (9 kcal) are liberated. It is recommended that the amount of solid fat in the diet (trans- and saturated fatty acids) should represent no more than about ten percent of total energy intake (E% = the proportion of total energy intake expressed as a percent). The total fat content of the diet should be limited to about 30 E%, or 28 E% when in the form of fatty acids. Essential fatty acids (polysaturated n-6 and n-3) should contribute at least 3 E%. A minimum intake of 0.5 E% is recommended for n-3 fatty acids. In cases of significant weight loss due to illness, it may be necessary to revise this recommendation in favour of increased fat intake in order to maintain restrictions on the total volume of food. When the proportion of fat in the diet increases, it is important to monitor the combination of fatty acids so that quantities of saturated varieties do not increase, as well.

Carbohydrates

When one gram of carbohydrate is burned, 17 kJ (4 kcal) are liberated. Carbohydrates should provide 55–60 percent of total energy intake. The amount of dietary fibre should be 25–35 g/day, corresponding to 3g/MJ in healthy individuals. For most people, these recommendations represent a significant increase of both carbohydrates and fibre. Carbohydrates are the primary source of energy for the body. More complex forms, such as di-

and oligosaccharides, are converted into monosaccharides, galactose, fructose and glucose. With illnesses that often involve limited appetite, intake of carbohydrates and fibre should be limited in order to reduce the food's total volume.

Proteins

When one gram of protein is burned, 17 kJ (4 kcal) are liberated. Cellular protein synthesis requires twenty different amino acids, of which eight are regarded as essential for adults. Amino acids are necessary building blocks for the growth and repair of the body. for enzymes and immune-system proteins, and for other nitrogen-containing substances. Since protein is known to contain an average of 16 percent nitrogen, its quantity can be estimated from the amount of nitrogen with a conversion factor of 6.25 (protein = 6.25 nitrogen).

Protein should account for 10–15 percent of a healthy individual's energy intake. But losses can be considerable during illness, due to catabolic (decay) processes which lead to increased losses of nitrogen (6). In such cases, the proportion of total energy provided by protein should increased to 18–20 percent (12). The exact size of the nitrogen requirement is uncertain. For healthy persons, it has been calculated at 0.1g/kg per 24-hour day, corresponding to 0.6 g/kg protein. The ranges for invalids are 0.15–0.2 g/kg nitrogen and 0.94–1.30 g/kg protein. These amounts usually provide a satisfactory nitrogen balance, assuming that energy intake is sufficient (6). In cases of heavy nitrogen loss, the requirements may be larger.

Water

Water is the most abundant substance in the body, representing some 45–55 percent of body weight in women, and 55–65 percent in men. The volume of water in the body decreases with age. It consists of two main portions: intracellular liquid (ICW), representing slightly less than two-thirds of total body water (TBW), and extracellular water (ECW) making up the balance of slightly over one-third. ECW may be further subdivided into three-fourths interstitial liquid and one-fourth plasma. The daily requirement for liquids is about thirty mg per kg of body weight, which can also be expressed as one ml per kcal (4.2 kJ). Fever increases water loss by about ten percent for each degree centigrade above normal. In warm and dry climates, losses from the skin and lungs may increase by 50–100 percent, and even more during heavy labour.

Vitamins and minerals

The Nordic nutritional recommendations also include minimum levels of certain vitamins and minerals. The minimums are intended to be used in assessing the results of dietary records. Intake below those levels for a lengthy period of time implies an increased risk of deficiency symptoms. There are also recommended upper limits for certain vitamins and minerals which, if exceeded for a lengthy period, lead to increased risk of undesirable consequences.

The best way to satisfy basic requirements for vitamins and minerals is to provide a varied and balanced diet with sufficient energy content. Vitamins comprise a chemically diverse group of substances, and are usually sorted into two categories, water-soluble and fat-soluble.

Minerals are usually sorted into two categories, as well. They are:

- Macroelements, which together comprise over 0.05 percent of body weight. These include calcium, which accounts for about half of the body's total mineral content, and phosphorous which accounts for circa one-fourth. The daily requirements for macroelements range from ca. 100 mg to one or more grams.
- Microelements are the remaining minerals in the body. Their concentrations are so low that it was previously impossible to measure them with any accuracy, which is why they are also called "trace elements". Daily requirements of essential microelements range from one microgram to a few tenths of a milligram.

Some twenty minerals have known functions in the human body.

In recent years, there has been a great deal of interest in substances with anti-oxidant properties. The levels of anti-oxidants studied thus far have usually been considerably higher than the recommended minimums. The Swedish Council on Technology Assessment in Health care (SBU) and the National Institute of Public Health have conducted a joint review of the available scientific literature. The results were published in 1997 (13), and among the conclusions was the following:

- A diet that includes high levels of anti-oxidants, particularly from fruits and vegetables, can have a preventive effect against some serious diseases. But there is no scientific evidence that supplements of anti-oxidants, in addition to those included in a balanced diet, are able to prevent illness.

Thus, the most effective way to attain the levels specified in the nutritional recommendations noted above is to follow a diet that includes a large proportion of fresh fruits and vegetables.

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2. Causes of Malnutrition

Tommy Cederholm, Ingegerd Johansson & PO Sandman

Malnutrition often develops as a result of interrelated medical, oral hygienic, psychological and socio-economic factors. When the intake of energy and nutrition is less than required, the body's reserves of nutrients are used up and tissues are broken down. On the one hand, inadequate intake due to stroke, difficulty with swallowing (dysphagia) and other problems is a primary cause of malnutrition. On the other hand, metabolic factors associated with cancer and infection, for example, may lead to diminished appetite or increased utilization of the body's fat reserves and musculature. Malnutrition usually develops as a consequence of both inadequate food intake and increased utilization of the body's reserves.

Reduced food intake

Appetite regulation and causes of poor appetite during illness

The sense of being hungry or satiated is a neuroendocrinal phenomenon which is regulated by interactions between the hypothalamus, the gut and fatty tissues (Table 1). Neuropeptide Y (NPY), which is produced by the central nervous system, is the most powerful appetite stimulant that is known. NPY, orexines and galanines are examples of hypothalamic appetite stimulants that are produced while fasting (1, 2, 3). The sense of taste also stimulates increased opiate activity in the central nervous system (dynorphins), resulting in feelings of pleasure (4). Dynorphins cause us to feel hungry, and hunger signals are modified by a number of satiation peptides.

During meals, corticotropin-releasing hormone (CRH) is produced in the hypothalamus (5). Released in the gut and pancreas are cholecystokinin (CCK), enterostatin which separates from procolipase in connection with fat digestion, and glucagon-like peptide, GLIP (6, 7, 8). Insulin, whose level increases during meals, also stimulates the satiation centre in the hypothalamus. Produced at the same time as insulin is amylin, also known as amyloid polypeptide (IAPP), which has a strong satiation-inducing effect (9). In recent years, much interest has been focused on leptin, a peptide produced in fat cells which induces satiation by stimulating leptin receptors in the hypothalamus, where it also depresses NPY activity (10, 11).

Inflammation is a basic systemic reaction which influences appetite and accompanies or causes many illnesses. The reaction is mediated by, among other things, the cystokinins, tumour necrotic factor-α (TNF-α), and interleukin-1β (IL-1β) and IL-6. These proteins are secreted mainly by monocytes and macrophages, the white blood cells that help to regulate the immune system and are found in all the tissues of the body. Loss of appetite, heightened body temperature, increased metabolism, production of acute-phase proteins (e.g. CRP) in the liver, capillary leakage of albumin, protein decay in muscle tissue, lipolysis and insulin resistance are some examples of inflammation-induced reactions that affect the invalid's nutritional status. TNF-α, IL-1β and IL-6 cause loss of appetite, probably by reducing NPY levels in the hypothalamus, but also by stimulating insulin production in the pancreas (12, 13). In addition, TNF-α och IL-1β interact with fat cells' leptin production (14).

Table 1. *Examples of biochemical substances that influence appetite ("CNS" = central nervous system).*

Substance	Effect	Produced by
Neuropeptide Y	+	CNS
Orexine A and B	+	CNS
Galanine	+	CNS
Dynorphin	+	CNS
Corticotropin-releasing hormone	–	CNS
Cholecystokinin	–	Intestines
Enterostatin	–	Intestines
Glucagon-like peptide	–	Intestines
Insulin	–	Pancreas
Islet amyloid polypeptide	–	Pancreas
Leptin	–	Fatty tissue
Tumour necrotic factor	–	White blood cells
Interleukin-1	–	White blood cells

Swallowing difficulties (dysphagia)

Difficulties in swallowing lead to reductions in nutritional intake, and therewith to an increased risk of malnutrition due to reduced food intake or to dependence on a liquid diet with lower concentrations of energy and nutrients.

Swallowing is a two-step process consisting of the oropharyngeal phase, in which food is transported from the mouth via the larynx to the upper section of the oesophagus, and the oesophageal phase, in which the food is transported by peristaltic contractions down to the stomach. A large number of medical conditions can affect muscle function and neural regu-

lation, create physical obstacles or pain, etc. Dysphagia is a threatening condition from the standpoint of nutrition, as it is nearly always associated with reduced intake of food and liquids, rapid weight loss, and a substantial risk of dehydration as a consequence. Since the fundamental causes of dysphagia are usually not specified in studies of a predictive nature it is difficult to assess the relative significance of obstructions to swallowing, insufficient muscular co-ordination, inability to masticate, and dysfunction of the salivary glands (15, 16).

Oropharyngeal dysphagia

With oropharyngeal dysphagia, the individual experiences difficulty in emptying the mouth and commencing to swallow. The most common cause is neuromuscular dysfunction associated with stroke, Parkinson's disease, cranial trauma or muscular dystrophy. Pharyngeal dysphagia can also be caused by physical obstructions or psychological factors (Table 1). Oropharyngeal dysphagia can be further complicated by aspiration of food into the windpipe, with risk for suffocation or lung inflammation. Aspiration occurs in roughly half of all dysphagia patients, and half of these lack a protective cough reflex (17).

A number of cohort studies, using a variety of evaluation methods and most of them with 50–100 subjects, have found that dysphagia is correlated with malnutrition (15, 16). In cases of severe cranial trauma, there was an observed frequency of 60 percent for swallowing difficulties and 40 percent for aspiration; the corresponding figures for neurological disease were roughly 95 percent and 45 percent, and for Parkinson's disease about 60 percent and 15 percent (18, 19, 20). Half of all stroke patients were undernourished when admitted to rehabilitation clinics; among those with severe stroke, the rate of dysphagia was 50–60 percent, and the rate of aspiration was 40–50 percent (22, 23). By the end of the first week, those figures had declined significantly, and most patients had returned to normal food within six months (21–23). The oropharyngeal phase of swallowing deteriorates with advancing age due to neuromuscular factors.

Oesophageal dysphagia

Oesophageal dysphagia is usually due to constriction of the oesophagus, but there are also neuromuscular causes. Food caught in the throat, and retrosternal pain is felt directly after swallowing. Aspiration is not as common as dysfunction of the larynx. Oesophageal constriction with steadily increasing difficulty in swallowing solid food often indicates a malignant tumour. Mild constrictions, inflammation and sores in the oesophagus, e.g. due to reflux of caustic stomach juices, often have a long history of symptoms. The oesophagus is affected in about seventy percent of cases of scleroderma, an unusual disease of connective tissue, with associated difficulties in swallowing. Oesophageal dysphagia is not related to age.

Table 2. *Principal causes of dysphagia.*

Oropharyngeal dysphagia
Neuromuscular causes
Stroke
Parkinson's disease
Muscular dystrophy
Head injuries
Cerebral paresis
Motorneural disease (e.g. amyotrophic lateral sclerosis)
Obstruction
Pharyngeal recess
Goitre
Psychological causes
Globus hystericus
Infection
Acute tonsilitis
Oesophageal dysphagia
Neurological causes
Achalasia cardiae
Multiple sclerosis
Diffuse oesophageal spasm
Diabetes mellitus
Myasthenia gravis
Muscular causes
Scleroderma
Myotonic dystrophy
Obstruction
Constriction related to cancer
Constriction related to chronic oesophagitis
Diverticulosis
External compression (aortal aneurysm)
Post-operative constriction, e.g. after radiation
Infection
Candidiasis

Chewing difficulties

Poor dental conditions and inadequate chewing ability are associated with increased risk of malnutrition, primarily among invalids and older persons (16, 24–26). It is not the number of teeth remaining, but rather the number of functional chewing surfaces which determines choice of food (27). Occasional loss of teeth or!are regarded as insignificant (26, 27). But

complete loss of teeth, even if replaced by a prosthesis, usually leads to reduced chewing and swallowing ability, and thus to a more limited choice of food (28–32). In cases of toothlessness without a prosthetic substitute, the risk of reduced food intake increases (28, 29).

Some recent sample surveys have not found any connection between toothlessness and reduced energy intake, but they have found evidence of altered food choices (33, 34). Since the individual's dental status is affected by genetic, medical and life-style factors, it is not possible at this time to distinguish the causal effect of tooth loss from the correlation between dental status and factors associated with malnutrition. When interpreting studies from different time-periods, it is also necessary to take into account the trend toward improved dental care that has occurred among all age-groups, and the fact that the category of "toothless" now represents an increasingly narrow segment of the population, including individuals who are sicker, more socially disadvantaged, and less health-conscious that the vast majority.

Tooth loss can affect choice of food due to problems with mastication, and to reduced mixing and lubrication of the food with saliva. For example, stimulated saliva secretion decreases within a few days when a liquid diet is adopted (35). Although the studies cited above did not establish a connection between dental status and food intake, there are empirical grounds for the assumption that poor dental conditions (limited chewing surfaces, pain, etc.) can inhibit intake in certain individuals, with associated risk of malnutrition. This is supported by the fact that remedial measures, such as replacement of missing teeth or poorly-functioning prostheses, have been shown to improve the intake of chewable foods in some individuals. The improvement was modest at the group level, however (27, 36).

Pain or burning sensation in the mouth

Pain and burning sensation in the mucous membranes of the mouth due to mucositis, sore, infection, etc. make eating more difficult. Mucositis, and sores in the mouth and larynx are common side effects of treatment for cancer with such methods as radiation to the head and throat area, chemotherapy and immunosuppression.

Discomfort in the mouth leads to eating problems, especially with acid, spicy or "sharp" foods. Such problems are compounded if treatment has side effects – e.g. nausea, dry mouth and candidiasis infections – which diminish appetite and eating ability. Large sores in the mouth such as those from recurrent aphthous stomatitis, epidermolysis bullosa, etc. make eating more difficult. For patients who are not able to describe their difficulties, even smaller sores such as those resulting from the chafing of teeth or prostheses and from painful prosthetic stomatitis can result in unwillingness to eat.

Dry mouth (xerostomy)

Xerostomy, the sensation of dry mouth due to hyposalivation, is an often neglected cause of infections and other problems of oral mucous membranes, tooth loss, and diminished ability to eat, speak and swallow (37). Dehydration and malnutrition reduce the volume of saliva (38, 35), but the most common causes of hyposalivation are illnesses such as primary and secondary Sjögren's syndrome, pharmaceuticals, and side effects of medical treatments such as radiation to the head and throat area.

The number of secretion cells in the salivary glands decrease with normal ageing, but this is not manifested as a measurable decrease in the amount of saliva. However, older people in general produce less saliva than younger, due to a higher rate of illness and use of pharmaceuticals. Several studies have found that hyposalivation occurs in more than half of older persons with polypharmacy or illness.

For individuals with dry mouth, it is more difficult to begin and complete the swallowing process (39). They have lower energy-nutrient intake, and avoid vegetables, "sticky" foods and dry foods such as bread (40). The biological significance of dry mouth is unclear, however, since none of the cited studies evaluated the subjects' nutritional status; also, the level of food intake prior to diagnosis is not known. Support for the thesis that saliva quantity has significance for energy-nutrient intake is provided by a pilot study which found that treatment with artificial saliva before meals led to increased energy intake in a sample of individuals with dry mouth.

Malabsorption

Certain diseases of the digestive tract are distinguished by reduced nutrient absorption. The mucous membrane of the small intestine is broken down by the inflammation of Chrohn's disease; celiaki (gluten intolerance) impairs its immunological reactions. From the 1950s and well into the 1970s, ventricular resection was often performed on victims of duodenal ulcer. Many of those patients later developed malabsorption and malnutrition. Cystic fibrosis is distinguished by dysfunction of exocrine glands in the lungs and intestines, and is complicated by malabsorption, among other factors.

Appetite and ageing

Physiological ageing is associated with reduced appetite and food intake. There are many contributing factors, including diminished senses of taste and smell (41). Both the activity level of the hypothalamus and its sensitivity to NPY decrease, which may explain why culinary delights do not attract the old as strongly as the young (43). Levels of circulating CCK

increase with age (44). Among the consequences of low physical activity is peripheral insulin resistance, leading to an increase of serum insulin levels. Levels of serum IAPP also increase with ageing (45). In addition, there is a decline in the ability of the stomach and intestines to relax and expand in connection with meals, due to local production of nitrogen oxide; this may contribute to a premature sense of satiation (42). It has been reported that food intake is reduced by 30–50 percent between the ages of 35 and 80 (46). There is good reason to assume that this is explained by the neuroendocrinal changes noted above. The age-related decline in physical activity may partly explain why body weight increases for most people up to ages 60–70, despite reduced food intake (47). Longitudinal and cross-sectional studies indicate that, after that period, body weight decreases by an average of roughly 0.5 kg/year (48–49)

Accelerated tissue decay

Illness- and trauma-related catabolism of muscle and fat tissues

The skeletal musculature and the body's fat reserves undergo a constant process of decay and reconstruction which is regulated by endocrine substances such as growth hormone (GH), testosterone, insulin-like growth factor 1 ((IGF-1), insulin and cortisol. Inflammation-reducing muscular catabolism is mediated by TNF-a and IL-1b. These cytokins have a direct activating effect on, among other things, the ubiquitin-proteasome system, a cylindrical protein-protease complex which is the cell's most important instrument of protein decay (50, 51, 52). When insulin inhibits the ubiquitin-proteasome system, protein decay is activated by reductions in intracellular insulin activity (insulin resistance), as in the case of diabetes, ageing and inflammation. Inflammation also reduces serum levels of the anabolic hormone IGF-1, while levels of muscle-catabolic cortisol rise (53).

Trauma and surgical operations activate the inflammation system. Severe trauma can lead to significant loss of muscle within a short time (54). Chronic infections and inflammatory diseases, such as tuberculosis, AIDS and rheumatoid arthritis, are often associated with muscular decay (sarcopenia) and gradual weight loss. Cancers activate the inflammation system, and are often aggravated by life-threatening malnutrition. Less well-known is the fact that other wasting diseases are often associated with low-grade inflammation (55, 56); these include chronic obstructive lung disease, chronic heart disease and kidney failure (57–59). What triggers the cytokin activity of these conditions is not known; but likely contributing factors are hypoxia, and secretions of cortisol and catecholemine (60).

