

MeritCare Medical Center

Aunt Cathy's Guide to:

Nutrition for People with Epidermolysis Bullosa



Aunt Cathy 2008

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Epidermolysis bullosa is a family of genetic diseases that primarily affect the health of body surfaces including the skin, the mouth and the digestive system. Skin is extremely fragile and easily blistered from even minor trauma or friction. The degree of severity is quite variable and nutrition concerns will vary with the degree and type of injury. This paper is a summary of my presentation at the 2006 National DEBra Patient Care Conference in Nashville. (DEBra is the Dystrophic Epidermolysis Bullosa Research Association of America.) I have arranged the issues with a problem-solving focus, with the needs of the most seriously affected people in mind. Many issues overlap, so various aspects of important issues may be discussed in several places within the paper.

The general suggestions made here are intended to be of use to patients and their families with the approval and assistance of their health care professional and not in isolation. They are based on my very best guess about what aspects of normal and therapeutic nutrition might be especially helpful or important for people with EB. My best guesses are based on the most recent scientific literature and by what I would do to optimize the health of a family member fighting these battles. Please note that I do not sell anything and I never will. There is very little EB-specific nutrition information available in the scientific literature, so the recommendations are primarily based on the role of nutrition in managing wound healing, inflammation, constipation, dental problems, anemia, osteoporosis, and other conditions associated with EB.

Some parts of this paper may focus on issues for infants and children, but in almost all cases the information or concepts will apply to adults as well (so don't skip over the "kids" parts. ☺) Although this paper was written primarily for people who have EB and their families, you will find that some parts will be primarily of use to the health care professionals. I included this information not to "blind you with science," but because I want to be sure that the underlying scientific principles are clear enough to let people use the information creatively to solve new problems that may arise.

You may share this paper with anyone, but please do not alter it in any way. Copies can be downloaded for free along with other articles cited here from MeritCare's website. Go to www.meritcare.com and type my name in the search box. You can then click a button that says "Cathy Breedon's Handouts." My sincere hope is that you will find some useful information here and that you will share it with others who may benefit. And now . . .

1. Getting enough calories

People with severe EB often have higher than usual needs for energy

(calories.) In part this is because of the need to continually heal wounds. At the same time, they may have decreased ability to take in food because of difficulty with eating due to oral problems. These may include decreased ability to open the mouth wide, blisters in the mouth, esophageal strictures, or significant dental problems. Many people with EB struggle with constipation, which can greatly decrease appetite. As a result, as children they often fail to grow optimally and at any age the ability to heal wounds and to be active can be impaired. Their intake of vitamins, minerals and protein can also be compromised by poor total food intake. This leads to poor immune function, inadequate energy to participate in activities, additional compromise of skin integrity, impaired wound healing, anemia and other problems.

Increasing the calories of formulas for infants usually involves concentrating the product to make a higher caloric density. For example, using only 9 oz of water instead of the usual 13 oz when preparing a 13 oz can of infant formula concentrate will make the formula have 24 calories per ounce instead of the usual 20. The nice thing about this approach is that it provides ALL nutrients in higher amounts (not just calories,) it does not distort the ratios of nutrients per calorie, it contributes no additional cost, and it is safe to use. Sometimes fat or carbohydrate calories will still need to be added, but these should generally be used only to add calories beyond the 24 calories per ounce concentration. Infants would rarely if ever be fed a product with more than 30 calories per ounce. How to increase calories beyond the 24 calories per ounce mixture described above should be determined with the help of a person familiar with these issues, as there are sometimes important reasons to use one additive over another in a particular child's case.

Boring Science Alert:

This next section will likely be of interest only to health care professionals, and probably not even to them. But if I don't include the explanation they might not trust trying it. ☺

Everyone else gets to skip to page 5.

Issues and suggestions for increasing an infant's formula to 25 - 30 calories per oz when necessary.

Sometimes some oil or carbohydrate is used to add additional calories above the 24 calories per oz level. This is because if lots more protein is taken in than is needed, the nitrogen waste from the excess protein may be more than the kidneys can easily handle. Unlike extra protein, neither oil nor carbohydrate contribute to this “(potential) Renal Solute Load” (RSL) – the work the kidney has to do if all the nitrogen in that protein had to be excreted. As a rule of thumb, this number should (ideally) be around 300 mOsm (particles) per kg of water available to excrete the waste through the kidney, especially in the first three months of life. Maturity of kidneys reduces the risk of this problem. **Note, however, that the Potential Renal Solute Load of a product becomes much less important for an infant**

who is growing or who is continually trying to heal wounds. This is because the protein nitrogen consumed (the biggest contributor to RSL) will be most likely be used to make tissue rather than needing to be excreted as a waste product.

Carbohydrate can contribute quite a lot to the “osmolality” of a feeding (the number of tiny particles floating in the amount of water available in the intestine (not in the kidney.) The same ≤ 300 mOsm per kg water (or expressed as “osmolarity” – 300 mOsm *per liter of formula*) is the rule of thumb. However, people concerned about an osmolality of a feeding being over 300 will be comforted to know that the reason it is set there is because sometimes higher osmolalities may contribute to looser stools and even result in an “osmotic diarrhea” in some infants.

However, for infants troubled by constipation, this effect can actually be helpful! The higher number of particles *per volume* (the osmolality) of a formula tends to attract water which helps keep water in the intestines to keeps stools softer. Many constipation treatments work the same way, like milk of magnesia, lactulose, Miralax® (Baintree Labs) and prune juice. For example, the **osmolarity of regular prune juice is reported in some references as being 800-1265 mOsm/liter!**

For all of these reasons, it can be reasonable to consider a different approach to increasing the caloric density of an older infant’s formula (or some of a younger infant’s formula) in a somewhat nonstandard – but maybe a better – way, especially for an infant with constipation and wounds to heal. **Instead of adding all those empty calories from fat and carbohydrate to a 24 calories/oz infant formula to make it have 30 calories per oz., consider using a mix of infant formula with some of a “complete nutrition” type of liquid formula designed for children.**

Most “complete nutrition” formula products for people ages one through adulthood provide 30 calories per ounce. With appropriate professional supervision these products can also be useful for helping children younger than one year, although they are not marketed for this use. For example, nutrition professionals will be interested to know that the Renal Solute Load and the Osmolality of the products designed for children are quite comparable to the levels found in infant formulas, especially when the infant formulas have needed to be concentrated to a higher calorie level per oz. The reason that they are not marketed for use with older infants is related primarily to the considerable cost of submitting and getting the products “approved” to be called infant formulas, and the fact that the companies would then be competing with their own infant-focused products in that age-group.