One of the first characteristics detected in TNF was its ability to inhibit lipoprotein lipase, LPL (60). LPL splits circulating triglycerides, which is

a precondition for the incorporation of liberated fatty acids into fat tissue. With reduced LPL activity, triglycerides remain in circulation, with hypertriglyceridemia as a result (61). With inflammation, lipolysis is more prevalent than lipogenesis. When TNF was discovered in the mid-1980s, it was believed that LPL-inhibition was the basic mechanism in the development of TNF-mediated cachexia. But as noted above, several interrelated mechanisms are involved, including loss of appetite and simultaneous decay of fat and muscle.

Altered physical constitution with increasing age

Increasing age is accompanied by decreasing levels of the anabolic hormones GH, testosterone and IGF-1; this leads to reductions in muscle mass (62, 63). Conversely, serum insulin levels increase with age due to increased insulin resistance. As noted previously, insulin resistance is linked to the activation of the ubiquitin-proteasome system, which implies a risk that age-related muscle-decay is further accelerated. Insulin sensitivity in older fat cells is not affected to the same extent as in muscle cells. Since insulin stimulates lipogenesis, the combined age-related effect of insulin resistance and high levels of serum insulin is that muscle tissue breaks down more rapidly, fat mass increases, and appetite decreases. It may be assumed that these hormonal changes in combination with reduced physical activity explain why muscle mass decreases and fat mass increases in older individuals (64).

Increased energy use

Fasting leads to reduced basal energy use, due to reductions in body temperature and heart rate. Increased energy use is often associated with illness. Inflammation leads to increased body temperature. In addition, stress hormones such as catecholemines and cortisol are produced, which leads to increased heart rate and energy use, among other effects. With some illnesses, non-inflammatory factors also increase energy use. Chronic obstructive lung disease and heart disease are associated with increased breathing effort, and some studies have found that those conditions are associated with increased resting metabolism (65, 66). The restless wandering of some dementia patients has been suspected as a cause of the energy losses they experience (67).

In order to satisfy energy needs, the body first makes use of fat reserves. When all the fat has been used up, protein from skeletal musculature and the muscle tissue of internal organs (such as the heart and diaphragm) is utilized (68, 69). It is easy to understand the consequences that such a sarcopenic development may have in older patients who already have heart or lung disease (55, 70).

Social-psychological factors

There are other factors besides age and illness which may be assumed to contribute to the development of malnutrition, including social-psychological, socio-economic and demographic factors. Living alone can mean an absence of emotional support and practical help, but also of social control. The food prepared may not be of the same quality as when it is shared with others. Mealtimes may also be less regular, with negative consequences for nutritional status.

A study of older U.S. citizens by MacIntosh *et al.* found that married individuals had higher intake of energy and protein than those who were unmarried or divorced (71). Also, those with more extensive social networks also had significantly higher food intake. Another finding was that the greater the experience of financial stress, the lower the food intake. A limited social network and stress from financial worries, etc. were also negatively correlated with food intake.

A study by Donkin *et al.* found that old age, female gender, smoking and reduced appetite were related to lower scores on the Mindex index of physical constitution (72). Under- and overweight persons were more likely to belong to lower socio-economic subgroups, and they also had fewer social contacts. A study of 68-year-old men in the city of Malmö during the mid-1980s found no statistical relationship between food intake and socio-economic class or civil status. However, there were correlations between inadequate dietary habits and limited social participation, low physical activity and high BMI (73). Another subgroup with a higher risk of malnutrition consists of mentally ill individuals with extensive needs for care and medical treatment. Depression may lead to reduced appetite and low food intake, with malnutrition as a consequence (74). Alcohol abusers comprised another high-risk group.

The development of malnutrition among individuals who reside or are cared for in institution-like settings may be linked to dining atmosphere and the organization of meals. Food and dining may be regarded as important elements in the creation of a healing climate in which the individual's self-healing forces can be mobilized (75). Meals provide opportunities for social contacts which may help to process traumatic experiences related to illness and accidents. Also, food is in itself a source of pleasure which can provide a sense of well-being for a time.

These properties of food and dining are important aspects of care. The significance of the dining atmosphere for food intake has been studied by Elmståhl *et al.* (76). Their study of nursing-home residents found that changes in dining atmosphere and procedures, which were designed to provide greater opportunities for self-determination and social interaction, led to a 25-percent increase in food intake. When the former atmosphere and routines were reinstated, food intake also returned to former levels.

The Swedish population now includes growing numbers of older immigrants whose cultural food habits differ from the Swedish. There is a risk, especially in institutional settings, that nutritional problems may arise if consideration is not given to the special needs and preferences of this subgroup.

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3. Prevalence and Incidence of Malnutrition

Sölve Elmståhl

Malnutrition is common among elderly persons in hospitals and in other forms of care. According to a variety of published studies, the rate of protein-energy malnutrtion (PEM) varies from about 11 percent to 66 percent (1). This wide range of variation may be due to the stage of illness at which the patient is examined, differences in age or between diagnostic groups, and the criteria used to define PEM. In studies of older persons in the general population, however, the observed rate of PEM is much lower – less than ten percent (ref. 2; Table 1). But data on the incidence of PEM are very limited.

Table 1. *Rate of protein-energy malnutrition (PEM). Examples from studies of general population, and of patients in hospitals, out-patient care and old-age care during 1967–1998.*

Population and (reference)	Country	Year	Sample Size	Age	Rate of PEM	Def. of PEM	
General population (13)	England	1967	1879	>65	1.4 %	a	
General population (15)	England	1972	365	>65	7.1%	a	
General population (14)	Sveden	1990	1206	>65–80	5.0%	b	
General population (16)	Norway	1986	201(M)	>75	4.0%	a	BMI < 18.5
	Norway	1986	196(F)	>75	14.0%		
Out-patients (1)	USA	1998	408	>65	11.0%	b	alb<35g/l
			609	<65	7.0%		weight<90%
Hospitalized (11)	France	1992	128(M)	x 70	30.0%	b	
			196(F)		41.0%	b,c	
Hospitalized (17)	USA	1976	251	57	38.0%	b	
Hospitalized (10)	Norway	1991	121	>70	55.0%	b	weight<90%, alb<30g/l, TSF<5th percentil
Surgery patients(18)	USA	1986	218	>70	11–24%	b	weight,albumin<32g/l, TSF<3th percentil
Geriatric patients (5)	Sveden	1990	501	81	28.5%	b	
Nursing homes (19)	USA	1993	2811	–	11.8–27.5 %	b	26 nursing homes, albumin<35g/l, AMC, TSF<90%
Nursing homes (20)	USA	1982	200	64	47–66%	b	weight<90%, albumin <35g/l
Nursing homes (9)	Sveden	1997	61	87	30.0%	c	energy intake<BMR, based on FAO/WHO

M = Male F = Female. Definition of PEM based on:

a) Anthropometric data, % weight loss, reference weight, TSF (thickness of upper arm's subcutaneous fat) .

b) Anthropometric data, blood chemistry including albumin.

c) Diet register.

Table 2. *Rate of protein-energy malnutrition (PEM) among various diagnostic groups.*

Diagnosis and references	Country	Year	Sample Size	Age	Preva-lens	Defi-nition	
Cirrhosis (21)	Italy	1993	120	29–75 år	34	b	<5% percentil for TSF, MAMC
Post-op lung cancer (22)	England	1989	39	62 år	36,0%	a	<25% percentil for TSF, BIVII
Chronic obstr. lung disease (23)	USA	1984	60	62 år	62,0%	a	<90% TSF, <90% weight
Cardiac insufficiency (24)	USA	1989	48	50 år	50,0%	b	<10% TSF, MAMC, albumin<35g11
Cardiac insufficiency (25)	Sveden	1994	50	78 år	25,0%	b	
Severe stroke (10)	Norway	1996	104	66 år	26,0%	b	<10% TSF, MAIVIC, albumin<35g11

Definition of PEM based on:

a) Anthropometric data, % weight loss, reference weight, TSF (thickness of upper arm's subcutaneous fat).

b))Anthropometric data, blood chemistry including albumin.

c) Diet register.

Frequency variations between illnesses and care-subgroups

There are variations in the PEM rates for specific illnesses, depending upon which diagnoses are studied and the clinical status of the patient (acute vs. chronic phase). In studies conducted during the 1980s and '90s, the PEM rate varied from 25 to 66 percent for common diseases of the heart, lungs and liver (see Table 2). In a number of studies, the definition of PEM was based on a combination of anthropometric and biochemical variables (<5 percentile for subcutaneous fat of the upper arm [TSF], or <90 percent of reference . The subjects of one study of chronic obstructive lung disease were polyclinic patients, of whom 62 percent showed signs of PEM (3). One-fourth of the patients had experienced a weight loss of more than five percent during the preceding year.

The focus of several studies was not diagnosis, but rather the type of care that the patient was receiving, e.g. in-hospital or out-patient, nursing home, clinic, etc. The variation in PEM rates within these care subgroups was roughly as great as for various illnesses. The range was from 11 to 55 percent among patients of surgical, medical and geriatric clinics, and from 12 to 66 percent among hospital patients (Table 1). Out-patients had a higher rate of PEM, according to a study of 1017 patients of a general-medicine clinic (1). The rate among those aged 65 and older was eleven percent, compared with seven percent for younger patients, suggesting that the increase in PEM was age-related.

Explanatory models for PEM include both endogenous and exogenous factors. Among the former are the illness, itself, altered requirements, and changes in nutritional intake related to the illness. Exogenous factors may include features of the surroundings, and access to food among older persons with functional impairments and need of assistance. Inability to feed oneself is a risk factor for the development of PEM. A study of U.S. nursing homes found that newly admitted residents who were initially independent became dependent on assistance at some homes more quickly than at others (4). Those differences were judged to be exogenous, and therefore capable of being prevented.

Incidence

Few studies describe the incidence of PEM. Interpretation of incidence data is complicated by the facts that clinical conditions change over time, and vary between illnesses. Thus, the appropriate choice of time-period for specifying the incidence of PEM may vary with the study population. In a Swedish study of 50 hip-fracture patients at an orthopaedic clinic, 62 percent did not have PEM upon admission, but 29 percent of these had developed the condition nine weeks later (5). A six-month study of geriatric patients initially without PEM found that 26 percent had developed it by the end of the period (6).

Several studies have found that PEM has predictive significance for survival and impaired functional status, even when age and other illnesses are taken into account (7, 8). An Italian study of 370 patients above age 70 in geriatric and internal-medicine hospital wards found that, regardless of other illness, the risk of dying within eighteen months of admission increased by a factor of 1.9 if the patients also had PEM (8). The analysis controlled for other illnesses, and PEM was defined on the basis of body-weight index, albumin and lymphocyte level.

A Swedish study of 61 nursing home patients with an average age of 87 found that 18 percent died within six months of admission. Regardless of age and incidence of cancer, those with a daily energy intake of less than 1185 kcal (median level) experienced a 12-times greater risk of dying within the first six months, compared with other patients (9). Patients in the last stage of life were not included in the study.

Contributing factors

Inadequate diagnosis or documentation of PEM can lead to a false impression of low frequency. Mowe and Bøhmer have found in a Norwegian study that, of 121 older patients admitted to a medical clinic, 66 (54 percent) had a reference weight of <90% (10). In the majority of these patients, PEM was manifested in small amounts of subcutaneous fat, and

narrow upper-arm circumference (<5 percentile for both TSF and AMC). Of the 24 patients found to have PEM, only five received any kind of remedial nutrition, and none of them received a diagnosis of PEM or its equivalent upon discharge.

Another factor which influences the frequency of PEM is mortality. High mortality leads to a low rate of PEM. A French study of 324 patients found that 30 percent of the men and 41 percent of the women had PEM upon admission to hospital (11). Eight percent of the total died within the first fifteen days. In order to evaluate and compare various studies, it is therefore necessary to take into account the stage of illness at which PEM is studied, depending on the selection that otherwise may occur in the study population.

The pace at which PEM develops can vary with some illnesses, depending on whether the cause is insufficient intake, increased requirements, or a combination of both. The stage of illness at which PEM is studied is therefore important in such cases. With stroke, for example, swallowing difficulties (dysphagia) are common, and may lead to reduced food intake and PEM. A Spanish study that followed 104 first-time stroke victims for one month found that average time in care was 20 days, and that 41 percent experienced difficulty in swallowing (12). At admission, the rate of PEM (s-albumin <35 g/l, or TSF/ MAMC <10th percentile) was 16 percent, compared with 26 percent after one week and 35 percent after two weeks (12).

This suggests that, in evaluating frequency and comparing studies, length of time in care should be taken into account, regardless of diagnosis or type of care. Given the increasingly shorter times spent in care which have been reported in a number of medical fields during the 1990s, there is a growing risk that an ostensibly low rate of PEM may be due to the fact that patients are being discharged earlier and sent home or transferred to other types of care.

Changes over time

Few studies of the general population have dealt with PEM trends over time. A representative English study of 1879 individuals over age 65 conducted in 1967 found that just under two percent were malnourished (13). A similar Swedish study at the end of the 1980s found that five percent of 1206 subjects aged 65–80 had PEM (14). When the proportion with inflammation was excluded from the analysis, only 3.5 percent had PEM, based on anthropometric data.

There have been a number of Swedish studies of PEM rates, and 25 of them are reviewed in Table 3. Taken together, the studies included 5120 patients in various kinds of care during the 1980s and ’90s. The average observed frequency for the studies is 28 percent. All 25 were clinical

studies, with one exception; if that general-population study is excluded, the total average frequency of PEM becomes 36 percent. There is considerable agreement between the results of the studies, which applied a variety of methods based on biochemistry, anthropometry and dietary theory. All of this suggests that the resulting estimates are quite valid.

Most of the studies applied similar diagnostic techniques. The apparent rise in PEM during the 1990s indicates that the clinical problem of malnutrition is of current significance.

Table 3. *Swedish studies during 1980–1990 on rate of protein-energy malnutrition (PEM) among total of 5,120 patients in health and old-age care.*

Reference		Type of facility	No.	Def.*
Asplund et al., 1981	(26)	Psychogeriatric	91	10
Albiin et al., 1982	(27)	Medical	75	22
Symreng et al., 1983	(28)	Surgical	112	28
Warnold et al., 1984	(29)	Surgical	215	12
Sandman et al., 1987	(32)	Nursing home	44	50
Elmståhl et al., 1987	(30)	Nursing home	30	30
Elmståhl et al., 1987	(31)	Nursing home	16	31
Axelsson et al., 1988	(33)	Stroke unit	100	16
Larsson et al., 1990	(6)	Geriatric	482	28.5
Thorslund et al., 1990	(14)	*(General population)*	1206	5
Cederholm et al., 1992	(45)	Emergency medical	96	39
Broqvist et al., 1994	(34)	Cardiology	22	9
Larsson et al., 1994	(35)	Surgical	199	35
Larsson et al., 1994	(36)	Infection/Medical	382	27
Unosson et al., 1994	(37)	Medical/Stroke	50	8
Cederholm et al., 1994	(25)	Medical	50	25
Cederholm et al., 1995	(38)	Emergency medical	205	20
Unosson et al., 1995	(39)	Orthopaedic	50	38
Ek et al., 1996	(40)	Geriatric	90	30
Eneroth et al., 1997	(41)	Vascular surgical	32	87
Elmståhl et al., 1997	(9)	Nursing home	61	30
Christensson et al., 1999	(43)	Nursing home	261	29
Ponzer et al., 1999	(44)	Orthopaedic	42	36
Saletti et al., 2000	(42)	Assisted housing	872	36
Flodin et al., 2000	(46)	Geriatric	337	36

* Definition av PEM base on:

a) Anthropometric data, % weight loss, reference weight, TSF (thickness of upper arm's subcutaneous fat).

b))Anthropometric data, blood chemistry including albumin.

c) Diet register.

d) Mini-nutritional Assessment (MNA).

Summary

Using current definitions of protein-energy malnutrition (PEM), a high frequency of the condition, ranging from 10–60 percent, has been found among acute and chronically ill patients. A similar high frequency has been observed among those in old-age care. The rate of PEM is low in the general population, however. Few studies have analysed the incidence of PEM in various age- and care-groups, and there have been virtually no repeat studies to detect changes in PEM rates over time. The latter type of research is of interest for a variety of reasons, including: the demographic trend toward an increasingly older population; the above-noted changes in morbidity and mortality from several illnesses, including stroke and circulatory diseases; and the rapid organizational changes taking place in the health-care system which include shrinking hospital resources, shorter time in care, and growing municipal responsibility for old-age care.

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4. Prevention of Malnutrition

Sölve Elmståhl

The promotion of good health and the prevention of illness and premature death through better food and exercise habits are the primary goals of the national nutrition action plan which the Swedish government adopted in 1995. The plan identifies care recipients, the handicapped and medical patients as categories subject to a high risk of malnutrition. It also calls for more intensive continuing education of personnel in health care and human services. National public health goals and proposed strategies for achieving them were published in a 1998 report of the Swedish government.

Policy objectives for the promotion of healthy food habits can be formulated within a variety of perspectives. One approach uses illness and death as key indicators. Another focuses on general health in terms of mental well-being and level of physical independence, with functional impairment and handicap as typical indicators. Goals and strategies can also be based on measures directed to both the individual and society at large.

Alternative strategies include those which focus on: diagnosis and prevention of malnutrition, alone or in combination with other illnesses; high-risk groups such as the elderly in health and old-age care; and "arenas" that include various actors, such as the personnel in health and old-age care. As one example of an appropriate strategy, the 1998 report emphasized the importance of clarifying the responsibility of public authorities for the meals of the elderly.

Both hospitalization and outpatient care offer good opportunities for preventing illness and treating protein-energy malnutrition (PEM). Among the preconditions for successful prevention are uniform definitions and methods of identifying individuals at risk. The purpose of primary preventive measures is to prevent the onset of illness; depending on the objective, such measures can be directed to individuals or to the general population. The purpose of secondary prevention is early detection of illness in order to limit the period of illness through the swift application of treatment. Such measures are directed to individuals, and require a thorough anamnesis and examination focusing on PEM.

Definitions

- Primary prevention: to prevent the development of PEM. Objective: lower incidence of PEM.
- Secondary prevention: to detect PEM through clinical examination or screening in order to shorten period of illness or prevent relapse by means of treatment for PEM. Objective: reduced prevalence of PEM.
- Tertiary prevention: to reduce the effects of PEM. Objectives: symptom alleviation; lower rate of complications such as sores and infection.