Table 1. on the next page will be especially likely to be of interest only to health care professionals. It shows a sample of the osmolality and potential renal solute load of some of the products made by major manufacturers compared with one of their own standard infant formulas at different caloric densities. The osmolality and renal solute load of infant formulas concentrated to 24 kcal/oz plus additional carbohydrate or fat calories to make a 30 kcal/oz feeding is not much different from the better-tasting children’s products, and the children’s products provide considerably more protein. They also contribute important vitamins and minerals not provided by carbohydrate and oil additives.

Of course, it is always important to review the entire feeding regimen for appropriateness of all nutrients. For infants and children length and weight growth progress can serve somewhat as markers that intake of calories and protein is likely too low, adequate, or excessive. Growth alone, however will not necessarily detect inadequacies of many other nutrients that have less of a direct effect on calorie and protein utilization. Also, the use of standard growth charts can be helpful in charting a child's growth against his earlier measures, but the grids themselves may not reflect what is typical or ideal or even possible growth for a child with severe EB.

Table 1: The protein content, osmolality and potential renal solute load of some of the “complete type” children’s liquid formula products made by major manufacturers compared with one of their own standard infant formulas at different caloric densities. *

Company		Calories per oz	Protein grams per oz	Osmolality mOsm/Kg (usual goal <300 ideally)	Potential Renal Solute Load mOsm/Liter (usual goal <300 ideally)
Mead Johnson	Children’s Product Kindercal®	30	0.89	440-520 vanilla/choc 345 tube feeding	270
	Infant Product Enfamil®	20 ----- 24 ----- 30	0.42 ----- 0.50 ----- 0.50	300 ----- 360 ----- higher with added carbohydrate	181 ----- 217
Nestle	Children’s Product Nutren Jr®	30	1.0	350	204
	Infant Product Good Start Supreme®	20 ----- 24 ----- 30	0.42 ----- 0.50 ----- 0.50	265 ----- 318 ----- higher with added carbohydrate	135 ----- 162
Ross	Children’s Product PediaSure®	30	1.0	430	276
	Infant Product Similac®	20 ----- 24 ----- 30	0.47 ----- 0.56 ----- 0.56	300 ----- 360 ----- higher with added carbohydrate	187 ----- 224

*Values from the Baylor Pediatric Nutrition Handbook for Residents 2003

Back to everybody:

Many of the substances added to foods or formulas to add calories can seriously distort the nutritional balance unless the protein, vitamins and minerals are carefully adjusted. For example, corn syrup, sugar, glucose polymers products like Polycose® (Ross), butter/margarine, cream, regular vegetable oil, MCT oil® (Mead Johnson/Novartis), and emulsified fat products like Microlipid (Mead Johnson/Novartis) and Intralipid® (Pharmacia & Upjohn) all have one thing in common. **They all just add empty calories.** In small amounts there is no concern, but if a significant percentage of the person's calories is contributed by these products there is potential for distorting the ratio of calories relative to the nutrients needed to metabolize them.

People trying to grow or to heal wounds will have higher needs for all nutrients, not just generous calories and protein. In this situation it is important to recognize that just adding protein and/or calories will not work well in the absence of the critically important vitamins and minerals that the body needs to convert fuel (calories) to make usable energy, and/or to construct tissues. This is key in conditions that require extra production of tissue, such as wound healing and have an increased need for immune system activity. Interestingly, skin, intestinal, and immune system cells are the ones with the greatest need for rapid growth. Failure to assure adequacy of micronutrients can make other efforts unsuccessful.

Unfortunately, this issue often does not get the attention it deserves and it is not uncommon for people to be given calories-only or protein-only supplements without assuring adequacy of the necessary vitamins and minerals to use the protein. Also, giving just protein in the absence of adequate calories will result in the protein being burned as an energy source instead of using it for construction. I think of this as like living in North Dakota in the winter: if we run out of fuel we start burning the furniture! Most nutrients have many additional important roles, some of which will be described further a bit later.

One should keep in mind that the usual recommended amounts of calories and nutrients such as the RDAs or RDIs are based on the needs of “most healthy people.” They do not address the needs of people with illness or other health conditions. The health care professionals will need to think through the particular challenges of an individual's situation and make adjustments in goals accordingly. A good example is **zinc**, a mineral needed in over 200 different places in a person's body. Every time we try to make a new cell, we need zinc to make the DNA in the center of it. **That means that people who need to make a lot of new tissue will need a more generous intake of zinc.**

Poor zinc status impairs growth in children, and it limits the ability to heal wounds – another situation that requires a lot of new tissue formation. Recovery from wounds and staying healthy in general also depend on adequacy of zinc because **the production of T-cells of the immune system is very dependent on adequate zinc.** At the same time, **excessive amounts of zinc can cause problems.** Determining the right amount requires a close look at the individual's situation.

2. How much zinc?

Some recommendations for zinc intakes needed for healing serious burns in hospitals have been about the same on a “per body weight” basis as the levels recommended for healthy infants. [For example, the RDA tables show 5 mg zinc for a baby with an average weight of 9 kg (about 20 lbs.) Using that ratio of 5-to-9, the zinc for a 90 kg (198 lbs) man would be 50 mg, which happens to be a very typical supplemental dosage for healing serious wounds.]