Older persons often have a greater susceptibility to the development of PEM due to illness, greater use of pharmaceuticals, increased physical dependence, and altered socio-economic circumstances. The increased mortality observed in connection with PEM cannot be explained solely by related illnesses. It is also a consequence of ancillary complications. Studies of nutritional support have demonstrated that it is possible to reduce post-operative mortality and morbidity (1). It has been found that the presence of malnutrition among older persons at the time of admission to hospital is predictive of lower survival 1.5 to 4.5 years later, regardless of diagnosis (2, 3).

Previous descriptions of PEM have focused primarily on mortality and morbidity, especially sores, infections and post-operative complications. Studies have often involved patients with acute or chronic illnesses. It would also be desirable to include other measures of health in assessments of PEM, such as subjective experience of well-being. Inadequate food intake, for example among older persons in need of assistance at mealtimes, results in less available energy for physical activity, which in turn has negative consequences for health.

It is anticipated that in coming years there will be an increase in the proportion of the “oldest elderly”, leading to increasing numbers with long-term illness and functional impairment. Increasing age is also associated with multiple illnesses, which may manifest themselves in different ways than at younger ages. The increasing physical dependence and assistance requirements of an ever-expanding older population (care-group perspective) means that preventive measures can not be concerned only with the individual (illness perspective), but must also include the personnel who take care of the individual in question (arena perspective). Among the fundamental requirements for meeting this challenge are ongoing training and guidance for personnel in municipal health and old-age care, and methods of identifying individuals with PEM.

Goals of prevention

What to include in preventive measures depends on the goals that have been set. As noted above, there are different strategies for primary and secondary prevention. There are often many factors in the aetiology of PEM, and a variety of medical, social and psychological factors may be present all at once. Among the more important factors are access to food, shopping opportunities, food-preparation facilities, need for assistance, physical environment and type of housing. The aetiology determines the choice of strategy and measures, depending on whether an *illness, care-group* or *arena perspective* applies.

The incidence of PEM varies significantly between care-groups. According to a random-sample study of 1,206 individuals, the rate is five percent among those aged 65–80 living at home (4). Much higher figures, 20–60 percent, have been observed in health and old-age care; the variation depends on type of patient, diagnosis, age and definition of PEM.

Illness perspective

The outcome of measures to prevent PEM may be short-term (e.g. preventing disturbances to electrolyte function or energy and lipid metabolism) or long-term (e.g. effects on mortality, physical activity level, infections, healing of sores, formation of fistulas). Most studies involve observation or secondary prevention, and are concerned with treatment of high-risk groups with impaired nutritional status. Few or no studies have investigated quality of life. Some psychiatric conditions such as anorexia, depression, dementia and mental confusion, which may be transitory due to aetiology, involve an increased risk of malnutrition. In order for secondary and tertiary treatment to be applied, it is necessary to consider nutrition issues in hospital and outpatient care. A detailed discussion concerning treatment of malnutrition in connection with various illnesses, with examples taken from studies of secondary prevention, is provided in Part II, chapters 5–8.

There are few controlled, random-sample studies of primary prevention, and most of the nutrition studies cited here have been concerned with secondary preventive measures in patients with PEM. One controlled study of primary prevention included 501 geriatric patients whose mortality rate declined after treatment with nutritional supplements (5). A group of 138 patients were treated with a nutritional supplement of 400 kcal, and compared with a control group of 182 patients; both groups were selected at random from the 320 patients who did not have PEM at time of admission. After 26 weeks, mortality for the group receiving treatment was 8.6 percent, compared with 18.6 percent for the control group. A larger proportion of those in the test group who initially had anergy improved, while

a larger proportion in the control group were found to have developed PEM.

There can be a variety of factors in the aetiology of PEM, including reduced intake due to lack of interest in food, difficulty in eating or swallowing due to stroke, rheumatism, malabsorption, increased energy needs (e.g. due to increased muscular strain due to emphysema and bronchitis), inflammation, infection, diarrhoea and vomiting. In cases where the underlying cause cannot be treated, tertiary preventive measures are all that remain. Since a number of drugs have side effects that include nausea and disinterest in food, and the frequency of polypharmacy increases with age, continuous monitoring of prescription medicines is another important type of preventive measure.

Care-group perspective

A high proportion of older patients in various kinds of care show signs of low nutrient intake, indicating that a care-group perspective may be a useful alternative to an illness perspective. Repeated studies have found that 30–50 percent of the institutionalized elderly have low body weight, low biochemical or anthropometric values, or low nutrient intake as indicators of PEM. The condition often goes undetected, and documentation of nutritional aspects is scanty.

The question that arises is whether or not the condition is irreversible, ancillary to the underlying illness and/or related to exogenous factors such as mealtime routines, range of choice, need and availability of assistance, dining atmosphere and the social-psychological setting in general. A number of intervention studies of changed dietary restrictions, effects of nutritional supplements, and altered dining atmosphere/routines at nursing homes have found that improvements are possible (6, 7, 8).

A significantly lower incidence and prevalence of PEM have been noted in studies of the general population One study of 1,017 outpatients in Missouri who were followed during two years found that eleven percent of those over age 65 showed signs of malnutrition, compared with seven percent among younger age-groups (9).

There is a demonstrated relationship between socio-economic status and mortality from circulatory diseases. But there is a lack of knowledge regarding any similar connection with PEM. Dining habits and choice of food vary; and in a study of those aged 70 and older in the general population, those in higher socio-economic classes had a higher intake of fruit and vegetables, along with a lower intake of fat, red meat and sweets (10).

Sociological and ethnological research has emphasized the significance of food and dietary preferences for the expression of identity. It is not clear whether differences in socio-economic and civil status constitute risk-fac-

tors for the development of malnutrition among the elderly (11). It appears that social network and social isolation influence nutrient intake. Single persons, especially older men, have lower nutrient intake than couples (12).

Arena perspective

Society-wide measures affecting the incidence of PEM can be based on policies and education directed to staff, administrators and other actors in health and old-age care, among other arenas. Other examples of preventive measures are information directed to the high-risk groups or the general public, delivered meals, catering for the elderly living at home, day care and support to local clubs where mealtimes are social occasions that promote independence.

Working procedures

In Sweden, there is a legal obligation to monitor the quality of health care. According to the Health Care Act of 1982, the quality of health care shall be systematically and continually developed and assured. The National Board of Health and Welfare has issued regulations and guidelines that specify quality-control requirements (*Kvalitetssystem i Hälso- och sjukvården*, SOSFS 1996:24). There are similar specifications for municipal old-age care (*Socialstyrelsens allmänna råd om kvalitetssystem inom omsorgerna om äldre och funktionshindrade*, SOSFS 1998:8). In addition, there are several different models for the evaluation of quality-control systems, including: the Association of County Councils' "*Qvalitet, Utveckling, Ledarskap (QUL)*"; the Health Care Development Institute's "*Organisationsgranskning (OG)*"; and the international ISO 9000 standard.

In order to develop a quality-control system for malnutrition, it is necessary to adopt uniform definitions of screening procedures for malnutrition, and to follow up treatment measures. To be meaningful, follow-up must also be systematic and continual. In order to be able to follow up the incidence and prevalence of malnutrition, there is a need to develop methods for treating and assessing it, and for evaluating the effects of treatment. These should include provision for self-evaluation and follow-up, as well as programmes for the development of competence and continuing education of personnel in matters of nutrition.

Primary preventive measures can be directed to both healthy persons and those with acute or chronic illness being treated within the health-care system. Preventive measures directed to the general population may include public education on dietary matters, and health-related messages with instructions on self-evaluation for PEM. Vaccination of both the elderly and personnel who work among them have been shown to reduce

mortality (13). In cases of PEM, several immune functions can be modulated with variable reductions of antibodies for various antigens and reduced cell-mediate immune defences (14). In this way, it is possible to reach a major share of the population via primary health care.

There is a need for increased awareness of PEM, not only among the general public, but also among health-care personnel. A study of a hospital in Oslo, Norway, found that only 36 percent of the 66 cases of PEM detected among newly admitted patients at a medical clinic were noted in their journals. Only seven percent of them received nutritional supplements, and in not one case was this noted when they were discharged (15).

Another study involving 1017 polyclinic patients found eleven percent with PEM, defined as albumin levels less than 35 g/l, body weight under 90 percent of reference weight, and/or weight loss of 2.5 kg or more during the past six months. PEM was detected in 43 percent of patients above age 65, compared with 12 percent in younger age-groups. During a two-year follow-up period, treatment was applied in only fourteen percent of treatable cases (9).

In order to diagnose, treat and prevent PEM, there is a need for interdisciplinary effort, and co-operation among various occupations. The establishment of nutrition teams including physicians, dieticians, speech therapists and nurses provides favourable conditions for the work of prevention. Within health and old-age care, the appointment of a dietary supervisor – a staff member responsible for food service – is an effective measure for preventing PEM among patients. It is important to determine the attitudes and preferences of patients and personnel regarding the organization of mealtimes, and to review dining atmosphere and routines so that they are suited to the wishes and capabilities of patients and residents (7, 16).

An alternative method for applying measures directed to the general population is screening of high-risk categories, for example subgroups with various illnesses or in which PEM is common.

Which indicators should be used for screening? Anthropometric and biochemical measures are recommended for detecting PEM. As indicators of malnutrition, low values for body weight, albumin and prealbumin have been found by various prospective studies to predict for mortality and length of time in care (2, 17). Another measure for identifying individuals at risk is the Body Mass Index (BMI), where a value under 20 usually indicates underweight. For older persons, 22 has been proposed as the upper limit for underweight. Since weight, alone, can be misleading in cases of overweight, changes in weight should also be considered. Apart from these measures, a change in food habits has been proposed as an indicator. For a discussion of screening and normal values for indicators, see Part I, Chapter 2: “Evaluating the patient’s nutritional status”.

A variety of screening procedures and nutrition journals have been developed for the elderly in group homes. The Mini-Nutritional Assessment (MNA) includes anthropometric measures, general health status, food habits and subjective experience, where a score of less than 17 of 30 possible indicates risk of malnutrition (18). Subjective Global Assessment (SGA) is a procedure that combines questions concerning health status and diet; however, it has been shown to result in a high rate of faulty classification, compared with objective assessments of nutritional status (19).

A questionnaire that can be used with large groups has been developed by Davies *et al.* It includes questions on ten risk factors, including: less than eight meals during past week; few meals with vegetables, fruit or dairy products; loneliness/depression; weight change; low income; difficulty with shopping; and handicap (12).

Several different types of nutrition journal are available, including those which record food and liquid intake (20). One nutrition journal developed for use by care personnel records seven days' food intake in standardized portions, and has been found to be highly valid in comparison with traceable-isotope water (21). With few exceptions, however, screening procedures and nutrition journals lack data on validity and reproducibility. A diet journal may yield more detailed information concerning inadequate nutrient intake. Cases in which screening indicates a risk of PEM require further assessment in order to form a basis for decisions on examination, treatment of underlying conditions, and nutritional support. There is a need for greater agreement between and evaluation of screening procedures than is the case today. Which more detailed assessments of individuals at risk shall be made, and what kinds of treatment and follow-up shall be tested?

Health and old-age care personnel often have to deal with older persons who do not want to eat. The causes may be related to age, medical and social factors, or the surroundings; but it may also be a question of personal choice. An important distinction in this context is that between inability to eat and refusal. The ethical issues and principles that may conflict with each other in such situations are: respect for the individual's integrity, the sanctity of life, and compassion. These considerations apply especially to patients who are not able to communicate their wishes and whose behaviour is difficult to interpret. Eating problems leading to self-induced weight reduction and distorted body image are unusual among the elderly. However, one study found that undernourished men above age 70 who received polyclinic checkups had atypical attitudes toward eating and a body image that deviated by about ten percent from the actual (22). Potentially treatable conditions such as depression, mental confusion, etc., or treatment that leads to disinterest in food or weight loss shall be excluded.

The work of prevention must proceed from an awareness that the aetiology of protein-energy malnutrition (PEM) often involves a variety of factors, including type of illness, pharmaceuticals, aspects of health and old-age care and physical environment. Other important factors are social, cultural and symbolic aspects of meals, food habits and personal choice Several intervention studies of institutionalized old people have demonstrated that PEM is treatable (6).

For patients who are judged incapable of feeding themselves, decisions on whether or not to supply nutrition enterally or parenterally should be made within seven days. For those who already have PEM, measures should be taken even earlier. Parenteral nutrition may give rise to a number of complications, including infections and metabolic disturbances. Enteral nutrition is therefore preferred, and may be provided by means of nutritional supplements, feeding tube or permanent ostomy,

Summary

The work of prevention must proceed from an awareness that the aetiology of protein-energy malnutrition (PEM) often involves a variety of factors, including type of illness, pharmaceuticals, aspects of health and old-age care, physical environment, and cultural aspects of dining. Established goals determine the nature of preventive measures (primary or secondary). Depending on aetiology, the choice of measures and strategy varies according to the basic perspective adopted – illness, care-group or arena. In cases of illness, the outcome of treatment may include short-term effects such as those relating to electrolyte and energy balance, and/or long-term effects such as those relating to functional capacity, healing of sores and mortality.

The care-group perspective is concerned with high-risk groups such as the elderly in various types of old-age care who often have low energy intake. In such cases, PEM may be caused by individual and environmental factors, mealtime routines, and the need and availability of assistance.

The arena perspective may include society-wide measures involving policies for education of staff and administrators in health and old-age care, as well as information directed to high-risk groups and the general public, support for day care, delivered meals and local clubs.

Uniform definitions and procedures for screening and follow-up are required in order to develop quality-control systems in the prevention of PEM. For patients who are not able to feed themselves, the preferred alternative for supplying nutrition is enteral feeding; other alternatives for preventing PEM-related complications are nutritional supplements, feeding tube, and permanent ostomy.

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5. Treatment of Malnutrition: Chronic Non-malignant Illness

Gunnar Akner & Tommy Cederholm

Summary

Many illnesses activate biochemical and physiological mechanisms that influence the body's ability to process energy and nutrients. As a result, the metabolism of invalids often differs from that of healthy individuals. Chronic illness may involve long periods during which metabolism shifts to a catabolic state (i.e. decay processes predominate). This leads to an increased risk of malnutrition, making the prospect of recovery less likely. Since the degree of risk is related to the severity of illness, the causal relationship between malnutrition and lowered prognosis is complex. It is therefore not entirely certain that treatment for malnutrition will increase the patient's state of health and prognosis. As with all medical questions, recommendations for nutritional treatment must rest on solid scientific grounds.

This chapter reviews the results of 65 studies of nutritional treatment administered to chronically ill older patients, most of whom were undernourished. The emphasis is on controlled random-sample studies; but studies in which the level of control was not no strict are also discussed. The studies must be evaluated in light of the considerable methodological problems associated with the execution, interpretation and comparison of such research.

Definitions of malnutrition vary, and it is a condition that is associated with illness-related catabolic processes that are difficult to control. Further, interpretation is complicated by uncertainty surrounding patients' compliance with prescribed treatment, other measures being applied at the same time which may have interactive effects, small and often heterogeneous study samples, diverse methods of treatment, short treatment times, and anthropometric and biochemical variables whose relation to prognosis is not always clear.

Despite such reservations, available studies of treatment indicate that positive results can be achieved with dietary supplements, including those in liquid form, which are administered to patients with potential or established malnutrition. Such treatment can improve breathing function in patients with chronic obstructive lung disease. It has been shown that

nutritional therapy can accelerate the recovery of older women with hip fractures, and improve the functional capacity of older persons of both genders with multiple illnesses.

However, the current state of knowledge is limited. There is a great need for prospective, controlled, randomized long-term studies of the effects of structured nutritional programmes for the treatment of older patients with both single and multiple illnesses. In addition to determining outcomes as measured by anthropometric and biochemical variables, emphasis should be placed on such clinically relevant factors as morbidity, functional capacity, health-related quality of life, time spent in care, and mortality. It is important for all health-care professions to systematically develop and evaluate nutritional therapy for the elderly and the chronically ill.

Background

There is an extensive literature in the fields of geriatric and internal medicine which documents a strong connection between chronic illness-related malnutrition and increased morbidity, mortality and prolonged time in care. The causal relationships have not been clarified, however, which means that treatment with additional energy, nutrients and liquids does not necessarily improve the patient's health status or prognosis. Also, reduced food intake and the breakdown of body tissues partly result from biochemical mechanisms that are activated by illness. This raises additional questions about the potential for correcting illness-related malnutrition by increasing the supply of nutrients.

This chapter summarizes research on the effects of nutritional therapy for existing or potential malnutrition, especially in connection with chronic illnesses that are very often associated with the condition (see Table 1). The final stages of most chronic organic illnesses – especially those of the lungs, heart, nervous system, skeleton, kidneys and joints – are associated with both general and specific catabolic and hypermetabolic processes, as well as reduced intake of nutrients and liquids. This may lead to malnutrition in some patients. (For a discussion of gastrointestinal illnesses, including cirrhosis of the liver, see Part II, Chapter 7.)

Table 1. *Chronic medical conditions often associated with malnutrition.*

Chronic obstructive lung disease
Chronic heart disease
Aftermath of stroke
Dementia
Recovery from fractured hip
Chronic renal failure
Rheumatoid arthritis
Multiple illnesses in the elderly

The studies of treatment selected for this review are all concerned with treatment of general protein-energy malnutrition. In most cases, the treatment consisted of dietary supplements via drinkable liquids, or enriched foods which in some cases were administered via feeding tube. Some of the studies involve treatment with drugs such as growth hormone and anabolic steroids. To the greatest extent possible, randomized controlled trials (RCT) have been selected. However, that methodological foundation is lacking in many cases, and it has been necessary to include some less well-controlled studies.

In order to provide an overview, the most important results are summarized in tabular form, usually in reverse chronological order. Every section begins with background information on the prevalence of malnutrition, pathophysiological mechanisms, and the prognostic significance of malnutrition for various illnesses.

Methodological consideration

It turned out to be difficult to find literature in the medical data base, Medline, that provides a comprehensive description of nutritional therapy's effects. For example, only 69 original articles were found in the spring of 1998, using the OVID program to search under the following categories: "nutritional and metabolic diseases", "nutrition disorders", "wasting and starvation", and the combination of "diet therapy, drug therapy, nursing, rehabilitation, therapy". The searches were all in English and restricted to studies of individual adult humans.

There are several probable reasons for the meagre results. Among other things, Medline's indexing of articles on nutritional treatment is not uniform. For example, articles on the subject may be included under the headings of "intervention", "supplement" and "support". Treatment studies are often included in articles that also deal with epidemiological issues, diagnosis and prognosis. Further, some nutrition publications, such as the Nordic journal, *Näringsforskning*, are not indexed in Medline. Some have only recently started to be indexed, such as the *Journal of Human Dietetics and Nutrition* (from 1995) and (from 1998). This means that many Swedish and other treatment studies are not indexed in Medline.

The search program, PubMed, has also been used, including the function "see related articles". After repeated searches in Medline, partly with the help of our own and the expert panel's reference data, 65 references have been found which bear some relation to treatment of malnutrition in the chronically ill.

Chronic obstructive pulmonary disease

The rate of malnutrition in patients with various forms of chronic obstructive pulmonary disease (COPD) has been reported as varying between 20–70 percent; the highest rates are among those with emphysema (1, 2, 3).

COL-related malnutrition probably involves a combination of hypermetabolism due to increased breathing effort (4–7) and inflammatory catabolic activity (8–10). A recent study using double-indicator water found that average total energy use among COL patients was about twenty percent higher than in a matched control group (7). The baseline metabolic rate (BMR) was not elevated, but energy use among COL patients increased in connection with physical work and greater diet-induced thermogenesis. Another recent study, of COL patients during stable phases, found that BMR was related to plasma levels of tumour necrotic factor (TNF), but not to respiratory function (11).

Other factors which may contribute to malnutrition include adaptation to reduced physical activity, and treatment with systemic glucocortocoids. There has also been some discussion of the possibility that COL may develop as a result of hypermetabolism, anorexia and iatrogenic starvation in connection with acute stages of disease (5).

The loss of lean body mass in COL patients leads, among other things, to reduced diaphragm mass and to impaired function of the breathing muscles and peripheral skeletal muscles (1, 12). General muscle hypotrophy leads to general reductions of functional capacity. In COL patients with the same level of reduced lung function , body weight is negatively correlated with mortality (13). It has therefore been speculated that impaired lung function from emphysema may possibly be related to nutritional status (1, 14). As early as thirty years ago, it was reported that the five-year survival rate of COL patients with significant weight loss was lower than those without weight loss. After the onset of weight loss, the average survival time was three years (15).

Treatment (table 2)

Summarized in Table 2 are fourteen studies, including twelve based on RCT methodology (2, 16–28). Among the fourteen are four (including three RCT) which studied treatment with dietary supplements in combination with anabolic steroids or growth hormone (GH). There are also two non-controlled studies, and two on the effects of dietary supplements on COL patients who were not undernourished. With the exception of one study, the sample sizes were small (9–33 patients), and the treatment times ranged from two to 52 weeks.

Table 2. *Studies of treatment for malnutrition in COL patients.*

Authors	Year	Type	Patients			Treatment				Effects		
			No.	Mean age	Mal-nour-ished	Type	Energy (kcal/d)	Protein (g/d)	Time	Anthro-pometry/ Biochemistry	Function	Morta-lity
Ganzoni *et al.* (16)	1994	RCT	30		Yes	Special food	Energy ↑		52 wk	None	None (subj. ↑)	X
Rogers *et al.* (17)	1992	RCT	27	64	Yes	Special food ?	+ 0,3 x REE		16 wk	Weight ↑	Musc. strength ↑ (breathing, hand, walking)	X
Fuenzalida *et al.* (18)	1990	RCT	9	62	Yes	SUP	+ 1080	+ 43	3 wk	None	Immunity ↑	X
Whittaker *et al.* (19)	1990	RCT	10	71	Yes	Enteral NG	+ 1000	0	6 d	Weight ↑	Musc. strength ↑ (breathing)	X
Otte *et al.* (20)	1989	RCT	13	56	Yes	SUP	+ 400	+ 20	13 wk	Weight ↑ SC fat ↑	None	X
Efthimiou *et al.* (21)	1988	RCT	14	60	Yes	SUP	+ 690	+ 29	12 v	AM ↑ LBM ↑	Musc. strength ↑ (breathing, hand) AT ↑, walking ↑	X
Lewis *et al.* (22)	1987	RCT	21	65	Yes	SUP	+ 500–1000	+ 18	8 wk	None	None	X
Ferreira *et al.* (23)	1998	RCT	23	70	Yes	Testosteron			27 wk	AM	None	X
Burdet *et al.* (24)	1997	RCT	16	66	Yes	Special food + GH	40/kg/d		3 wk	LBM ↑	None	X
Schols *et al.* (25)	1995	RCT	217		Yes	SUP + Nandrolone	+ 420		8 wk	Weight ↑ (Special food ⇒fat ↑ Comb⇒LBM ↑)	Musc. strength ↑ (breathing)	X
Saudny-Unterberger *et al.* (26)	1997	RCT	33	69	No	SUP	+ 10/kg	+ 10	2 wk	X	Lung function ↑	X
Knowles *et al.* (27)	1988	RCT	25		No	SUP	+ 360–540	+ 21–32	8 wk	Weight ↑	None	X
Sridhar *et al.* (28)	1994	NC	9	66	Yes	SUP	+ 50 %	+ 1.5 g/kg	16 wk	None	None	X
Pape *et al.* (2)	1991	NC	7	63	Yes	Special food + GH	35/kg/d	1/kg/d	3 wk	Weight ↑ Nutr. balance ↑	Musc. strength ↑ (breathing)	X

Abbreviations: AM = anthropometric index, GH = growth hormone, LBM = lean body mass, NC = non-controlled, NG = nasogastric tube, RCT = randomized controlled trial, REE = resting energy expenditure, SC = subcutaneous, SUP = dietary supplement, X = not studied.

The main findings were as follows:

- 14 of 19 studies (8 RCT) found positive effects of treatment, based on various structural measures, primarily body weight.
- 14 of 17 studies (6 RCT) noted functional improvements in lung function, immune system function, or the strength of skeletal muscles (breathing and/or extremities).
- 14 of 15 studies (4 RCT) found positive effects, based on both structural and functional measures.
- 13 of 14 studies (2 RCT) found no effects of nutritional treatment.
- None of the studies evaluated effects on mortality or quality of life.
- Of the four studies involving treatment of COL patients with anabolic steroids or growth hormone (separately or in combination with dietary supplements) positive effects as measured by anthropometric indices were found in all four, and improved muscle function in two of the studies.
- Of the two studies involving treatment with dietary supplements to COL patients who were not undernourished, one found positive effects on lung function.

Conclusion

Many of the studies, but not all, found that nutritional treatment of malnutrition in cases of chronic obstructive lung disease can have positive effects on physical constitution and, in some cases, also on muscle strength and breathing function.

Chronic heart disease

Malnutrition in connection with serious, chronic heart disease (rating of 3–4 on New York Heart Association scale) is classified as heart cachexia (29–32). The reported rate of malnutrition varies between 10 and 25 percent, depend on the type of heart condition involved (33–37). The question of whether or not the increasing use of ACE inhibitor has reduced the risk of heart cachexia has not been studied.

Among the pathophysiological mechanisms of heart cachexia are reduced appetite, premature satiation, secondary portal hypertension with venous stasis in the liver and the splancnic area with dyspepsia, malabsorption of fat, and protein loss in the gut (32, 38–41). Recent years' research has found that cytokin-triggered catabolism contributes to heart

cachexia (37, 42–44). The basal metabolism of older patients with chronic heart disease is about 15–20 percent higher than that of matched controls (40, 45). Possible causes are increased breathing effort or oxygen requirements of the myocardium. Systemic factors, e.g. increased activity of the sympathetic nervous system, may also contribute (46). Due to the lower level of physical activity, however, total daily energy use does not increase, as measured with the double-indicator water method (47).

Starvation leads to hypotrophy of the heart muscles, in proportion to hypotrophy of the skeletal musculature (48). In healthy individuals, this can be an adaptive response to lower metabolic demands (e.g. bradycardia, hypotension, reduced blood volume), which seldom leads to heart disease (39). It has been reported that undernourished patients with no clinical indication of heart disease may have EKG and FKG-like indications of subclinical left-chamber dysfunction which can be reversed with nutritional therapy (49). Nutritional treatment of starvation involves a risk of heart disease, especially when nutrition is supplied parenterally; this is the so-called refeeding syndrome (32, 39). There is a correlation between heart disease and excess mortality (50–52).

Treatment (table 3)

One non-controlled study has investigated the effects of nutritional treatment on five patients with both chronic heart disease and malnutrition (53). There is also a Swedish RCT study of the effects of nutritional treatment for chronic heart disease in patients who were adequately nourished (36), and another Swedish study of nutritional treatment and heart function in patients with healthy hearts but multiple diagnoses for other types of illness (48). These studies were limited in scope, however, and no negative effects of nutritional treatment, e.g. volume overload, were found.

Nutritional treatment of heart disease is complicated by the fact that patients' daily liquid and saline intake should not exceed 1.5 litres or 2 g sodium, respectively. Therefore, heart cachexia often requires highly-concentrated energy and restricted sodium intake (41, 54). A schedule of frequent meals may be preferable to a smaller number of heavy meals.

Conclusion

Nutritional treatment of malnutrition in cases of chronic heart disease has not been adequately studied.

Table 3. *Studies of treatment for malnutrition in patients with chronic heart disease.*

Authors	Year	Type	Patients				Nutritionsbehandling				Effekter		
			No.	Mean age	Diag-nosis	Mal-nutri-tion	Typ	Energy (kcal/d)	Protein (g/d)	Time	Antropo-metric/Bio-chemical	Function	Morta-lity
Heymsfield *et al.,* (48)	1978	NC	5	49	Mul-tiple; healthy heart	Yes	Enteral Parent	3000–4000	75–135	2–5 v	Weight ↑ LBM ↑	Heart ↑	X
Heymsfield *et al.,* (53)	1989	Hist. NC	4	55	Heart disease NHA 3–4	Yes	Enteral	35/kg	1.0/kg	2 v	Weight ↓ LBM ↑	None	X
Broqvist *et al.,* (36)	1994	RCT	22	65	Heart disease NHA 3–4	No	SUP	+ 750	+ 30	8 v	SC fat ↑	None	X

Abbreviations: AM = anthropometric index, GH = growth hormone, LBM = lean body mass, NC = non-controlled, NG = nasogastric tube, RCT = randomized controlled trial, REE = resting energy expenditure, SC = subcutaneous, SUP = dietary supplement, X = not studied.

Stroke aftermath

Among victims of stroke, 8–16 percent show signs of malnutrition from the onset of illness (55–57). Within one week of stroke, about one-third of the victims need help with feeding and their nutritional status steadily declines (56).

A Swedish study of stroke patients found that the rate of malnutrition increased from 16 percent at admission to 22 percent upon discharge (55). The corresponding figures in a Spanish study were 16 percent and 26 percent after one week (57). Over eighty percent of stroke patients hospitalized for more than 21 days had problems with eating (58). Nearly half of the patients referred to one stroke rehabilitation clinic were undernourished (59).

Much of the functional impairment associated with stroke has an effect on the invalid's ability to maintain adequate nutrition. Difficulty in swallowing, dysphagia, affects 30–45 of victims (60–61). Half of them have recovered the ability to swallow after one week, and the great majority (87 percent) have done so after two weeks (60, 62). At present, there is uncertainty about the point in time at which dysphagia in a patient should be regarded as permanent. This uncertainty often leads to delays in supplying nutrition to stroke/dysphagia victims, in anticipation of spontaneous improvement.

This tendency to avoid nutritional treatment is strengthened by a lack of guidelines based on the results of controlled studies (63). Other factors that may contribute to the risk of malnutrition after stroke include paresis of the body's dominant side, communication and perceptual disturbances such as aphasia, and impairment of the taste and smell senses. Davalos *et al.* have speculated that catabolic processes in the acute phase, expressed as heightened cortisol levels in urine and plasma, may contribute to a negative energy-nutrient balance which can rapidly worsen nutritional status in many stroke patients (57).

Malnutrition in stroke patients is associated with increased rates of infection, bedsores, prolonged time in care and increased mortality (57, 64). As with many other conditions, hypoalbuminemia is an especially strong indicator of poor prognosis (65).

Treatment (table 4)

Table 4 summarizes six studies, including two using RCT methodology (57, 66–70). The studies dealt with various types of nutritional treatment, all of which focused on prevention of malnutrition following a stroke. One study found that oral dietary supplements lead to increased nutrient intake and less pronounced deterioration of nutritional status (66). Another, non-controlled, short-term study found that gastronasal feeding did not hinder the deterioration of nutritional status (57).

Table 4. *Studies of nutritional treatment of stroke patients.*

Authors	Year	Type	Patients		Treatment				Effects	
			No.	Dys-phagia	Type	Energy	Protein	Time	Anthropometry/Biochemistry	Function/Mortality
Gariballa *et al.,* (66)	1998	RCT	40	No	Oral SUP	+600 kcal	+20 g	4 wk	Increased intake of energy (75%) and protein (50%). Lower S-albumin in control group	
Norton *et al.,* (67)	1996	RCT	30	Yes	PEG or NG 14 days after onset of illness	100 ml/hr. NG		6 wk	Weight and s-albumin rose in PEG-gruppen. Both variables declined in NG group	Lower mortality, shorter care time, fewer complications in PEG group
Davalos *et al.,* (57)	1996	NC.	91	Yes & no	Normal food (oral) or, if dysphagic, enteral nutrition via NG	2000 kcal (oralt) alt. 30 kcal/kg (NG)	16 g (oral) 14 g (NG)	1 wk	Those with low TSF, AMC or salbumin increased from 17% to 32% despite treatment	
Wanklyn *et al.,* (68)	1995	Retro-spective	37	Yes?	PEG 26 days (median) after onset of illness					25 of 37 patients died within three months
Nyswonger *et al.,* (69)	1992	Retro-spective	20/32		Enteral nutrition (NG) before and after 72 hrs. from onset of illness					20 days in care with early treatment; 29 days if later
Elmståhl *et al.,* (70)	1999	NC	38	Yes	Mouth-muscle training; training in swallowing and body position					60% improved swallow function and nutrtional status

Abbreviations: AMC = arm muscle circumference, NC = non-controlled, NG = nasogastric tube, PEG = percutaneous endoscopic gastrostomy, RCT = randomized controlled trial, SUP = dietary supplement, TSF = triceps skinfold.

One RCT study compared percutaneous endoscopic gastrostomy (PEG) with the nasogastric feeding tube method (67). In the latter case, patients with severe stroke and persistent dysphagia received 100 ml/hour standard solution via feeding tube. Mortality was lower in the PEG group – twelve percent, compared with 57 percent among those fed nasogastrically. In addition, time in care was briefer, complications from aspiration pneumonia were fewer, and nutritional status was better in the PEG group.

A retrospective of long-term study of effects on stroke patients who received PEG found that 25 of 37 patients had died within three months of stroke (68). It was not possible to evaluate the extent to which this poor outcome resulted from inadequate nutrient intake prior to treatment with PEG. A non-controlled Swedish study has found that training the swallowing function and adjustments in diet improved swallowing and nutritional status in a majority of dysphagic stroke patients (70). In a review and analysis of the literature on treatment of dysphagia in victims of severe stroke, the Cochrane Library concluded that far too few studies had been conducted. It is possible that PEG can improve function and nutritional status in stroke patients more effectively than the nasogastric method.

Conclusion

Nutritional therapy for the effects of stroke has not been adequately studied. In cases of permanent dysphagia, treatment with percutaneous endoscopic gastrostomy circa fourteen days after the onset of illness may be preferable to the nasogastric feeding tube method.

Dementia

Malnutrition occurs among 12–50 percent of those institutionalized with dementia (72–74). The rate for dementia of Alzheimer type, DAT, has been reported to be higher than for vascular dementia (75). Within eight years of DAT's onset, fifty percent of those affected needed artificial nourishment or assistance with feeding (76). This raises important ethical issues (77).

There is a demonstrated relationship between weight loss and time spent in an institution, especially with DAT and even in patients whose food intake has been adequate (72–73). One retrospective longitudinal study of ten DAT patients fund an average weight loss of circa five kg/year following institutionalization (72). But dementia patients who are able to remain at home do not display any weight loss, according to other research (73, 78). This may be due to the fact that the amount of time allocated to meals is often longer in the home than in institutions (79). Another report has noted that the development of dementia may be preceded by involuntary weight loss of 3–4 kg within ten years, and the authors discuss the possibility that weight loss may be part of an early stage of dementia (80).

Dementia leads to lower energy intake, due among other things to reduced appetite/hunger/thirst, impaired eating function (e.g. chewing and swallowing), altered senses of smell and taste, and refusal or neglect to eat. Alzheimer patients may often experience increased energy loss due to hyperactivity, and there is some evidence that daily energy use in some patients can increase by as much as 1,600 kcal (81).

Controlled studies of DAT patients using indirect calorimetry have found both unchanged and increased basal metabolism (82, 83). A study of energy balance in DAT patients using double-indicator water was unable to find any evidence of hypermetabolism (84). Reference has been made to the so-called "sundown syndrome", a decline in the cognitive ability of DAT patients during the evening, due to fatigue caused by hyperactivity during the day (85).

It is likely that inflammatory processes in the brain are significantly related to the development of DAT (86–87). Patients with DAT show signs of ongoing brain inflammation, both local and systemic; among the indications are heightened levels of TNFa (88–90). The question arises as to whether this may contribute to weight loss. There are also indications that DAT patients experience a general deterioration of homeostatic regulatory mechanisms, such as those for body temperature and cardiovascular reflexes, which may lower the capacity to conserve energy (91).

A six-year longitudinal study found that weight loss was correlated with mortality and to the severity and progression of DAT, while weight gain lowered the risk of death (92).

Treatment

One study of nutritional therapy for patients with dementia and malnutrition at a psychiatric hospital in England found that, of 300 patients, 80 (27 percent) were underweight (74). Of these, 46 were included in a randomized controlled study of treatment with liquid dietary supplements of 600 kcal per day for twelve weeks. This resulted in an average weight increase of 3.5 kilograms, while the average weight of the control group remained unchanged. No evaluation of function or mortality was included in the study.

A retrospective study of nursing home residents with severe cognitive dysfunction found no effects of nasogastric feeding on survival rates (93). Especially in advanced stages of dementia, it is important to consider the ethical aspects of artificial nutrition.

Conclusion

Treatment of dementia-related malnutrition has not been adequately studied.

Rehabilitation after hip fracture

Roughly fifty percent of all older persons who suffer hip fractures are undernourished (94–97). Inadequate nutritional intake may contribute to the development of osteoporosis, which is often a precondition of fractures in the elderly. Malnutrition is also associated with muscle weakness which leads to increased risk of falling, and with reduced amounts of shock-absorbing subcutaneous fat (98, 99). Prospective long-term epidemiological studies have found that maintaining body weight after menopause is a significant factor in the prevention of fractures (100).