This is not surprising since both the injured person and the infant are trying to produce a lot of cells in a hurry. It led me to think the best nutritional model for optimal wound care would be to “**baby the wound.**” In other words, think of providing the amount of a nutrient per body weight needed in infancy as being a reasonable guide for the amount per weight in a child or adult with serious burns or wounds. The 5-to-9 ratio can be rounded to an easier **0.5 mg per kg (or 0.25 mg zinc per lb) for wound healing.** Many standard multivitamins provide 12-15 mg zinc and additional zinc can be supplemented alone. **However, the very best absorbed form in the greatest amount is found in meat, and especially red meat.** [Meat is actually color coded . . . red meat has more than white meat!] Other foods (except for oysters) never even come close. My “Iron and Zinc” handout has more details, but here’s a tiny peek:

1 oz	Zinc mg	Iron mg
beef liver	1.5	2.2
beef	1.3	1.0
pork	0.8	0.9
chicken	0.7	0.3
fish	0.5	0.3

(Data Source: Agriculture Handbook No. 8-4 US Dept. of Agriculture Science & Education Admin.)

Other factors that may affect the amount of supplemental zinc that may be recommended for an individual include:

1. Whether he/she is presumed to have adequate or poor zinc stores to start with;
2. The amount of construction work needing to be accomplished; and
3. Dietary factors such as meat consumption.

For people with poor stores or increased needs, it is not uncommon for them to be prescribed 50 mg zinc/day or more for fairly short periods. As a general rule, avoid long-term supplementing over that amount without the physician’s knowledge and approval. Problems have been noted in some folks with long-term supplementation at that level, sometimes because of impaired absorption of copper – the two minerals compete for absorption in the intestine. People taking higher than usual zinc as supplements should be sure that their multivitamin with minerals also contains copper. Interestingly, the competition effect is much less when the zinc source is meat instead of supplements. Some disturbance in cholesterol levels has also been reported occasionally in people in the general public taking high dose

zinc supplements for a long time. However that effect is unlikely to be a concern in EB because the actual zinc requirements are higher than average, and zinc losses can also be much higher from the “weeping” of wounds.

3. How Much Protein for Wound Healing?

A very similar situation turned out to be the case in determining a good amount of protein for individuals with wounds. The World Health Organization suggests that **healthy** adults should get at least 0.8 g protein per kg body weight (about 3.6 g protein per pound.). Americans typically eat considerably more than this minimum guideline, however.

A number of reference books about wound care have suggested that 2.2g protein per kg (1.1 g per pound) would be a reasonable amount for optimal healing. It caught my eye because I work primarily in pediatrics so I recognized that 2.2g protein per kg body weight is the level often suggested as a reasonable amount for healthy normal infants! This turns out to be a suggested increase to about 2.75 times the WHO figure for average adults. This intake amount is clearly safe and not excessive, since many Americans eat 2-3 times the WHO level normally! **To the best of my knowledge, my “Baby the Wound!” system of determining nutrient needs in serious burns or other wounds has not been adopted by any big official agency. Again, it’s just my best guess for a safe but effective intake level to start with, and a way to think about the best nutrient to promote healing instead of just providing RDA levels.**

Aunt Cathy’s “Baby That Wound!” Theory (Remember: I made this up – this is not official science!)



**This little baby elephant* is a good model for the “Baby That Wound” concept:
A lot of food is needed every day in order to grow as fast as she should!**

Some examples are shown on the next page.

*This cute baby elephant is called Tamani (a Swahili word for “Hope”)
www.lowryparkzoo.com/baby_elephant/photos.html
used by permission of the Lowry Park Zoo in Tampa, Florida,
with best wishes for children with EB.

	Protein grams per kg body wt	Zinc mg per kg body wt
9 kg Baby	2.2	0.5
Wound Healing Man	2.2	0.5
70 kg Average Man	0.8 (W.H.O)	0.11 (new RDA)
70 kg Average Man	0.9-1.0 (new RDA)	0.17 – 0.21 (former RDAs of 12-15mg)

What about other vitamins and minerals?

A generous intake of **vitamin B12 and folic acid** (another B vitamin) is also required for making DNA (for making all cells) and in particular for making new red blood cells. **Sometimes “anemia” is not caused by inadequate iron but by a relative inadequacy of these nutrients, or others (like vitamin E and other antioxidants) that are needed to keep red blood cells from being broken apart too soon.** This blood cell breakage can be more likely to happen because of the higher production of free radicals related to inflammation. Antioxidants and free radicals will be discussed in more detail later, as will anemia issues.

Vitamin C also helps protect the white blood cells of the immune system to let them live longer to keep on killing germs. **Vitamin C and copper** are also players on the team that lets us build connective tissue for wound healing, and both are also required to use iron in the body. And on and on. These are just a few of many examples of the critical role played by vitamins and minerals in health, and why this aspect of a person’s nutrition cannot be ignored. For some specific additional information, please see my handouts on folic acid, vitamin B12, magnesium, chromium, vitamin D, copper, zinc and iron. A recent report in the scientific literature specifically about vitamins and trace mineral adequacy in EB reached the following conclusion:

Vitamin and trace metal levels in recessive dystrophic epidermolysis bullosa. [J Eur Acad Dermatol Venereol.](#) 2004 Nov;18(6):649-53. Conclusion: Vitamin and trace metal deficiencies are frequent in RDEB, even in patients receiving gastrostomy feeding, and often go unrecognized. Regular nutritional evaluation is necessary. Dietary advice and supplements should be given. Enteral feeding by gastrostomy should be discussed in early childhood.

Another issue in supplementing calories and protein in the diet is cost.

The “regular food” items are many times cheaper than the commercial additives. For example, consider **fat additives** commonly used: **MCT oil** (Mead Johnson) is about **\$1.00 an ounce (\$65 per quart)** and the calories are about 5 calories less per teaspoon than most food fats and oils. It is specially designed for use in certain digestion problems that involve inadequate bile production or poor ability to “recycle” bile. Unless an individual is known to have a digestive problem involving bile, it is unlikely to provide any special benefit to warrant the high cost. Comparing prices, today in Fargo, **canola oil** (a good choice) costs less than **\$0.06 an ounce (\$1.82 per quart.)**

The advantage of using special “**emulsified products**” is that they are better at staying mixed into formulas. That is what emulsification means . . . keeping the oil and water in a food from separating. But unless that is a major problem in an individual’s situation, it is useful to know that they are even higher in cost. This is because they are primarily designed to be used for intravenous (i.v.) feedings. “Intralipid” (Pharmacia & Upjohn) and Microlipid” (Novartis/Mead Johnson) cost about 88 cents per oz, but they have only half the calories of other fats, so you need to use twice as much. Again, compare these with the cost of canola oil shown earlier – it is MUCH more expensive. Some other issues about the use of particular forms of fat will be discussed later.

Protein additives are also much more expensive than excellent quality protein in foods. At about 7 g of protein per egg, **egg protein costs about a penny a gram** and it contains some additional nutritional value. Milk protein (in milk, yogurt, cheese and cottage cheese) and eggs are extremely useful in EB because they are much easier for some people to eat than many meats. The whey protein supplements used by body builders provide very nice protein and I have found prices of various products on line, some of the lowest between \$10-\$30 for a two pound can. Prices in stores appear to be more. These products provide ONLY protein – no other nutrients, but they might have some benefit for people who find the casein in milk protein to be constipating, however. Milk protein normally is about 82% casein and 18% whey. (More on this in the discussion of constipation later.)

The liquid pasteurized “no yolk” egg protein products available in grocery stores are more expensive than eggs, but cheaper than the special additive products. For example, “EggBeaters” provides 6 g protein per ¼ cup, at about 7 cents a gram at a grocery store here in Fargo. It has the advantage of being pasteurized so it can be added to foods that are not intended to be cooked, such as a smoothie or eggnog. An ounce of milk has about a gram of protein. Powdered milk is another very inexpensive product that can be added to foods or beverages. It provides 1.5 g protein per tablespoon, and some calcium and other nutrients are provided with it. It can be stirred into many different foods, such as puddings, soups, and smoothies, etc., but it doesn’t have to be a dairy food that you add it to. Try adding it to hot cereal, jello, mashed potatoes and even meatloaf! (I add EVERYTHING to meatloaf . . . you should see it!) If lactose intolerance is an issue, lactase enzyme can be used to minimize this problem. Some brands of lactase enzyme are: Dairyease®, Lac-Dos®, Lactaid®, Lactrase®, RiteAid® Dairy Relief™, Surelac®, Walgreens® and Dairy Digestive.™

Adding Carbohydrate Calories:

“**Glucose polymers**” (such as “**Polydose**” by Ross) are simply starch in solution and they have no advantage over regular food carbohydrates like sugar or food starch. They are designed primarily as a carbohydrate that can be added to beverages without adding a sweet taste. There is usually no reason to avoid sweetness in children’s feedings. The **risk of tooth decay is identical** because any carbohydrate fed orally is food for bacteria in the mouth. The bacteria then produce acids that attack the tooth enamel. **The main factors that increase risk of tooth decay are frequency of feedings and contact time with the teeth**, not whether it was sugar or starch. **Because of**

difficulty of dental care in EB, however, the whole issue of tooth decay is not to be taken lightly. Some dental issues will be discussed later.

Back to the issue of using sugar versus glucose polymer products: There is no danger of causing a “sweet tooth” to be developed in a child. Children just come that way . . . human milk is sweet and it is all part of the design to make babies want to nurse. I have found that using regular table sugar can often make many foods and formulas more palatable for children, and therefore it is more effective because they eat more. And, of course, the dental and sweet tooth concerns are even less of a concern when the child is fed through a tube instead of orally.

A teaspoon of glucose polymer products weighs 2 grams and provides only 8 “empty calories” from carbohydrate. Price per 100 calories: \$5.00

A teaspoon of sugar weighs 4 grams and adds 16 “empty calories” from carbohydrate; Price per 100 calories: \$0.05

That means you need only half as much sugar to get the same calories. A 12.3 oz (350 grams) can of a glucose polymer product costs about \$7-\$8.30 from the cheapest on-line sources. That is equal to about a **half cent per calorie** provided. Compare that with table sugar, which in Fargo today costs \$4.29 for a 10lb. bag. That is **only five 100th of a cent** per calorie. **Looked at another way, the Polycose costs 100 times as much for an equal amount of calories.**

In most circumstances there is no need to use these expensive special products at all. “MCT oil,” an example noted earlier, is designed for special needs related to certain liver diseases or intestinal malabsorption problems such as Cystic Fibrosis. It is often inappropriate for other uses because besides being very costly, **it is all saturated fat** (from coconut oil) and it therefore provides **none of the “essential” fats or any omega-3 and omega-6 polyunsaturated fats at all . . . just calories.** I have also found that using regularly available food products from the grocery store also has the psychological advantage of “de-medicalizing” at least one part of a person’s care.

Sometimes health care professionals are not familiar with these issues, because they have to know so much about everything else. It might be beneficial to share this paper with them if these very costly products are suggested in order to use them only when regular carbohydrates and fats available at the grocery store will not do. In addition, remember that just adding fat or carbohydrate calories or “just protein” from any source will contribute no other nutrients and so they should be used as only a small part of a higher calorie or “nutrient dense” feeding regimen.



Energy to grow and to go!