The combination of fractures, trauma from falls and surgical intervention often leads to intense inflammation that contributes to catabolic conditions in pre- and post-operative phases. The metabolic and nutritional consequences during these phases are discussed in Part II, Chapter 8.

One study of malnutrition's prognosticative significance for hip-fracture patients found that the risk of malnutrition was correlated with longer times in hospital and lower levels of rehabilitation (95).

Treatment (table 5)

Table 5 summarizes seven RCT studies of nutritional treatment of hip-fracture patients during the post-operative rehabilitation phase (101–107). All of the studies were controlled and randomized; but the randomization procedure is not clearly described in every case. Two of the studies involving dietary supplements were controlled with the use of placebos.

Four of the six studies of dietary supplements found that they led to less time in hospital. Two of six by the same research group found fewer post-operative complications such as infection. One of these six studies found significantly lower mortality; but the sample was very small, and a single death in the experimental group probably would have nullified that finding. One of the studies found that four weeks' treatment with anabolic steroids (nandrolone) had no positive effect.

A review and analysis by the Cochrane Group, of research involving a total of 943 patients above age 65, concluded that there was no evidence of positive effects from treatment with oral protein-energy supplements. However, the general quality of the studies was judged to be low and additional studies were recommended.

Conclusion

Nutritional treatment following hip fracture in the elderly may have positive effects. Available studies indicate that time in hospital can be reduced by oral or enteral treatment with enriched dietary supplements containing 20 grams or more of protein per day for at least three-four weeks during the post-operative phase.

Table 5. *Studies of nutritional treatment of hip-fracture patients.*

Authors	Year	Type	Patients		Treatment				Effects	
			No.	PEM	Type	Energy/d	Protein/d	Time	Anthropometry/ Bio-chemistry	Function/Mortality
Schurch *et al.,* (101)	1998	RCT, placebo	82	No	Oral SUP	–	+20 g	6 mo	Bone density and IGF-1 increased	Shorter time in hospital under 1 year: 33 vs. 54 days
Sullivan *et al.,* (102)	1998	RCT	18	No	Nightly NG feeding	+1400 ml		~15 d		Lower 6-month mortality, 0 vs. 50%
Tkatch *et al.,* (103)	1992	RCT, placebo	62	No	Oral SUP	–	+20 g	38 d		Lower mortality, fewer complications. Shorter care times under 7 mo.:
Delmi *et al.,* (104)	1990	RCT	59	No	Oral SUP	+250	+20 g	1 mo		Fewer complications. Shorter care times:
Williams *et al.,* (105)	1989	RCT?	28	Yes	Oral SUP	+~400 kcal	+14 g	~3 wk	TSC and AMC unchanged in exper. group; declined in control group	
Bastow *et al.,* (106)	1983	RCT	122	Yes	Nightly NG feeding	+1000 kcal	+28 g	~4 wk	AMC rose	Faster rehab.: 10 vs. 12 days ("thin") and 16 vs. 23 days ("very thin")
Sloan *et al.,* (107)	1992	RCT, placebo	29	No	Nandrolone 2 mg/kg intravenously	–	–	4 wk	Neither positive nor negative	

Abbreviations: AMC = arm muscle circumference, IGF-1 = Insulin-like growth factor 1, NG = nasogastric tube, PEM = protein-energy malnutrition, RCT = randomized controlled trial, SUP = dietary supplement, TSF = triceps skinfold.

Chronic renal failure

Malnutrition in connection with renal failure often becomes clinically detectable at GFR < 10 ml/min, and occurs with both conservative and active treatment for uraemia (GFR = glomerular filtration rate). The rate of malnutrition can be as high as 40–76 percent, and is especially common among older patients (109–111). It has been stated that undernourishment is very common with chronic renal failure that is ancillary to diabetes mellitus (112). Of 224 ambulatory patients with a mean age of 53 who underwent peritoneal dialysis (PD) for an average of 32 months, 41 percent were assessed as undernourished, and eight percent of these were extremely undernourished, according to SGA measurements (110).

Uraemia-related malnutrition is related to a combination of nutritional, metabolic, hormonal and inflammatory factors. The development of renal failure is often accompanied by gradual anorexia with spontaneous reduction of protein intake, independent of any diet counselling that may be offered (113). At GFR <10 ml/min, protein intake is often spontaneously reduced to < 0.6 g/kg per day (112). With careful diet counselling emphasizing increased energy intake, it has been possible to prescribe lower-protein food without the emergence of malnutrition (114). For many patients, however, the risk of malnutrition is great.

The activity of proinflammatory cytokins with anorectic and muscle-catabolic effects is heightened in cases of renal failure, and is associated with the development of malnutrition (115). Metabolic acidosis may contribute to muscle proteolysis and reduce albumen synthesis (116, 117). However, it is not clear whether it is possible to impede the development of malnutrition by treatment for metabolic acidosis (112).

Among the other factors that may contribute to disturbances to nutritional balance that are related to chronic renal failure are insulin resistance, increased concentrations of glucagon, secondary hyperparathyroidism, and reduced levels of thyroid hormones. To these factors may be added other potential co-morbid conditions such as diabetes mellitus, depression, drug side effects and physical inactivity. Several studies have reported that energy use in cases of chronic renal failure, with or without hemodialysis or continous peritoneal dialysis (CAPD)was the same as in healthy control subjects (118–120). But there are also studies that indicate increased energy use in cases of renal failure.

Variables that indicate malnutrition reflect strong risk-factors for both morbidity and mortality in connection with chronic dialysis (122, 123). There is also evidence that existing malnutrition, in itself, may have a negative effect on kidney function (124).

Treatment (table 6)

Table 6 summarizes eleven studies, three using RCT methodology (125–135). The sample sizes of the studies were small, ranging from 7–50 patients, and treatment time lasted from seven days to twelve months. Some studies involved treatment with a combination of food/supplements and growth hormone, a method that has been reported to improve nitrogen balance and reduce serum urea levels, without affecting muscle function (133). The question of whether or not four weeks is too short a treatment time was also discussed.

Nine of ten studies, including two of RCT type, found positive effects on the basis of various anthropometric and biochemical indices. Function was measured in only two studies.

To maintain a positive nitrogen balance in cases of chronic renal failure, with or without hemodialysis or CAPD, an energy supply of 35–38 kcal/kg is needed. There are no studies of energy or protein requirements in older dialysis patients (122).

For patients who cannot tolerate oral or enteral feeding, there are alternative methods for use with dialysis. It is possible to compensate for inadequate protein intake by supplying a high protein:energy ratio with intradialytic parenteral nutrition (IDPN), i.e. intravenous supplements of glucose, amino acids and/or fat administered in connection with dialysis (136). However, there are no published RCT studies of the effects of IDPN on malnutrition with chronic renal failure.

The few studies that do exist have shown a slight positive effect on biochemical nutrition indicators, and improvements in immunologic function (126, 132, 135). One non-randomized controlled study found that IDPN led to higher survival rates, but only in cases of severely impaired kidney function (126). A retrospective study of the same issue found that IDPN improved the survival rate of patients with chronic renal failure and malnutrition (127).

Another method for supplying nutrition in connection with dialysis is intraperitoneal nutrition (IPN) with solutions based on amino acids. No controlled study of treatment with IPN has been found.

Conclusion

Treatment of malnutrition associated with renal failure has not been adequately studied. Available research suggests that positive effects can be obtained for anthropometric and biochemical variables.

Table 6. *Studies of treatment for malnutrition in patients with chronic renal failure.*

Authors	Year	Type	Patients				Treatment				Effects		
			No.	Age	Dialysis	Mal nutrition	Type	Energy (kcal/d)	Protein (g/d)	Time	Anthropometry/ Biochemistry	Function	Mortality
Tietze *et al.,* (125)	1991	RCT	19	55	HD	Yes	SUP (fish prot.)	32 kcal/ kg/d	+ 8	3 mo	Anthropom ↑, Weight ↑, muscle ↑, protein profile ↑	X	X
Chertow *et al.,* (126)	1994	Non-rand. control			HD		IDPN			12 mo	S-albumin ↑	X	↓ if s-alb. <35, S-krea <700 ↑ if s-alb. >35
Capelli *et al.,* (127)	1994	Retro. non-rand. control	50	60	HD	Yes	IDPN	+670–725 kcal/ dialysis	75–100g/ dialysis	9 mo	Weight ↑, Fat mass ↑	X	↓
Hecking *et al.,* (128)	1978	Non-rand. control	13	41	HD	Yes (?)	EAA	+ 60	+ 15,7	3 mo	None	X	X
Milano *et al.,* (129)	1998	NC	22	43	HD	Yes	SUP	+ 380	0	6 mo	Antropom ↑, fat mass ↑	X	X
Elias *et al.,* (130)	1989	NC	8	49–78	PD	Not stated	SUP	+ 80	+ 15	4 mo	Nutr. balance ↑	X	X
Acchiardo *et al.,* (131)	1982	NC	15		HD	Yes	Ess. tot. protein profile+ Energy	35 kcal/kg/d	1		S-tot-prot ↑, S-albumin ↑, S-transferin ↑, TLC ↑, Bone density ↑		
Johannson *et al.*, (132)	1999	RCT	17	73	HD	No	GH			6 mo	Fat free mass ↑, S-IGF-1 ↑, S-albumin ↑	Mobility ↑, HK ↑	
Iglesias *et al.,* (133)	1998	RCT	8	64	HD/PD	Yes	GH	Special food	Special food	4 wk	Weight ↑, S-IGF ↑, S-transferin ↑, S-urea ↑	None	X
Ikizler *et al.,* (134)	1994	NC	10	46	PD	No	GH	–	stable	7 d	S-IGF ↑, S-albumin ↓	X	X
Schulman *et al.,* (135)	1993	NC	7	48	HD	Yes	IDPN + GH	+18 kcal/ kg/dialysis	+0,69 g/ kg/dialysis	6 wk	N-balance ↑, S-albumin ↑, S-transferin ↑	X	X

Abbreviations: EAA = essential amino acids, GH = growth hormone, HD = hemodialysis, HK = hand strength, IDPN = intradialytic parenteral nutrition, IGF-1 = insulin-like growth factor 1, NC = non-controlled, PD = peritoneal dialysis, RCT = randomized controlled trial, SUP = dietary supplement, TLC = total lymphocyte count, X = not studied.

Rheumatoid arthritis

Reported rates of malnutrition in connection with rheumatoid arthritis (RA) range from 26–71 percent (138, 139). It has been noted that RA patients seldom have reduced appetite, and that they can be in a definite state of malnutrition without this being detected by clinical examination (140). In one study of individuals with RA, only a few were diagnosed as undernourished (141).

RA implies a risk of malnutrition for several reasons. Patients with RA lose muscle mass, even with high protein intake (142). This is consistent with the catabolic processes that are linked to the chronic inflammation of RA, which is in turn consistent with findings of increased system TNF-α activity associated with the development of RA-related malnutrition (140, 142).

Distinct radiological changes, extra-articular manifestations and low functional capacity are all strong indicators of malnutrition with RA (138, 143). There is often weight loss during the active phase of the illness (144). New treatment strategies targeted directly a TNF-α activity are starting to be applied to RA (145, 146). What effects this may have on general illness-related catabolism are not yet known.

Other factors that may possibly contribute to malnutrition are adaptation to reduced physical activity, and treatment with systemic glucocorticoids. Secondary Sjögren's syndrome, including dry mouth, is relatively common with RA. Also, there may be some risk of malnutrition associated with repeated periods of fasting or laxative diet for the purpose of lowering illness activity.

Conclusion

The treatment of malnutrition in connection with rheumatoid arthritis has not been studied.

Treatment

There are no published studies on the effects of nutritional treatment of malnutrition in connection with rheumatoid arthritis.

Multiple illnesses in older patients

The combination of old age, multiple chronic illnesses and polypharmacy implies an increased risk for malnutrition (34–35, 147–150). A Swedish study of internal-medicine patients found that the rate of malnutrition among those above age 74 was twice that of those aged 65–74, i.e. 27 vs. 13 percent (35). In connection with an ongoing evaluation of a major reform of old-age care by the National Board of Health and Welfare, it has been reported that malnutrition as defined by the MNA method (see Part I, Chapter 2) is very common in Swedish old-age care (151–153).

Within geriatric and old-age care, it is often difficult to link malnutrition to any definite illness-related process. The degenerative processes of ageing often lead to reduced reserve capacity in several organs. Further, older patients often have several illnesses in various organic systems at the same time. This means that the pathophysiological mechanisms of isolated illnesses referred to above may interact in various ways, increasing the risk of malnutrition in older persons.

A number of studies have found evidence that malnutrition and underweight (especially in connection with ongoing weight loss) sharply increase the risk of mortality among the elderly and the chronically ill (51, 154–163). A retrospective study of undernourished older nursing home patients found that individuals whose weight increased by five percent or more during roughly one year experienced lower mortality, compared with those whose weight declined or remained unchanged (164).

Treatment (table 7)

Table 7 summarizes 23 studies of treatment, including thirteen using RCT methodology (165–187). Most of the studies involved orally administered liquid dietary supplements. The study periods ranged from two weeks to six months, and the number of patients from 12 to 435.

Eighteen of the studies (10 RCT) noted a rise in anthropometric and/or biochemical measurements in the experimental group. Ten studies (5 RCT) observed functional improvements. One RCT study reported that dietary supplements reduced the number of fall-trauma incidents (172). In one Swedish study, nutritional treatment administered to the adequately nourished control group was associated with both reduced mortality and increased general function; but no such effect was observed among the undernourished subjects (172).

We have found one study that evaluated the effects of treatment in undernourished older patients with intravenous nutrition. Sixteen moderately undernourished patients (average age 68) were randomly distributed into a group that received total parenteral nutrition (TPN) and a control group. It was found that protein synthesis was stimulated if energy supply from carbohydrates and fat corresponded to 200 percent of basal metabolism (188). We have not found any study which examined the effects of adjuvant parenteral nutrition, often administered to hospitalized older patients.

Conclusion

Some studies, but not all, have fund that nutritional treatment for malnutrition in older patients with multiple illnesses may have positive effects, primarily on physical constitution, and in some case also on muscle strength and immunologic function.

Table 7. *Studies of treatment for malnutrition in older persons with multiple illnesses.*

Authors	Year	Type	Patients			Treatment				Effects		
			No.	Age	Mal nutrition	Type	Energy (kcal/d)	Protein (g/d)	Time	Anthropometry Biochemistry	Function	Mortality
Fiatarone Singh *et al.,* (165)	2000	RCT	50	85	No	Nutr. drink	+ 360		10 wk	Weight ↑, fat ↑, FFM ↑	None	X
Laque *et al.,* (166)	2000	RCT	78	85	Yes/No	Nutr. drink	+ 400			Weight ↑ in undernourished	MNA ↑, None on hand strength	X
Bourdel-Marchasson *et al.,* (167)	2000	RCT	672	83	Yes/No	Nutr. drink	+ 400		15 d	X	Risk of bedsores ↓	X
De Jong *et al.,* (168)	1999	RCT	145	78	Yes/No	Enriched food				Vitamin status ↑, else none	X	X
McWhirter *et al.,* (169)	1996	RCT	86	72	Yes	Nutr. drink (enteral)	+ 590 + 640	+ 22 + 24	10 d 12 d	Weight ↑	X	X
Volkert *et al.,* (170)	1996	RCT	46	85	Yes	Nutr. drink	+ 250		6 mo	None	ADL ↑, Independence ↑	X
Hogarth *et al.,* (171)	1996	RCT	87	83	No	Glucose and/ or multivit.	+ 540	0	30 d	None	X	X
Gray-Donald *et al.,* (172)	1995	RCT	50	78	No	Nutr. drink	+ 150	+ 5	12 wk	Weight ↑	No. cases ↓	X
Fiatarone *et al.,* (173)	1994	RCT	100	87	No	Nutr. drink + training	+ 360	+ 15	10 wk	Weight ↑	None	X
Hankey *et al.,* (174)	1993	RCT	14	81	No	SUP + glucose-polymer	> 1000		8 wk	TSF ↑ AMC ↑	X	X
Unosson *et al.,* (175) Larsson *et al.,* (176)	1992 1990	RCT	435	79	28 % of group	Nutr. drink	+ 400	+ 16	26 wk	Weightindex ↑ AMC ↑, but only for well-nourished S-prealb ↑	Activity ↑ mainly for the well-nourished Skin test ↑ for both under- and well-nourished	↓ Only for well-nourished

Table 7. *Continued.*

Authors	Year	Type	Patients			Treatment				Effects		
			No.	Age	Mal nutrition	Type	Energy (kcal/d)	Protein (g/d)	Time	Anthropometry Biochemistry	Function	Mortality
McEvoy *et al.,* (177)	1982	RCT	51	–	Yes	SUP	+ 644	+ 36	4 wk	Weight ↑ TSF ↑	X	X
Banerjee *et al.,* (178)	1978	RCT	50	81	No	Nutr. drink	+ 265 (eg + 0)	+ 11	14 wk	Skin fold ↑ Skin status ↑	X	X
Bos *et al.,* (179)	2000	CNR	23	80	Yes	Nutr. drink	+ 1,67 MJ	+ 30	10 d	Proteinsynthesis ↑, fat free mass ↑	X	X
Ödlund-Olin *et al.,* (180)	1996	CNR	36	82	No	Enriched food	+ 450	+ 17	6 wk	Weight ↑	Physical aktivity ↑	X
Cederholm *et al.,* (181)	1995	CNR	23	74	Yes	Nutr. drink (Fortimel)	+ 400	+ 40	12 wk	Weight ↑, AMC ↑ TSF ↑	Musc. strength ↑ (hand), Skin test ↑	X
Hébuterne *et al.,* (182)	1995	NC	46	77	Yes	Enteral (Ventricular tube)	+ 1300	+ 68	2–6 wk	Weight ↑, TSF ↑, AMC ↑, S-prealb ↑	X	X
Gray-Donald *et al.,* (183)	1994	NC	14	–	No	Nutr. drink	+ 390		12 wk	Weight ↑	Musc. strength ↑ (hand) Wellbeing ↑	X
Elmståhl *et al.,* (184)	1987	NC	28	85	No	Nutr. drink (3 diff.)	+ 500 (eg. + 250–400)	+ 1–4	8 wk	Weight ↑	X	X
Lipschitz *et al.,* (185)	1985	NC	12	75	Yes	Nutr. drink	+ 815	+ 30	16 wk	Weight ↑, S-albumin ↑ S-TIBC ↑	X	X
Katakity *et al.,* (186)	1983	NC	12	77	No	Nutr. drink	+ 204	+ 9	12 wk	X	Musc. strength ↑ (hand)	X
Lipschitz & Mitchell (187)	1982	NC	9	75	Yes	Nutr. drink/ (Ventricular tube enteral)	1800–2500		21 d	Weight ↑ S-albumin ↑, S-TIBC ↑	Mobility ↑	X

Discussion

Basic vs. "medical" nutrition

As far as possible, recommendations for treatment should be based on the results of randomized controlled trials (RCT). But in some respects, nutritional treatment is an exception to that scientific rule. An adequate supply of nutrition is undeniably a precondition for the continuation of life in both healthy and unhealthy individuals, and there is no need for randomized studies to confirm this.

However, questions do arise concerning appropriate methods for administering and evaluating treatment for potential or established malnutrition. Apart from maintaining basic life-sustaining functions, nutritional treatment may also have "medical" significance.

Illness-related malnutrition is usually caused by the illness, itself, which can activate biochemical and physiological mechanisms that affect appetite, the structure of body tissues, and the ability of metabolic systems to process energy and nutrients. Such pathophysiological changes may be an adaptive and homeostatic.

As previously noted in this review of the literature, the current state of knowledge is in most cases inadequate to provide a solid scientific basis for guidelines and recommendations concerning the design of nutritional treatment.

Methodological problems

It should be underlined that there are substantial methodological problems associated with the execution of randomized controlled studies of treatment, and with the interpretation and comparison of results. Definitions of malnutrition vary between studies, reflecting the fact that there is no generally accepted definition of the concept (see Part I, Chapter 2).

The interpretation of results is also complicated by the diversity of treatment methods, uncertainty as to whether the specified treatment has been properly carried out, the simultaneous application of other interacting measures, small and often heterogeneous samples, short treatment times, and lack of clinically relevant outcome variables. It should also be noted that malnutrition usually occurs together with chronic illnesses and catabolic processes whose natural courses are difficult to control. Positive effects may be difficult to detect in the typically complex situations of nutritional treatment.

In addition, the results of treatment are usually studied only at the group level. Thus, there is a great risk that positive effects among certain subgroups may not be observed, given that there are often wide variations in energy intake by the same individual and between different individuals.

Structure & function

An important question to consider is the significance of treatment-induced increases in the values of anthropometric and/or biochemical variables. Weight loss and hypoalbuminemia are both strongly correlated with increased mortality of invalids. Since the causal relationships are often unclear, there is no guarantee that patients' functional capacity, prognosis or quality of life will improve as a result of nutritional treatment that increases the value of anthropometric variables such as body weight, or biochemical variables such as serum albumin.

Several studies have found that balanced nutritional treatment can influence physical constitution according to the following sequence: First, total body water increases, then fat, and finally lean body mass, i.e. muscle and protein (191, 192). An important objective of nutritional treatment is to restore lean body mass. However, many of the studies reviewed have found that nutritional treatment leads primarily to increased storage of fat. It is unclear whether this finding is of minor clinical relevance, or points to an indirect indicator of simultaneous anabolic muscular processes. On the other hand, improvements of clinical function need not be related to increased body weight, since nutritional treatment can more rapidly affect an organ's function than its size and mass (193).

The possibility cannot be excluded that an optimal supply of nutrition, provided by the means available today, has only a limited potential to improve the health of undernourished patients – especially if the condition is related to catabolic processes and increased energy use, rather than to reduced energy-protein intake. Physical training and pharmacological measures, both anabolic and anti-catabolic, may come to serve as supplementary treatment methods, for example to promote muscle growth. Studies in this area are currently in progress.

A potential weakness of most treatment studies is that total energy intake can seldom be reported. Nutritional treatment usually involves an additional 200–500 kcal of energy per day, which does not necessarily lead to a corresponding increase in total intake. Treatment with dietary supplements may suppress appetite and reduce intake of the normal diet (22, 27, 173, 184). Older patients vary in their ability to follow instructions for dietary supplements (171, 174). Large doses of liquid supplements have been reported to produce bloating and gas formation as side effects (22). But many studies have found that supplements or enrichment can increase total energy intake (66, 166, 169, 170, 180, 194).

Fat quality

Another uncertain factor is the extent to which the additional supply of fat has any effect on health, other than serving as a concentrated source of energy. At present, enriching the energy quotient of meals is usually

achieved with additions of saturated fatty acids in the form of dairy products. The question of whether this leads to negative effects, such as increased thrombogen activity, needs to be investigated.

Research on standard health care

As a rule, treatment studies are conducted by specialized research groups under standardized conditions. Consequently, the results of that research cannot be applied to standard health-care treatment without reservation. This is illustrated by a six-month study of the routine administration and evaluation of artificial nutrition in a Scottish teaching hospital. The researchers found that prescriptions for nutritional treatment were neither adequate nor administered to patients according to prescription, and concluded that the supply of nutrition was insufficient (148).

In another example, a retrospective study of nursing homes found that dietary supplements were used as non-specific treatment for weight loss, without regard to diagnosis of underlying causes, and with no documentation of the amounts consumed or the outcome of treatment (195). Such findings underline the need to increase care personnel's knowledge and awareness of nutrition's significance, through education and the improvement of procedures.

Conclusion

A total of 65 studies of nutritional treatment (32 RCT) have been reviewed, the majority of which involved orally administered liquid dietary supplements. Mortality benefits were noted in five of the studies (eight percent), functional improvements in 23 (35 percent), and anthropometric/biochemical improvements in 42 (65 percent). Six studies (nine percent) with control groups found no improvements. In no study were serious side effects observed.

Even though there are many uncertain factors relating to the reviewed studies, the available data indicate that dietary supplements, in the form of balanced-liquid or protein-rich drinks, can yield positive results in patients with existing or potential malnutrition connected with certain chronic illnesses.

A similar conclusion was reached by a recently published review and analysis of 32 studies involving a total of 2286 randomized patients who received dietary supplements orally or enteralally (196). There was no indication that the advantages of treatment were limited to special diagnostic groups. The most positive results of treatment have been reported for undernourished patients with chronic obstructive lung disease (improved breathing function), older women recovering from hip fractures (accelerated rehabilitation and correspondingly shorter time in care), and adequately nourished older persons with multiple illnesses (increased functional capacity).

However, the literature is not conclusive, and there is a lack of treatment studies for certain types of illness. The same general conclusion is drawn in two recently published articles (197, 198).

In accordance with the above-noted reviews and analyses, the authors also conclude that there is a great need for additional randomized, controlled long-term studies, preferably with the use of placebos, into the effects of structured programmes for the treatment of single and multiple illnesses in older patients. Apart from measuring the values of anthropometric and biochemical outcome variables, attention should be focused on clinically relevant measures of function such as morbidity, functional capacity, health-related quality of life, time in care and mortality.

There is an additional need for experimental studies and randomized treatment studies, in order to develop improved methods of treatment to impede catabolic processes while stimulating appetite and anabolic processes. It is also urgent to focus research on the development of nutritional treatment programmes that are integrated with other types of clinical treatment, and on the effects of long-term treatment in the patient's home environment.

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6. Treatment of Malnutrition: Chronic Malignant Illness

Ingvar Bosaeus

Summary

Malignant illnesses are usually associated with high rates of malnutrition. There is a direct relationship between mortality and loss of both body weight and active cell mass. Malnutrition affects a number of functions such as muscle strength, physical capacity and cognitive ability. This may in turn affect ADL functions and quality of life.

The connection between cachexia and mortality has led to the assumption that preventive or remedial treatment of the condition can postpone or prevent death from cancer. However, there is no direct evidence that nutritional treatment of cancer-related cachexia prolongs life. Active treatment can produce weight increases in cancer patients, but these consist largely of increased fat reserves, and frequently of extracellular volume, but not of cell mass. The unintended or absent effects of nutritional treatment of cancer may possibly result from systemic inflammation reaction of varying intensity, with associated catabolic effects on skeletal musculature, etc.

The routine administration of artificial nutrition does not reduce cancer-related complications or mortality among patients who undergo chemotherapy or radiation treatment. But many of the published studies in this area have defects which limit their clinical relevance. Protracted artificial nutrition may effect quality of life and survival in patients who cannot eat, through maintenance of liquid balance and nutrient supply. However, no randomized controlled studies of this issue have been published. Consequently, there is not enough information on which to base clear guidelines for clinical treatment of cancer-related malnutrition.

Background

Malignant illnesses are usually associated with high rates of malnutrition. Anorexia, cachexia and gradual weight loss are common in advanced stages of such illnesses. Weight loss is reported in more than half of all cancer patients (1). Contributing factors are anorexia, premature satiation and chronic nausea, all of which are common; they are related to both the illness, itself, and to its treatment. Reduced food intake is very common,

but quantitative measurements of this factor appear very seldom in the literature.

It is generally believed that reduced nutrient intake cannot by itself explain gradual weight loss (2). Metabolic changes, including increased energy use while at rest, contribute to the development of cachexia. The rate of increased energy use is high among cancer patients (3, 4). There is a direct connection between mortality and loss of both body weight and cell mass, especially among victims of cancer and AIDS (1, 5). Malnutrition affects a number of functions, including muscle strength, physical capacity and cognitive function, which in turn may affect ADL functions and quality of life.

The connection between cachexia and mortality has led to the assumption that preventive or remedial treatment of the condition can postpone or prevent death from cancer. However, there is no direct evidence that nutritional treatment of cancer-related cachexia prolongs life. It is conceivable that the relationship between cachexia and mortality reflects a link between weight loss and the severity of disease. If so, it is a different kind of link than that between weight loss and starvation, where the causal relationship is direct.

An alternative explanation is that the potential for influencing the development of cachexia with nutritional therapy depends on etiology. With cancer, there are often metabolic changes which accelerate loss of active cell mass or hinder its renewal. Compared with pure starvation, loss of active cell mass accounts for a larger portion of the weight loss associated with malignant illness.

Active nutritional treatment can yield weight gains in cancer patients, but these consist largely of increased fat reserves, and frequently of extracellular volume, but not of cell mass (6, 7). The unintended or absent effects of nutritional treatment for cancer may possibly result from systemic inflammation reaction of varying intensity, with associated catabolic effects on skeletal musculature, etc. At least one study has found that anti-inflammatory treatment can prolong the lives of patients with extensive metastasis (8).

Studies of nutritional treatment of cancer

The published literature includes at least forty studies that deal with the clinical effects of nutritional therapy on patients with cancer who have been treated with chemotherapy or radiation (9). Two reviews and analyses based on the data from many of these studies have been published (10, 11). These analyses concentrated on studies of parenteral nutrition therapy, and concluded that no positive effects could be demonstrated. The data also suggested that parenteral nutrition in combination with chemotherapy may lead to a higher risk of infection.

However, many of the studies analysed had major defects in both design and execution, as a result of which their relevance is questionable. The main criticisms concern the use of heterogeneous patient populations, the exclusion of patients with severe malnutrition (who could be expected to have the greatest benefit of treatment), and the inclusion of patients with normal nutritional status (who could be expected not to respond to treatment). Several studies involving diverse and non-comparable methods of cancer treatment also rendered interpretation more difficult.

The results of nutritional treatment have often been suboptimal with today's standard, one-sided use of parenteral nutrition, which often involves a higher risk of complications. Reliance on complications and mortality as the only end-points has been regarded as limiting, since they are less subject to influence by nutritional treatment than other factors such as functional capacity, growth (in children), and quality of life; however, there is a lack of data on such factors. Also, sample sizes have often been much too small to permit firm conclusions about clinically significant effects.

Chemotherapy

Eighteen randomized controlled studies have evaluated the use of parenteral nutrition in connection with chemotherapy for cancer (9). The treatment is typically administered for a short period (3–6 weeks), before or during chemotherapy. Nutritional treatment has usually led to increased body weight; but in most cases, physical constitution has not been assessed. One study found increased body weight, but loss of active cell mass and a physical capacity that was the same as the control group's (7).

Generally, there are few thorough evaluations of effects on physical constitution, functional capacity and quality of life. Most of the studies reported that risk of infections with parenteral nutrition increased to four times that of the controls, for whom there was no change.

Seven randomized controlled studies have evaluated enteral nutrition, administered either via dietary supplements or feeding tube (9). There were wide variations in the amounts administered, composition, length of treatment, and temporal relation to cancer treatment. No apparent improvements in survival rates, response to cancer treatment or complications of chemotherapy were observed. There are no randomized studies of artificial nutrition in the home environment, or which compare parenteral with enteral nutrition.

Radiation therapy

Contradictory results have been published regarding the effects of parenteral and enteral nutrition in connection with radiation therapy. The study samples have been small, and also heterogeneous with regard to diagnosis, nutritional status and other forms of therapy.

Four randomized controlled studies have investigated the clinical effects of parenteral nutrition in connection with radiation therapy (9). No clear differences in survival or therapy-related complications could be demonstrated.

Seven randomized controlled studies concerned enteral nutrition in connection with radiation therapy (9). The general finding was that oral or enteral nutrition resulted in less weight loss during radiation therapy, as well as fewer hematological and gastrointestinal side effects from radiation of the abdomen. One study found less weight loss and fewer complications in patients who received relatively lengthy enteral nutrition after combined treatment for upper gastrointestinal cancer. Another reported a greater frequency of complications in patients with tumours of the head and throat. No changes in physical constitution, functional capacity or quality of life were reported.

Bone-marrow transplants

Bone-marrow transplants entail severe catabolism, with relatively great loss of active cell mass. Many patients develop thick mucositis in the alimentary canal, necessitating parenteral nutrition. One study compared parenteral nutrition with hypocaloric liquid treatment (12). It found a distinct improvement in survival among those treated with parenteral nutrition, although only in combination with long-term follow-up. Another study compared enteral with parenteral nutrition, and found no difference in survival rates (13). Many patients in the enteral group received parenteral supplements due to limited gastrointestinal tolerance. Both studies found that body weight was maintained, compared with controls who received no treatment. But no assessment of physical constitution was made.

Three studies compared conventional parenteral nutrition with glutamine-supplemented TPN. Two of the studies reported positive effects, especially a lower rate of infection (14, 15). The third found no clear difference (16).

Palliative care

One important question has not been investigated with careful clinical studies – i.e. whether long-term nutritional treatment should be administered to cancer patients who can not maintain satisfactory food intake, due to illness or its treatment. It is possible that extra nutrition could prolong survival and improve the quality of life in some cases. But the available data are not sufficient to permit decisions about which cancer patients might benefit from long-term nutritional therapy.

Internationally, the use of parenteral nutrition for cancer patients in the home has increased substantially in recent years. The one-year survival rate is low, around twenty percent, but positive effects on functional capacity and quality of life have been established (17). Compared with

parenteral nutrition, enteral nutrition via ostomy results in fewer complications and is less costly. Further, non-controlled prospective and retrospective data indicate that long-term enteral nutrition via gastrostomy is easier to tolerate and can prolong survival (17, 18). No randomized controlled studies have been published, however.

Conclusions

Routine use of artificial nutrition does not reduce complications or mortality due to cancer among patients who undergo chemotherapy or radiation therapy (A). However, many published studies have defects which limit their clinical relevance (C).

For patients who are unable to eat, long-term artificial nutrition may influence survival rates and quality of life by maintaining liquid balance and nutrient supply (B). However, no randomized controlled studies of this question have been published.

Parenteral nutrition correlates with increased rates of infection in chemotherapy patients (A). It is possible that improved procedures for parenteral nutrition might reduce the rate of infection, but this has not been confirmed with controlled studies (C).

Parenteral nutrition in connection with bone-marrow transplants can improve long-term survival, but does not reduce the rate of infection (A). Glutamine supplements can reduce that rate (A).

Due to a lack of clinically relevant randomized studies, there is not enough information to form the basis of clear guidelines for clinical treatment of cancer-related malnutrition (C).

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

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7. Treatment of Malnutrition: Gastrointestinal Illness

Ingvar Bosaeus

Summary

In cases of short bowel syndrome, artificial nutrition administered either enterally or parenterally can prevent malnutrition and is essential to the survival of some patients. Systematic dietary treatment, substitution, and use of peroral rehydration solutions can reduce or eliminate the need of parenteral nutrition for some patients with short bowel syndrome.

Malnutrition and nutrient deficiency are common in patients with inflammatory bowel disease (IBD). Enteral nutrition probably has a therapeutic effect on Crohn's disease, but randomized controlled tests with placebos are lacking. Treatment of adults with steroids is more effective than enteral nutrition during attacks of Crohn's disease. Intestinal inactivity is not necessary to achieve remission, and does not improve clinical results.

The use of total parenteral nutrition has not been found to have any primary therapeutic effect on IBD. Nutritional treatment promotes growth in children with IBD and retarded growth. Malnutrition is common with advanced liver disease. Nutritional treatment improves indicators of liver function in patients with alcohol-related liver disease, but available data are not sufficient to permit a definite conclusion as to whether or not such treatment reduces morbidity and mortality in such cases. Treatment with branched amino acids has not been shown to improve encephalopathy, compared with conventional solutions of amino acids.

Short bowel syndrome

Loss of a large portion of the small intestine results in permanent malabsorption, the degree of which depends on the length of the remaining intestine, its potential for adaptation and proper function, and on whether or not the large intestine remains functional (1). Many patients who have undergone major intestinal resection require parenteral nutrition initially, until such time as the remaining intestine has adapted well enough to permit the transition to oral food.

Some patients with short bowel cannot survive without long-term parenteral nutrition, due to permanently insufficient absorption of nutrients,

salt and water. Patients whose small intestine is less than 100 cm in length, and have also undergone a jejunostomy or have a remaining jejunum of less than 50 cm with a functioning large intestine, usually require lifelong parenteral nutrition (2). Administered in the home, this type of therapy can improve functional capacity and physical constitution, and also facilitate social rehabilitation.

Treatment

Nutritional treatment is based on maximal use of remaining intestinal capacity by means of dietary adjustments and supplements, and compensation for losses of vitamins and minerals (2, 3). When this treatment does not suffice, it is supplemented with artificial nutrition, primarily enteral at night, and parenterally during the day as a secondary alternative. Peroral rehydration solutions are used to compensate for heavy losses due to ostomy.

Since parenteral nutrition is life-saving in this context, it has not been ethically possible to conduct controlled tests of this treatment. The main alternative method is small intestine transplantation, which is still being developed and, in cases of short bowel syndrome, still has a less favourable prognosis than long-term parenteral nutrition (4). In cases of life-threatening complications involving organs, especially liver failure, multiple organ transplants may be considered for individual patients.

Conclusions

Enteral and parenteral artificial nutrition can prevent malnutrition, and is essential to the survival of some patients with short bowel syndrome. [B].

Systematic dietary treatment, substitution and use of peroral rehydration solutions can reduce or eliminate the need of parenteral nutrition for some patients with short bowel syndrome [B].