A daily “complete” type standard multivitamin with minerals

It is very reasonable to add a standard multivitamin with minerals to the diet of a person with EB, and I strongly encourage it for many reasons. [Please note that I do not sell anything – I just think it is a very good idea, based on what we know about the usual nutrient density of people’s diets, and the increased requirements for many nutrients because of EB.] A multivitamin/mineral supplement is a good idea even if a “complete nutrition” formula product is used. It is also a good idea for everyone in the family – with EB or not. These products can be swallowed, chewed or crushed and added to foods. A mortar and pestle can do a fine job of turning pills to powder fine enough to be used with gastrostomy tubes. You can find a mortar and pestle for less than \$10 in the kitchenware section of all the large discount stores – people use them to grind spices.

None of the multivitamin/mineral products is truly “complete,” however. Most have no potassium, only about 200 mg of calcium, and just 10-25% of the recommended amount of magnesium. They are not intended to take the place of food, but to be used in addition to food. Most liquid products are even less complete, often containing much lower amounts of folic acid and minerals. They also add no calories, no protein and little if any beneficial “phytochemicals” (plant chemicals) available from foods. **Supplementation is very wise, but of course it is only a part of the regimen to improve the health of people with EB or other serious conditions.**

Some people with EB have severe physical eating problems.

This may include pain and blistering in the mouth, a very small mouth opening, esophageal strictures, and severe dental problems resulting in problems chewing and swallowing enough food or an adequate variety of foods. They often have inadequate intakes because of the time and effort required to eat even a small amount of food. Sometimes the entire diet must be blenderized to a puree texture because the ability to chew is so impaired. In this situation, the use of commercial baby foods is fast but certainly not flavorful or enticing, and in general these foods have very low caloric and nutrient density. They are usually pureed with water. Pureeing regular foods with taste-appropriate and nutritious liquids (like milk, cream soups, commercial formulas, juices, etc.) is a much better solution.

It may be necessary to use other feeding routes in order to achieve appropriate growth and the best possible health.

In some (non-EB) situations this may involve feeding through a tube from the nose to the tummy. This is an “NG” – a “naso-gastric” tube. But in EB there is potential injury to the face and other tissues with this approach so **it is not recommended.** Often this kind of tube placement is secured with tape to a person’s cheek, and this is definitely not reasonable to do in EB. In addition, NG tube feedings are used in circumstances where the expectation is that the tube feeding will be needed only for a fairly short period of time. **The expectation with severe EB is that a person would benefit from aggressive nutrition assistance throughout life.**

For all of these reasons, the tube is placed directly into the stomach or sometimes into the small intestine. Some tubes are placed through the skin to go directly into the tummy. They may be called a PG tube, a PEG tube, or another variation. PG stands for “Percutaneous” (through the skin) “gastrostomy” (through an opening into the stomach.) Sometimes it is positioned into the jejunum of the small intestine instead. **There are important issues in EB regarding which technique is used to place the tube.** The health care professionals will know the benefits and problems associated with using one approach over another for a particular individual. Whether such a placement can be accomplished with local instead of general anesthesia (as is sometimes the case in people with other medical conditions) is a question that needs to be discussed with the individual’s physician. Sometimes it must be done under general anesthesia, but it may be able to be done at the same time as another necessary procedure.

In my experience with many (non-EB) children who have ultimately required a gastrostomy tube to assure adequate nutrition, it has been shown repeatedly that it is far better to place the tube **before** the person has become poorly nourished from months of trying and failing to take in enough orally. **Acting before the situation becomes critical and the child debilitated and immune-suppressed is very important.** Additional factors such as the expected brain growth and development during this period make it critical that the child not be allowed to fail nutritionally. Many children fail to take in enough nutrition in spite of great effort on the part of families to provide appropriate oral feedings. **Studies of the growth and health of children with severe EB specifically have shown that it is much better and more effective to recognize the need for a tube placement and to place it proactively.**

Sometimes parents are hesitant about having a feeding tube placed because they perceive that it is somehow “admitting defeat” or that it is an indication that they are not willing to do what it takes to get food into the child. Some people just hate the idea of yet another procedure or adding yet another way in which the child will be different from other children. However, time after time I have been told by the family when they finally agreed to having the tube placed after months of huge effort and poor success, that **“we should have done this months ago.”**

It is reasonable to assume that an infant or child with severe EB will need a feeding tube. Delaying placement only increases the period of discomfort, frustration on the part of both child and caretaker, “feeding wars,” and feelings of failure. Most importantly, it also results in an insufficient intake of nutrients for the baby to grow and develop and to be as healthy as possible in spite of this devastating condition. Parents can “cash in” all that time they were spending struggling with very difficult feeding and use it to do something much more pleasurable ... like playing with the baby. ☺

If an individual can eat but just cannot eat enough, the tube feeding can be an excellent help because it allows the individual to be passively fed as needed, and it can also help administer medications. This approach also lets the person eat just preferred foods and the rest of the nutrition can be easily fed passively. I think of this as contributing to another important feeding issue: the **“happiness factor.”**

Certainly the skin care at the site of the tube placement is an important consideration and communicating with a health care professional familiar with the very special skin issues in EB is very important. DEBRA of America, Inc. is the best contact for help with this issue. The website is <http://www.debra.org/index.php> and the phone and email addresses are: (212) 868-1573 or (866) DEBRA76 (866-332-7276) or staff@debra.org.

As described earlier, many of the **commercial tube-feeding products** for children and adults provide about **30 calories per ounce and about 0.9 g protein per ounce**. However, there are many products on the market that provide more concentrated calories (**up to 60 calories per ounce**) and **higher amounts of protein per ounce**. The vitamins and minerals will vary as well. Many provide “RDA” levels of nutrients at about a quart a day but they are quite diverse so read the label. And since RDA levels in general are not sufficient to meet the needs of people with severe EB, additional micronutrient supplementation is advisable.