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Inflammatory bowel disease

Malnutrition and nutrient deficiencies are common in patients with inflammatory bowel disease (IBD). The most important factors behind the development of malnutrition in connection with IBD are reduced food intake due to loss of appetite, unpleasant experiences while eating, malabsorption, and increased losses of nutrients from the intestines (5). Therefore, nutrition therapy is generally accepted as a supplementary treatment for IBD in order to prevent or rectify nutrient deficiencies. Extra nutrition nutritional support has been used as primary treatment for IBD in a variety of situations, but is more controversial.

Crohn's disease – enteral nutrition

Several randomized controlled studies have evaluated the clinical effects of enteral nutrition on Crohn's disease. In most of the studies, some type of nutritional treatment was compared with standard pharmacological treatment, in most cases with steroids. Some studies have compared various enteral preparations, in most cases elementary diet with peptides or whole proteins.

Most published studies provide little clear evidence, due to small samples, heterogeneous populations, incomplete cases, and variations in treatment. Three reviews and analyses of the literature in this area have been published (6–8). Their general conclusion was that the clinical effect of enteral nutrition was less than that of corticosteroids (0.35 pooled odds ratio, 95-percent confidence interval 0.23–0.53). The remission rate was sixty percent for nutritional therapy and eighty percent for steroids. There was often a large number of incomplete cases in the studies reviewed – as high as forty percent of patients randomly assigned to elementary diet.

It is not possible to determine whether enteral nutrition has a primary therapeutic effect on Crohn's disease, since there is a lack of randomized studies that have compared nutritional treatment with placebos. However, the reported remission rate of enteral nutritional treatment was around sixty percent, which is higher than the 20–40 percent previously reported for placebo control groups of other studies.

Crohn's disease – parenteral nutrition

Three of the reviewed studies evaluated parenteral nutrition and intestinal inactivity as treatment for Crohn's disease. These studies found that intestinal inactivity by itself did not increase the rate of remission, compared with peroral feeding or enteral nutrition; nor could any difference be observed upon follow-up (9–11).

Colitis (Crohn's and ulcerous colitis)

Two randomized controlled studies with small samples have compared intestinal inactivity and total parenteral nutrition with peroral diet as treatment for colitis (12, 13). There were no differences between the two groups with regard to the need for surgical or medical treatment. One randomized test compared TPN with enteral treatment for patients treated with steroids who were undergoing severe attacks of ulcerous colitis (14). No difference in remission rate or need of colectomy was observed between the two groups; but complications from treatment were fewer among those who received enteral nutrition.

Use of special nutrients

A growing interest in the possibility of modulating inflammation with polyunsaturated fatty acids has stimulated several studies of omega-3 fatty

acids and fish-oil preparations for the treatment of IBD. Randomized controlled studies have yielded contradictory findings regarding the prophylactic value of polyunsaturated fatty acids in the treatment of Crohn's disease (15, 16). Moderate effects have been reported for treatment of ulcerous colitis; it was also found that steroid doses could be reduced, but treatment alone was not adequate to sustain remission.

It is still not possible to draw any definite conclusions regarding the use of glutamine for IBD, due to insufficient knowledge. The use of enema with short chain fatty acids (SCFA) has not been effective in the treatment of pouchitis (17).

Gastrointestinal fistulas

There are no randomized controlled studies of parenteral nutrition and intestinal inactivity for patients with gastrointestinal fistulas. Nevertheless, the results of that method have probably improved treatment for fistulas, a condition previously associated with high mortality rates due to malnutrition, peritonitis, and loss of liquid and electrolyte. A retrospective analysis found lower mortality and improved clinical results among patients who received nutritional treatment (17).

Retarded growth in children with IBD

Retarded growth and delayed puberty are common among children with IBD, especially those with Crohn's disease. Several studies have found improvements in growth and the level of symptoms after enteral or oral nutritional treatment (17).

Conclusions

Enteral nutrition probably has a therapeutic effect on Crohn's disease, but randomized control studies with placebos are lacking. [B]

For attacks of Crohn's disease, treatment with steroids is more effect than enteral nutrition. [A]

The large number of incomplete cases due to limited tolerance restricts the usefulness of elementary diet for treatment of IBD. [A]

No differences in clinical results have been found for different types of enteral nutrition preparations. [A]

Intestinal inactivity is not necessary to achieve remission, and does not improve clinical results. [A]

Total parenteral nutrition has not been shown to have any primary therapeutic effect on IBD. [A]

Nutritional treatment promotes growth in children with IBD and retarded growth. [B]

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Liver disease

Malnutrition is common with advanced liver disease. Assessment of nutritional status is complicated by the disease's influence on nutritional variables such as albumin. One retrospective study found that malnutrition was related to the degree and to the clinical development of the illness (18). Improvements in nutritional status were correlated with reduced mortality, but no causal relationship could be established.

Alcohol hepatitis

Several studies have investigated nutritional treatment for alcoholic hepatitis in combination with steroids (19). A randomized controlled study compared the four alternatives of supplementary parenteral nutrition, oxandrolone, a combination of both, and no treatment. Child's score was improved with the combination, but there was no difference in mortality between the four groups (20, 21). Another study found that the combination of oxandrolone and enteral nutrition with branched amino acids had no effect on mortality (22).

Alcohol cirrhosis

For hospitalized patients with cirrhosis, several randomized controlled studies have found a positive correlation between enteral treatment and improvements in liver function, encephalopathy and Child's score (27). One study reported lower mortality after enteral nutrition with branched amino acids, compared with normal food (23). In this study, however, mortality of the control group was very high.

Acute hepatitic encephalopathy

Clinical effects of branched amino acids administered intravenously have been investigated in nine randomized studies that are the subject of a published review and analysis (11). Treatment with branched amino acids led to improvements in encephalopathy during periods of one-two weeks. Differences in mortality could be assessed, due to the great heterogeneity of the study sample. The results may also have been distorted by the design of the control group's treatment, which in most cases consisted of large amounts of glucose with no amino acids. Only one study compared branched amino acids with conventional amino acid solution, and it did not find any difference in results. No study has reported on long-term results.

Chronic encephalopathy

Contradictory results have been reported for the effects of branched amino acids in the treatment of chronic encephalopathy, compared with conventional sources of protein. The most comprehensive studies indicate positive effects of branched amino acids on protein tolerance and symptoms of encephalopathy (17).

Conclusions

Nutritional treatment improves indicators of liver function in patients with alcohol-related liver disease. [A]

There is not enough knowledge to clearly establish whether nutritional treatment reduces morbidity and mortality in patients with alcohol-related liver disease. [A]

Treatment with branched amino acids has not been shown to improve encephalopathy any better than conventional amino-acid solutions. [A]

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Acute pancreatitis

With acute pancreatitis, ingestion of normal food often causes severe abdominal pains and increases of amylase levels in the blood. Extra nutrition can only be supplied if it does not aggravate such symptoms. Stimulation of pancreatic secretions has been felt to cause increased pain and inflammation of the pancreas. Several studies have therefore investigated the effects of various kinds of nutritional treatment on exocrine secretions from the pancreas. The majority of those studies have found that parenteral nutrition stimulates pancreatic secretions only slightly or not at all (1). Intravenous fat emulsions are often tolerated, if hypertriglyceridemia does not develop. The effects of enteral nutrition on pancreatic secretions are not clear; contradictory findings have been reported.

Mild to moderate pancreatitis

Around 80–90 percent of patients with pancreatitis have mild to moderate forms of the disease. They do not appear to require any special therapy, and there is no evidence that artificial therapy alters the course of the illness (24). The few randomized controlled studies of this issue have not found any effect on the course of the illness with either parenteral or enteral nutrition (25).

Severe pancreatitis

Roughly 10–20 percent of pancreatitis cases are severe, with a high risk of complications. The affected patients have increased nutrition requirements, due to increased energy use and protein decay. Negative nitrogen balance with severe pancreatitis is correlated with increased mortality, but this may reflect the illness' severity rather than a causal relationship.

There are no randomized controlled studies that have evaluated the clinical effects of artificial nutrition on severe pancreatitis. Total paren-

teral nutrition has been evaluated in studies of limited evidential value. The safety and clinical effects of enteral nutrition are not sufficiently understood at this time (24). One study has reported good tolerance of enteral nutrition via catheter jejunostomy, but has also noted cases of fatal complications associated with the application of the jejunostomy (26).

Conclusions

Nutritional treatment has not been shown to alter the course of mild to moderate pancreatitis. [A]

With severe or prolonged pancreatitis, there is a need for nutritional treatment in order to impede the development of malnutrition. At this time, lack of knowledge makes it impossible to suggest guidelines for the design of this therapy, due to inadequate knowledge. [C]

Enteral nutrition can be tolerated by the jejunum. [A] But it is not known which supply channel (ventricle, duodenum. jejunum) or type of preparation (high-fat elementary or whole-protein diet) entails the lowest risk of complications.

Intravenous fat emulsions are tolerated, if hypertriglyceridemia can be avoided. [A]

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

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8. Treatment of Malnutrition: Surgical Procedures

Torsten Mossberg

Perioperative nutrition

Summary

Pre-operative parenteral nutrition administered to moderately-to-severely malnourished patients for more than five days can reduce the frequency of post-operative complications, but does not affect post-operative mortality. Surgical procedures should not be postponed in order to supply additional nutrition, except in cases of electrolyte disturbances and/or severe malnutrition of functional significance.

Pre-operative enteral nutrition via feeding tube can reduce post-operative complications in severely undernourished patients. But available research does not permit definite conclusions in this matter.

As an alternative to fasting, *pre-operative carbohydrate nutrition* the day before an operation can reduce post-operative insulin resistance. The clinical significance of this is being evaluated by studies currently in progress.

It is not certain that *post-operative parenteral nutrition* affects post-operative mortality; and if dosage is not adjusted to the patient's current energy use, it may increase the frequency of post-operative complications. With adequate nutrition at appropriate levels, there is no reason to abandon the established practice of administering TPN (total parenteral nutrition) directly after surgical procedures to undernourished patients who cannot ingest food orally or feeding tube.

Post-operative enteral nutrition early in the post-operative stage after surgery of the lower gastrointestinal tract is beneficial, especially in combination with optimal pain-mitigation (epidural anaesthesia) and early mobilization.

Post-operative dietary supplements reduce post-operative complications and reduce time in care for undernourished patients who have undergone surgery for fracture of the collum femoris.

Pre-operative phase

Question: Can pre-operative nutrition reduce post-operative complications and mortality in undernourished patients?

Background

Over sixty years ago, Studley discovered that pre-operative weight loss is directly correlated with post-operative mortality in patients who underwent ventricular surgery. The post-operative mortality of those who experienced a weight loss of twenty percent or more was as high as 33 percent compared with 3.5 percent among those whose weight loss was less than twenty percent (1). Since then, a number of published studies have reported a correlation between pre-operative malnutrition and post-operative complications/mortality. There has usually been a combination of malnutrition and severe illness, such as cancer. Nutritional treatment cannot be expected to influence outcomes if malnutrition, independent of type of illness, has no effect on post-operative development.

In hospital surgery departments, the rate of malnutrition can be as high as thirty percent (2). Undernourishment is associated with an increased rate of post-operative complications, regardless of changes in fat or protein metabolism, cell function, modulation of intracellular enzyme activity or impairments of immune system function. All of this may lead to loss of strength in skeletal muscles, including those of the respiratory system; it may also increase susceptibility to infection and slower healing of sores (3).

Over the years, a large number of studies have addressed the question of whether adequate pre-operative nutrition can reduce the rate of post-operative complications and post-operative mortality. The studies have been primarily concerned with the effects of parenteral nutrition, but also considered those of oral and enteral pre-operative nutrition.

Parenteral nutrition

A consensus report published in 1996 was based on an analysis of 29 randomized prospective studies of perioperative nutrition in which a total of 2,500 patients were involved (4). Thirteen of the studies concerned 7–10 days' pre-operative parenteral nutrition administered to slightly over 1,250 malnourished patients, most of whom had gastrointestinal cancer and were moderately-to-severely undernourished.

Assessments were based on weight loss, plasma proteins and prognostic index. Patients who received pre-operative TPN had ten percent fewer post-operative complications, the rate of which declined from forty to thirty percent. Only one study found reduced mortality, and no difference could be observed in the combined analysis of all studies. All of the studies reported unusually high rates of post-operative complication.

Table 1. *Pre-operative total parenteral nutrition(TPN), PRCT.*

Ref.	Authors (patient group)	No.	% Under nourished	Non-protein energy	Nitrogen g/kg/d	Fat kcal/kg/d	Days pre-op. TPN	Complications, TPN (%)	control (%)	P	Mortality control(%)	TPN (%)
(6)	Fan, (esoph.ca.)	40	77	>40	0.25	X	14.0	75.0	85	ns	30.0	30.0
(7)	Thompson, (G-I ca.)	21	100	40–50	0.3	X	6.0–14.0	11.1	16.7	ns	0.0	0.0
(8)	Muller, (G-I ca., fat)	105	60	32–46	0.24	13.5	7.0–14.0	32.2	37.0	ns	18.6	21.7
(9)	VA TPN (surg.))	395	100	45	0.30	5.3	7.0–15.0	24.6	25.5	ns	10.5	13.4
(10)	Bellantone, (mixed G-I)	100	37	30	0.20	9	>7.0	35.3	30.0	ns	3.9	2.5
(11)	Muller, (G-I ca. glucose)	125	80	40	0.24	0	7.0–14.0	32.2	16.7	<0.01	18.6	4.5
(8)	Muller, (G-I ca. glucose)	113	X	32–45	0.24	0	10.0	30.9	13.8	<0.05	20.0	6.9
(12)	Smith, (mixed G-I)	34	100	50–60	0.25–0.30	0	8.0–15.0	35.3	17.6	0.16	17.6	5.9
(13)	Heatly, (G-(esoph. ca.)	19	X	40	0.20	0	7.0–10.0	44.4	23.7	<0.05	22.2	15.7
(14)	Fan, (hepatocell ca.)	124	18	30	0.24	15	7.0	55.0	34.0	<0.0 215.0	15.0	7.8
(15)	Meguid, (G-I ca.)	66	100	35	0.16	0	8.0	56.0	31.3	<0.03	0.0	3.0
(16)	Bellantone, (mixed G-I)	100	100	30	0.20	9	>7.0	7.8	14.8	<0.001	2.2	1.8
(17)	Moghissi, (esoph. ca.)	15	100	34–36	0.18–0.20	7	5.0–7.0	80.0	0.0	<0.05	0.0	0.0
(18)	Von Meyenfeldt, (G-I ca.)	101	100	35–40	0.16–0.20	4	10.0–23.0	14.0	0.0	ns	4.0	4.0

X =No data.

Some patient subgroups experienced remarkably positive results. For example, one study of hepatocellular cancer found that pre-operative TPN reduced mortality by 7.2 percent. The most favourable results were experienced by patients with cirrhosis of the liver. Several reviews of the same material have arrived at similar conclusions (5).

There was wide variation in the effect on post-operative mortality, from increases of three percent to decreases of seven percent.

Several studies included in this analysis have involved TPN doses far in excess of patient needs, and in combinations that did not conform with current knowledge of metabolism in the undernourished (see Table 1).

Conclusions

Pre-operative parenteral nutrition administered to moderately-to-severely malnourished patients for more than five days can reduce the frequency of post-operative complications, but does not affect post-operative mortality [A].

Surgical procedures should not be postponed in order to supply additional nutrition, except in cases of electrolyte disturbances and/or severe malnutrition of functional significance.

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Enteral nutrition

Pre-operative enteral nutrition is a relatively seldom-used method for improving nutritional status prior to surgery. Two studies in three publications have compared pre-operative enteral nutrition with spontaneous food intake, and found that the incidence of post-operative complications tended to be lower in the group that received a controlled amount of food enterally (18, 19, 20). Shukla's study found a mortality reduction from twelve to four percent. Mejerink's study of gastrointestinal cancer found a significant reduction of so-called major complications in undernourished patients who lost more than 500 ml blood during surgery (Table 2).

Conclusions

Pre-operative enteral nutrition via feeding tube can reduce post-operative complications in severely undernourished patients. The available research is not sufficient to permit definite conclusions [B].

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Table 2. *Pre-operative enteral nutrition (EN), PRCT.*

Ref.	Authors	Patients		Treatment	Comp-lications (%)		Post-op. mortality (%)	
		Illness	No.		EN	Controls	EN	Controls
(18)	von Meyenfeldt	Ventricular & colorectal cancer	101	10 days' oral feeding	12	14	8	4
(19)	Shukla	G-I, breast, oropharynx cancer & benign tumours	110	10 days' enteral feeding	10	37*	6	12

* P <0,05

Pre-operative oral carbohydrate nutrition

O. Ljungqvist and his associates have published a number of studies in which patients received carbohydrate drinks orally before surgery instead of fasting. Post-operative insulin resistance was less, and patients' well-being increased. There was a significant relationship between post-operative insulin resistance and time in care (21, 22). Preliminary results indicate that pre-operative oral carbohydrate nutrition can reduce time in care, suggesting that it may be more beneficial than pre-operative fasting.

Post-operative period

Parenteral nutrition

The standard recommendation in Sweden is that complete intravenous nutrition to undernourished patients following surgery should be started as soon as their conditions are stable, usually on the second post-operative day. On the basis of nine randomized prospective studies, involving over 700 moderately undernourished patients, of whom most were diagnosed with gastrointestinal cancer, it has been concluded that early TPN increases the risk of post-operative complications by roughly ten percent (an increase from thirty to forty percent). Mortality is not affected (4).

Another major study found a slight reduction of mortality and mild-to-severe post-operative complications in patients with gastrointestinal cancer who received both pre- and post-operative TPN (23). The control group received pre-operative oral diet and post-operative hypocaloric parenteral nutrition. It is difficult to evaluate this study, as only preliminary results are available Among other things, probable causes of post-operative deaths have not been reported. Somewhat more positive conclusions were drawn by two previous reviews and analyses, which found that perioperative parenteral nutrition tends to improve clinical results (24, 25).

Four of the nine studies noted above have not indicated whether the patients were undernourished (4). Most of the studies involved doses of TPN far in excess of patient needs, and in combinations which did not conform with current knowledge of post-operative metabolism. All of the studies but one involved total energy amounts of 30 kcal/kg. Intravenous nutrition in quantities that exceed the requirements of basal metabolism may lead to complications such as fever and liquid retention.

Nothing in the available literature suggests that Swedish health care should abandon its established practice of administering TPN directly after surgery to patients who cannot ingest food orally or via feeding tube. The basic precondition of positive results and few complications is that nutrient levels are adjusted to the patient's current needs. (Table 3).

Conclusions

There is no clear evidence that early post-operative total parenteral nutrition reduces the post-operative mortality of undernourished patients; and if dosage is not adjusted to the patient's current metabolism, it may increase the frequency of post-operative complications. With adequate doses in suitable amounts, there is no reason to abandon the established Swedish practice of supplying TPN directly after surgery to patients who cannot ingest food orally or via feeding tube [A].

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Enteral nutrition

Early post-operative enteral nutrition is applied with increasing frequency, and it has yielded good results when used in combination with pain-mitigating techniques such as epidural anaesthesia (35). A review of nine prospective randomized studies which compared early post-operative enteral nutrition with standard treatment found no difference in morbidity, mortality or time in care (36).

Two recently published studies of patients who had undergone surgery of the upper gastrointestinal tract found no improvement in the frequency of complications after early enteral nutrition (37). One of the studies reported that post-operative lung function became worse in the group receiving treatment (38). Reduced incidence of post-operative infection was observed in a study of enteral nutrition following surgery of the lower gastrointestinal tract (39). These results can be interpreted as indicating that (a) patients who undergo surgery of the lower gastrointestinal tract derive greater benefit from enteral nutrition than those who undergo sur-

Tabell 3. *Post-operative total parenteral nutrition (TPN), PRCT.*

Ref.	Authors (Patient group)	No.	% Under nourished	Non-prot. energy	Nitrogen	Lipid	Post op. TPN	Complications			Mortality	
				kcal/kg/d	(g/kg/d)	(kcal/kg/d)	(days)	Control (%)	TPN (%)	P	Control (%)	TPN (%)
(26)	Abel (Heart)	44	100	16–25	0.11	0	>9	29.2	80	<0.001	12.5	20
(27)	Brennan (Pancr. ca.)	117	100	30–35	0.15	10	12	22.8	45	<0.02	1.8	6.7
(28)	Preshaw (Colectomy)	47	X	40	0.16	6.4	5	17.4	33	ns	0	0
(29)	Sandström (General)	300	23	29	0.27	8.6	9	16	27.3	<0.05	6.7	8
(30)	Woolfson (GI/GU ca.)	122	X	35	0.2	4	>6	6.7	9.7	ns	13.3	12
(31)	Holter (GI ca.)	56	100	30	0.2	0	10	19.2	13.3	ns	7.6	6.6
(32)	Jensen (Rektal ca.)	20	X	40–50	0.24–0.32	0	6	40	10	ns	0	0
(33)	Collins (Colectomy)	20	40	37	0.23	0	13	90	20	<0.01	0	0
(34)	Reily (Liver transpl.)	28	X	35	0.24	6.2	7	X	X		20	5.6

X = No data.

gery of the higher tract, or (b) that enteral nutrition in such cases results in fewer complications in, for example, respiratory passages.

Conclusions

Early post-operative enteral nutrition yields benefits, especially when used in combination with optimal pain-mitigation (epidural anaesthesia) and early mobilization. The results are most certain for surgery of the lower gastrointestinal tract. [B]

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Peroral dietary supplements

Several studies have found that post-operative dietary supplements have positive effects on the frequency of post-operative complications. In one study of patients recovering from gastrointestinal surgery, those in the experimental groups received dietary supplements, while the control group was given a normal post-operative diet (40). Compared with the control group, the experimental group experienced a significantly lower rate of complications, increased muscle strength and less fatigue.

In one study, 54 patients who had undergone moderate-to-major gastrointestinal surgery were assigned at random to two groups: One received normal post-operative diet, the other received the same diet plus oral dietary supplements. The average daily energy intake of the latter group increased by about 700 kcal. Those patients maintained their pre-operative weight and had a significantly lower incidence of severe infectious complications than the controls (41).

Two randomized studies have found that dietary supplements administered to undernourished elderly women following surgery for fractures of the collum femoris experienced briefer times in care and fewer complications than patients who received only standard hospital food (42. 43).

These issues are discussed in greater detail in Part II, Chapter 5, which deals with chronic non-malignant illness.

Conclusions

Post-operative dietary supplements reduce the frequency of post-operative complications from gastrointestinal surgery. This is most evident in patients operated for fracture of collum femoris [A].

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

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9. Nutrition and Intensive Care

Torsten Mossberg

Summary

The seriously ill intensive-care patient, with trauma, sepsis, and failure of the lungs and several other organs, is both catabolic and hypermetabolic. This leads to the rapid development of malnutrition, with heavy losses of body mass and deterioration of all organic functions.

Randomized controlled studies have not found that either TPN or enteric nutrition (including immunonutrition) has any affect on mortality. This applies to patients with a moderate level of illness.

The addition of glutamine and branched amino acids can have a positive effect on mortality. Early enteric nutrition, especially immunonutrition, can reduce the frequency of septic complications in otherwise healthy patients being treated for multiple trauma.

The lack of any data to indicate that nutritional treatment influences morbidity and mortality does not mean that such treatment is of no value. The principal objective is to prevent starvation in catabolic patients.

Effective pain-mitigation with, for example, epidural anaesthesia is essential for alleviating catabolism.

Head injury

Early nutritional treatment of patients with head injuries has positive effects on both mortality and time in care. Supplied enterally.

Obstructive lung disease

Enteric nutrition is the preferred treatment for breathing insufficiency or acute exacerbation of chronic insufficiency. There is no consistent evidence that the proportion of fat in the energy supply should be higher than in the normal diet. Adjustment of the total energy supply to the patient's current metabolism is more important than the balance between fat and carbohydrate. There are no studies of mortality and infection in intensive care situations.

General intensive care, trauma and sepsis

Background

The seriously ill intensive-care patient, with trauma, sepsis, and failure of the lungs and several other organs, is both catabolic and hypermetabolic. This leads to the rapid development of malnutrition, with heavy losses of body mass and functional deterioration of all organs, including the lungs, heart, visceral organs and immune system. There are also negative effects on healing of sores, among other things.

Such patients often develop sepsis, but it is seldom possible to locate a focal point. This condition is called systemic inflammatory response syndrome (SIRS). If the damage is extensive, with heavy loss of body mass and failing immune response, the next stage is multiple organ failure (MOF).

In recent years, extensive reviews and analyses of the available literature have attempted to assess the value of nutritional treatment for the critically ill. The material is highly varied, however, and it is difficult to draw any conclusions.

One study of critically ill patients reported that energy-intake objectives were attained in only three of 35 cases, and protein-intake objectives in only four of 35 cases. In half of the cases, only eighty percent of the energy objective was attained, and only seventy percent of the protein objective (8).

Treatment objectives

The primary objective of nutritional treatment in intensive care is to prevent the starvation of catabolic patients and thereby impede the reduction of cell mass.

Question: Does enteral or parenteral nutrition affect morbidity or mortality in critically ill patients?

Parenteral nutrition

Klein et al included critical illness in their analysis (4). Heyland published two extensive analyses in 1998 (1, 2). The American College of Chest Physicians has published a consensus report (3).

By themselves, most studies are too limited in scale to provide a definite answer to the foregoing question. Heyland's analysis concerns 26 randomized controlled studies of surgery patients (some are also included in the perioperative material referred to above). They included recipients of liver transplants and patients with pancreatitis or severe burns. They should be regarded as post-operative, and not as intensive-care patients with failure of vital functions.

These studies compared TPN with standard treatment (oral or clear liquids). Taken together, a varied assortment of studies has not found any difference in mortality between various experimental and control groups. An analysis of studies that have reported serious complications reveals a tendency for TPN to reduce the level of complications. Studies conducted prior to 1968 were more likely to find lower mortality than those published from 1968 onward; the earlier studies were usually of poorer quality.

A study by Griffiths et al. showed that TPN with glutamine additives decreased mortality, as surveyed at six months after the end of the care period during which treatment was administered (4). The use of TPN with glutamine peptides following abdominal surgery was the subject of a randomized double-blind controlled study by Morlion et al. who found that the treatment improved nitrogen balance, and reduced time in care by an average of 6.2 days compared with the control group (5).

An RCT study of parenteral nutrition with glutamine supplements, administered to a group of patients with a variety of diagnoses, could detect no difference in infectious complications or time in care. Only for surgery patients were glutamine supplements associated with a significant reduction of time in care (6). Recent studies have found that additives of branched amino acids increase the survival rate of patients with sepsis (7).

Enteral nutrition aand immunonutrition

Adam and Batson have described the difficulties associated with enteral nutrition for patients in intensive care who received, on average, 76 percent of prescribed diet (8). Gastrointestinal dysfunction compelled interruption of treatment in 23 percent of cases. Several other studies have reported that the objectives of nutrition therapy were not reached in many cases; as many as one-third of the patients did not receive prescribed amounts of nutritional solutions (9,10).

Several studies have investigated the effects of enteral nutrition, especially immunonutrition, additions of nucleotides, n-3 fatty acids and arginine. Several studies have found a reduction of sepsis-related complications, particularly in young patients with multiple trauma. Atkinsson et al. found that, for example, ventilator hours could be reduced for severely ill intensive-care patients who tolerated (sic) early enteral immunonutrition (11). Mortality was not affected.

An extensive review of current literature on enteral nutrition for critically ill patients was published in both *Intensive Care Medicine and Clinical Nutrition* (12).

Houdijk *et al.* published in 1998 a randomized study of glutamine-enriched enteral nutrition for patients with multiple trauma; it was not designed to detect any differences in mortality. The group treated with glutamine had a lower frequency of infectious complications (13).

A review and analysis of eleven randomized controlled studies which compared enteral nutrition including special additives (immunonutrition) with standard enteral nutrition administered directly to critically ill patients and cancer patients was published by Heys et al. in 1999. The analysis found a lower frequency of infectious complications and shorter time in care among those who received immunonutrition, but no differences in mortality or the rate of pneumonia (14).

On the basis of these prospective randomized studies of enteral nutrition for severely ill patients, it may be concluded that such treatment has yielded promising results and that a large portion of the data suggest a positive effect, especially on immunological function. But the results also indicate that the treatment does not reduce the frequency of mortality or serious infection, such as that associated with pneumonia.

Pharmacological manipulation of metabolism

The supply of food, alone, is not sufficient to maintain the body cell mass of the critically ill. There have been many attempts to influence the course of illness with various kinds of pharmacological manipulation. The most frequently tested substances are human growth hormone (HGH) and insulin-like growth factor 1 (IGF-1). HGH and its derivatives have been shown to function well in patients without failure of vital functions, but less well in the critically ill. The preliminary findings are that many good results have been achieved with, for example, increased protein synthesis and lipolysis, which has led to increased access to energy substrate (15).

One multicentre study of HGH for critically ill patients at an early stage increased mortality in the experimental group (16). The anabolic effect of HGH is mediated by IGF-1 which is produced by the liver, a process that is impaired in the seriously ill. Administration of IGF-1 to the critically ill partially restored the decreased levels, but at the same time lowered HGH levels (17).

As yet, there have been no studies to define the role of manipulation of metabolism with HGH and IGF-1 in cases of severe illness.. Simpler treatments have been shown to improve protein economy, especially if combined with continuous epidural anaesthesia.

Conclusions

Prospective Randomized studies have found no positive effects of enteral or parenteral nutrition (including immunonutrition) on mortality [B]. Note that this applies to patients with moderate levels of illness.

Additives of glutamine and branched amino acids can reduce mortality [A]. Early enteral nutrition, especially immunonutrition, can reduce sepsis-related complications in otherwise healthy patients being treated for multiple trauma [B].

The lack of any data to indicate that nutritional treatment influences morbidity and mortality does not mean that such treatment is of no value. There are no studies designed to provide answers to the questions raised above.

Effective pain-mitigation with, for example, epidural anaesthesia is essential for alleviating catabolism.

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Special intensive care
Respiratory insufficiency

Background

Up to seventy percent of patients with chronic respiratory insufficiency who require the use of a ventilator are undernourished (18). Patients with acute lung damage develop malnutrition during care, due to severe catabolism. Malnutrition leads to reduction of diaphragm muscle mass in proportion to body weight.

Question

Does nutritional treatment during care have any effect on infection, time in care or mortality?

An increased supply of carbohydrates leads to increased production of carbon dioxide. Theoretically, an unbalanced diet consisting largely of carbohydrates may increase the likelihood that the patient will require the use of a ventilator at an earlier stage, or become dependent on such treatment, once begun.

A number of studies have investigated the significance of fat-enriched, carbohydrate-poor diet. Al-Saady et al. found that patients who received such a diet experienced a reduction of carbon dioxide pressure (paCO2) of sixteen percent compared with the control group, and an average reduction of 62 hours in the use of a ventilator (19).

In another study, however, Van den Berg could not find any difference in ventilator time, despite a reduction of carbon dioxide levels (20). It appears that adjustment of energy supply to the patient's current metabolism is a more significant factor in determining ventilator time than the balance between fat and carbohydrates (18). Enteral nutrition usually produces good results; patients who receive it seldom experience any difficulty with intestinal function. There are no studies of infection and mortality in intensive-care situations.

Conclusions

Enteral nutrition is often feasible, and is the preferred treatment. There is no consistent evidence that the amount of fat thus supplied is greater than with normal diet. Adjustment of energy supply to the patient's current metabolism is a more significant factor than the balance between fat and carbohydrates. [B] There are no studies on the frequency of infection and mortality in intensive-care situations.

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Akut pancreatitis

See part II, Chapter 7, on the treatment of malnutrition in cases of gastrointestinal illness.

Head injury

Background

Patients with head injuries have very high energy use; increases of 135–200 percent have been measured. Patients can be hypermetabolic, with steadily increasing nitrogen production or up to four weeks. The addition of glucose leads to uncontrolled increases of blood sugar, which in turn leads to increased formation of lactate on the periphery of the brain damage (21).

Question

Can active nutritional treatment in the post-traumatic phase affect morbidity and mortality in patients with head injuries?

There have been several reviews of the literature on this question, the conclusions of which can be summarized as follows:

Enteral nutrition should be used, since the intestines often function properly in cases of brain injury. Delayed ventricle discharge should be

observed. As it is especially important to overcome post-traumatic glucose intolerance in head-injury patients, the diet should include a large proportion of fat (22, 23).

Early TPN, i.e. within 48 hours of injury, reduces mortality in cases of head injury (24).

Conclusions

Early nutritional treatment has positive effects on both mortality and time in care. [A]. Supplied enterally.

[A] = Based on results of randomized controlled studies, or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies, or consensus statements of experts on the subject.

Acute kidney failure

Acute kidney failure results in the accumulation of urine substances in the organism, which intensifies catabolic processes. Continuous haemofiltration is now used to remove waste products, making it possible to supply adequate nutrition. With haemodialysis, the dialysis membrane may become catabolic and further increase nutritional requirements. There is a lack of prospective controlled studies of the effects of nutritional treatment on morbidity and mortality.

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10. Enteral and Parenteral Nutrition in Perioperative & Intensive Care

Torsten Mossberg

Summary

When the patient's intestines are functional, they should be used for supplying nutrition. A comparison presupposes a choice of alternatives. Such a choice is often possible in post-operative care, and in the treatment of patients with breathing difficulties, head injuries, etc.

Comparisons of enteral nutrition with parenteral nutrition have not detected any differences in the frequency of infection or mortality, in either perioperative or in intensive care. Due to enteral nutrition's trophic effect on intestinal mucous membranes and the reduced risk of complications, it should always be considered as the principal alternative.

Background

When the patient's intestines are functional, they should be used for supplying nutrition. Nevertheless, there has been a lively discussion as to whether enteral or parenteral nutrition should be used. A comparison presupposes a choice of alternatives. A choice of supply channels is possible with many patients in the pre-operative stage, as well as many post-trauma patients with head injuries, breathing insufficiency, and following (primarily) gastrointestinal surgery.

Experiments with animals have found that trauma and infection can lead to intestinal atrophy and increased permeability of the mucous membranes. Translocation of bacteria and endotoxins can, in animal models, initiate a general inflammatory reaction and cause multiple organic failure (MOF). There is little or no evidence that the same phenomenon occurs in humans. However, multiple organic failure can be triggered by intestinal ischemia without any translocation. The supply of food, orally or enterally, has a trophic effect, and stimulates growth of mucous membranes and motility in the alimentary canal; but it also requires adequate blood flow in the intestines.

Question

Is there a difference in post-operative complications or mortality between patients treated with enteral nutrition and those treated with parenteral nutrition?

Perioperative phase

Pre-operative

Two studies have compared pre-operative enteral and parenteral nutrition for malnourished patients (1, 2). Neither study found any effects on post-operative complications or mortality.

Post-operative

No definite conclusions can be drawn from the ten relatively small, randomized studies reviewed by Lipman (3). Most of the studies found no significant difference in morbidity or mortality. Sand studied patients who had undergone gastrectomy due to cancer, and found no differences in post-operative complications or time in care (4). Gianotti and Brag have conducted studies of pancreatic and ventricular surgery, comparing the three alternatives of standard enteral nutrition, immunonutrition and parenteral nutrition (5). No differences in the frequency of complications of infection were found between the standard diet and TPN.

Intensive care

A meta analysis of this area found that, compared with other methods of treatment, more patients who received TPN developed post-operative complications of infection (6). However, this applied only to patients with abdominal trauma. The treatment of those who received enteral nutrition was interrupted significantly more often due to gastrointestinal intolerance. A study by Kudsk also found that TPN patients developed more complications of infection than did those who received enteral nutrition (7). But this applied only to patients with severe trauma. Several small-scale studies found no difference in frequency of infection or mortality for the different methods of treatment.

As early as 1988, Cerra investigated the question of whether or not enteral nutrition could influence the development of multiple organic failure in post-operative patients with sepsis (8). There was no observable change in mortality or in the number of patients who developed multiple organic failure. Eighty percent of those who received enteral nutrition developed diarrhoea, compared with 26 percent of the patients who received parenteral nutrition.

An extensive review of current literature on enteral nutrition for critically ill patients has been published in both Intensive Care Medicine and Clinical Nutrition (10). It underlined the advantages of enteral nutrition, including the trophic effect on intestinal mucous membranes and the reduced frequency of complications. It also offered recommendations concerning administration of the treatment, and noted the mounting evidence that time in care can be reduced with immunonutrition.

Head injury

Five prospective controlled studies reviewed by Lipman found no significant advantage of enteral nutrition over parenteral nutrition (3). Two studies found significantly lower mortality among those receiving TPN. In an analysis based on some of the same material, Heyland arrived at an identical conclusion (9).

Conclusions

Comparisons of enteral and parenteral nutrition have found no significant difference, either in the perioperative stage or during intensive care, in the frequency of infection or mortality [A]. Due to enteral nutrition's trophic effect on intestinal mucous membranes and the lower risk of complications, it should be considered as the principal alternative.

[A] = Based on results of randomized controlled studies. or reviews and analyses of these.
[B] = Based on results of non-randomized prospective, retrospective or case-control studies of good quality.
[C] = Based on results of non-controlled studies. or consensus statements of experts on the subject.

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