For help with choosing a tube-feeding product or setting up a tube-feeding regimen, contact a registered dietitian with expertise in tube feedings. Many of them have the special certification “CNS” after their name and the “RD” in their credentials. This stands for “Certified Nutrition Support Dietitian” and it means that the dietitian will have been certified by the National Board of Nutrition Support Certification, established in 1984 by the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) To find a dietitian with this level of tube-feeding expertise you can call a local hospital (or a large teaching hospital) and ask one of the clinical dietitians there for help in locating someone. There may even be one on staff locally. If looking for help with tube feedings for an infant or child, you can also find help from dietitians who have “CSP” after their name and the letters “RD.” CSP means Certified Specialist in Pediatric Nutrition. Most children’s hospitals will have at least one on staff. You can also go to one of these websites for help in finding someone with the special skills that you need: <http://www.nutritioncertify.org> or www.eatright.org.

Many people with EB have major troubles with constipation.

Contrary to popular belief, simply increasing water or other fluids will not resolve constipation unless inadequate fluid intake was a contributing problem. Extra fluid is clearly needed if fiber is being added, but in the absence of added fiber any additional fluid is simply absorbed from the intestine and excreted via the kidney. As described in more detail later, many liquids like prune juice help with constipation for reasons unrelated to just their fluid content. In addition, adding fiber may not be a helpful approach to constipation for a person whose ability to push food through the lower intestinal tract may be impaired; in fact, it may actually contribute to bowel obstruction. Some types of fiber actually slow transit time through the intestine instead of moving things along, and some forms may be too physically rough on the intestinal lining for a person with EB. Ask your health care professional for specific guidance about fiber types. Some tube feeding products come in versions that are fortified with non-abrasive fiber.

Limitations on types of foods tolerated can certainly result in a relatively low fiber diet however. In addition, pain with elimination can be very severe and delicate rectal tissues can be torn. Sometimes this can lead to a child intentionally withholding stool to avoid the pain of elimination. Serious bowel impactions and colon enlargement can result. A plan for keeping stools soft and for minimizing pain is essential.

In many conditions with severe rectal pain keeping a very soft towelette with a specially formulated (and elegantly named) “butt paste” on it can be helpful. For example, I am personally very aware that many cancer chemotherapy patients suffer from what I call “flame-thrower diarrhea.” In that situation, it was extremely helpful to mix zinc oxide and lidocaine (a pain killer) on a soft tissue or paper towel and to keep it in place by the rectal opening until it is lost the next time the person went to the bathroom. **However, the very special skin problems of EB may make some of these common approaches unhelpful or inappropriate.** I described it here as something that worked well for me for control the pain from chemotherapy . . . and I mention it particularly because no one told me what could be done to help until weeks of pain had gone by! I am not a pharmacist, a physician or a nurse, so the best sources of specific help with this kind of pain for people with EB are the folks at DEBra of America, Inc. My point here is: **be sure to ask for their help** . . . do not suffer in silence because of the embarrassment of talking about this “end” of the natural food-digestion process.

For people with constipation problems for whom a nutrient-dense high-calorie diet is needed, it is useful to know that there are pretty generous calories in some of the foods and beverages we commonly use for constipation. Examples include “cranberry juice cocktail” and prune juice which have 20 calories per ounce – as high as whole milk. Corn syrup has 60 kcal per Tablespoon. They contribute to keeping stools soft by keeping water in the colon. This is called an “osmotic effect.” Prune juice has some additional properties that help.

When trying to “increase fluids” for constipation, remember that juices are 99.9% water. That means that they contribute essentially the same amount of fluid as plain water would, but they have the advantage of adding some calories, some beneficial phytochemicals and a few nutrients. **It makes little sense to concentrate a child’s formula or tube feeding and then feed plain water . . . it just re-dilutes the feeding.** A common estimate of “normal” fluid needs is about 1 ml fluid per calorie you eat, so if you eat 2000 calories a day, then 2000 ml (2 liters – a bit over 8-1/3 cups) of total fluid would be general goal. This is not just water, though . . . it includes all liquids. Sometimes people erroneously interpret this to think it means we must drink 8 glasses of water PLUS several more cups of milk, juice, and other beverages. This can be pretty unreasonable . . . and also unnecessary. Other factors such as heat and fluid lost from wounds, etc., may increase our fluid needs above average, however, and usually problems arise from taking in **too little** total fluid, not from taking in too much. So, it is best to stay on the generous side. And remember to try to pick fluids that are a source of calories and nutrients . . . not just water.

Also, consider whether some of the ways we add extra calories are possible contributors to the constipation. For example, “casein” is a curd-forming milk protein that can be quite constipating for some people. Whey protein is not curd-forming, and

therefore it is often less constipating. There are several generally available commercial nutritional beverage products used for children, such as Boost or KinderCal (by Mead Johnson), Carnation Instant Breakfast or Nutren Jr. (by Nestle), or PediaSure (by Ross) and many “adult” products.

If using these products, check the label to see if the protein is primarily in the form of casein. You may see the word “caseinate” on the label. This is a perfectly fine protein source for growth and healing, but for the chronically constipated individual it would be worth trying one that had less of the protein in the form of casein. Powdered products such as various brands of “instant breakfast” that are added to milk often include powdered milk as the protein source of the powder, too, so the protein would still be 82% casein.

This is also an issue in infant feeding. Mother’s milk is very useful for MANY reasons, including fat blend, immune-boosting factors and better absorbability of many nutrients. In addition to these great benefits, **it is unusual for babies to be constipated when exclusively fed mother’s milk.** It can be fed directly by having the baby nurse (if able) or the milk can be expressed and fed via a bottle or a tube. However, some children’s health situations can result in a degree of constipation even with mother’s milk.

Soy formulas are milk-free and so they have no casein, although for some children soy is constipating, too. Of the milk-based products, a variety of protein sources are available: Nestle Good Start Supreme is all whey (no casein) and the whey is partly chopped up. This product has been helpful for use with chronically constipated babies. Standard Enfamil Lipil (Mead Johnson) and Similac Advance (Ross) products have adjusted the casein-to whey ratio from 82%-to-18% (regular milk) to an easier to digest 40% to 60% ratio in an effort to try to approach the ratios in human milk. None of these has been studied in EB specifically, however.

The protein in all the “lactose free” milk-based infant formulas is 100% casein. Enfamil’s new “GentleEase” infant formula product has less lactose than their Enfamil and it has both casein and whey in the same ratio as cow’s milk (82% casein to 18% whey.) The difference is that they have hydrolyzed (chopped up) both of these proteins. This may be helpful for constipation although it is too new a product (6/06) for users to have had much experience with it.

Dairy fat (butterfat) can also be quite constipating. Butterfat is the fat in cream, whole and 2% milk, butter and cheese. Besides the constipation issue, it is a saturated fat and (like MCT oil) always a very poor source of the essential fatty acids or other omega-3 or omega-6 polyunsaturated fats. In spite of this, some diets, such as the **ketogenic diet for seizure control**, may contain a very high amount of cream. That diet is (not surprisingly) constipating for many children. Using other forms of fat in place of at least some of the cream can help a lot, both for constipation relief and for good nutrition.

Some iron sources can contribute to constipation, and it is not uncommon to find that the heavily iron-fortified infant cereal can contribute to the problem. High doses of **“inorganic” iron** (that is, the “ferrous” or “ferric” forms found in plants or in pills) can be

constipating and since it is also far less well absorbed, it is actually not the best route to improving iron deficiency in an individual. Iron in breastmilk is “organic.” It is not constipating and it is very well absorbed.

The standard amount of inorganic iron in infant formulas is not constipating. For example, “Nestle Good Start Supreme” formula (a “chopped up” whey-based product) is often very useful for helping constipated babies and it only comes with iron. Using “low iron” infant formula to assist with constipation is not recommended because it is not the iron that is causing the problem. However inadequate iron can cause lots of problems, so **the American Academy of Pediatrics recommends iron fortified formulas when formulas are used in infant feeding.** In addition, philosophically, even if removing the iron did help with constipation (which it doesn’t,) I find it puzzling that some parents or physicians would be willing to remove a high priority critical nutrient like iron from a child’s diet in order to form the “perfect stool.”

Highly absorbable and non-constipating “organic” iron is the kind found in meat. It is called “heme” iron (like in the word hemoglobin in red blood cells,) and there is also a substance in meat called “Meat Protein Factor” that improves absorption of the inorganic iron in the meal as well. Both iron and zinc are most generous and best absorbed from meat, and as noted, the foods are actually “color coded.” Red meats have more of both than white meats like chicken. But all meats have better amounts of available non-constipating iron than the inorganic iron in supplements, formulas and plants. See my iron and zinc handout for more information on this. A discussion of the problem of anemia will follow, as well.

Products to relieve constipation: Milk of Magnesia (magnesium hydroxide,) Lactulose and MiraLax (polyethylene glycol) all work by attracting water to the bowel by osmosis and so they can be useful for keeping stools from hardening. Both contribute no calories. Prune juice and corn syrup add considerable calories, but they act the same way (an osmotic effect), and the prune juice naturally has additional phytochemical substances that encourage defecation. The prunes themselves are helpful . . . not just the juice. Glycerol suppositories act locally at the rectum, but whether these should be used by a person with EB should be decided with your health care provider. Other products such as those containing senna can work by means of irritating the bowel to stimulate activity. For this reason it is important to talk with your pharmacist or other health care provider about the usefulness or safety of the many constipation treatment or prevention products available.

Some nutrients of special interest in EB:

As mentioned earlier, **increased nutrient excretion or turnover, or decreased absorption will alter nutrient requirements** so that the “normal” guidelines of adequacy or safety (such as the “RDA” or “RDI” level) or expected patterns of “normal” growth rates may not apply. They may not apply for other reasons as well, such as altered body composition or the effects of medications. **Many guidelines only address intake goals and growth expectations for “healthy” people.**

In many cases, special levels of certain nutrients can greatly affect the risk of complications and worsening of chronic conditions. One area of encouraging nutrition research is in the area of helping to control inflammation in inflammatory diseases. Also, looking promising is the use of antioxidants to help reduce the injury to tissues resulting from the excessive inflammation and higher metabolic rates due to wound healing. The term “antioxidant” includes vitamins E and C, and important substances made in the body that use minerals like selenium (“glutathione peroxidase”) and zinc (“zinc-copper superoxide dismutase.”) It also includes some “phytochemicals” and some “conditionally essential” nutrients like alpha lipoic acid and CoQ10. **The same patterns are emerging for many conditions that feature altered metabolism and/or inflammation, so it is reasonable to look closely at them in EB as well.**

Antioxidants

For many autoimmune diseases like diabetes, lupus, juvenile rheumatoid arthritis, inflammatory bowel disease, down syndrome, and apparently many other conditions including EB, the medical condition itself (or the therapy) results in increased production of damaging “free radicals.” This leads to increased frequency and severity of complications beyond those due to the condition or medication use alone. For this reason, **appropriate generous antioxidant supplementation** is advisable. In addition to vitamin/mineral antioxidants, there are many potent **antioxidants available in brightly colored fruits and vegetables.** The food pigments themselves are often antioxidants. Examples include orange colored “beta-carotene” in carrots and squash, red “lycopene” in tomatoes and watermelon, green “lutein” in dark leafy greens, red/blue “anthocyanins” in blueberries and beets, yellow xanthophyll in corn and kale, and white/yellow “flavones” in onions and garlic. **The simple rule of thumb about all these colorful vegetables and fruits is “Eat as much of ’em as you can!”**

This class of color-pigment substances is usually called “**phytochemicals,**” which simply means “plant chemicals.” (But it sounds so very scientific!) Many vegetables and fruits have a wide variety of phytochemicals that have benefits in addition to the generous antioxidant content, so children’s diets (and the diets of adults) should be as generous in these foods as possible. A great example: Lycopene, the red pigment in tomatoes, is 200 times as potent as a protective antioxidant than vitamin E. There is much to be gained from including brightly colored fruits and vegetables in the diets of everyone in the family. (More information on this topic is available in my “Eye Health” handout.)

Adding these foods can sometimes be a problem for anyone. I have had some success using pureed fruits and vegetables that are frozen in an ice-cube tray and then popped out and stored as cubes in a freezer bag. These are then quick and easy to add to foods like soups, spaghetti sauce, chili, meatloaf, etc. I have found that if the fruits and vegetables are pureed to the point where no identifiable “vegetable carcass” is discernible, people are unaware that they have been added. ☺ For a tube-fed child, any combination of fruits and vegetables can be pureed all together with formula or other nutritious liquids (e.g. prune juice) and frozen as described. Blenderizing the “veggie cubes” with the formula to be fed will usually thin it down enough, but it can also be strained if there is a concern about clogging the tube.

This sounds time-consuming, but some families find it can be done all at once for a month's supply. One can use canned, frozen or fresh (use low sodium vegetables if using the canned type.) Some folks have a routine of freezing any leftover fruits and vegetables immediately after a meal in a freezer bag and then blenderizing them all at once when a good amount has been stored up. Also, many Grandmas or friends who keep asking how they can help are very happy to take on this kind of project. It is something very concrete to do to really help. For everyone, of course, clean and safe food-handling techniques are very important. (Please see my Food-Borne Illness handout for more on this topic.)

Another option is to add readily available fruit and/or vegetable juices (e.g. cranberry juice, Carrot juice, prune juice, low sodium "V-8" type) as part of the liquid used to reconstitute infant or other concentrated formula. Variety is very beneficial because the various phytochemicals are not all in the same foods. There are also many new products to investigate now that the public is becoming aware of the importance of these phytochemicals for health. Some are powders or juice concentrates . . . but some are really pricey. The products themselves are usually just fine to use, but some clearly give the buyer the impression in their advertising that they are much more potent and all-encompassing than they really are. They do this by comparing their product with foods that are poor sources of various nutrients.

Example: One product advertises itself as having "**The vitamin C of 20 peaches!**" It sounds impressive, but they are counting on people not knowing that peaches are rich in vitamin A, but they are not among the best sources of vitamin C. An orange has about 80 mg of vitamin C, but a typical peach has only 6 mg.* Twenty peaches provides the vitamin C of just 1-1/2 oranges. Using this kind of logic, I could claim to be amazingly tall because I tower over nearly all of my patients! Sounds impressive, too, until you note that I work in pediatrics and my patients are babies and children. I am still only 5'4" no matter whom I compare myself to. Anyway, you get the idea. * Data from Pennington & Church: "Food Values of Portions Commonly Used."

Omega-3 / Omega-6 Oils

Along with antioxidant supplementation, manipulation of the inflammatory response by altering the **ratio of omega-3 to omega-6 fatty acids** is also looking very promising in the autoimmune and inflammatory diseases in particular. This ratio also appears to be very important in other areas of health research as well, such as risk of heart disease, cancer, HIV, depression, epilepsy, and degenerative eye diseases. **In each case, the direction of change that shows benefit is increasing the proportion of dietary fats that are rich in oils of the omega-3 family in relation to the intake of fats from the omega-6 family.** Vegetable oils that are high in "omega-6" (such as corn oil) contribute to a strong inflammatory response. Adjusting the intake of dietary fat to have a better proportion of oils from the "omega-3" family can significantly reduce the strength of an inflammatory response. In addition to the ratio, there is a minimum amount of omega-3 oil intake suggested, and as discussed below, some suggestions for the forms of omega-3 oils to use.

This can be particularly important in conditions characterized by excessive inflammation, like EB. Compared with corn oil, other vegetable oils like **canola oil, flaxseed oil, walnut oil and soy oil** (only if non-hydrogenated) contribute to a much better

balance of omega-3 to omega-6 oils. Ground flax seeds, soybeans, walnuts and other nuts and seeds have other nutritional benefits that the oil alone will not have, but your health care provider may want you to avoid the intact forms of these foods unless they are processed enough to eliminate rough edges.

Olive oil and peanut oil are mostly “friendly” monounsaturated oils. They are not rich in either omega-3 or omega-6 polyunsaturated oils, but if they replace the high omega-6 corn oil in the typical US diet, they can have a big beneficial effect on the **ratio** of the remaining omega-6 to omega-3 oils. This contributes to decreasing the strength of inflammatory substances that the body makes out of these two families of oil. It has the added advantage of displacing some of the less beneficial fats in the diet, like the saturated fats in coconut oil, palm oil and butterfat.

Fish oils contain a generous amount of the omega-3 oils, and they are in a form that is especially easily utilized in the effort to control inflammation. It is becoming very clear that many individuals benefit greatly from having the fish oil form in particular provided because it contains “ready-to-use” EPA and DHA. This is a really big deal because these two fats both have direct anti-inflammatory effects. DHA is also a critical fat of brain tissue (yes, we are all truly “fat-heads,”) and shown to have benefits in infant development, and in solving problems such as depression and alzheimers disease. More information is available in my handout on lipids and oils. EPA is key to decreasing inflammation. **EPA** stands for “Eicosa Pentaenoic Acid” -- but I like to think of it as standing for “**E**nvironmental **P**rotection **A**gency,” because it really helps to protect our internal environments! More information is available in my handout on lipids and oils.

How Much EPA and DHA Omega 3 Oil?

There are no official guidelines for EB, but the American Heart Association does have recommendations for levels of intake by level of heart disease (CHD) risk, and it might be a good guide for our use as well .



Going FISHing . . .

My best guess is that people with very severe EB would likely benefit from an intake of EPA+DHA of 2-4 grams daily, and for those with milder forms at least a gram daily.

AHA Recommendations for Omega-3 Fat Intake (2002)

People without documented heart disease	Eat a variety of (preferable oily) fish at least twice a week. Include oils and foods rich in alpha-linolenic acid (flaxseed, canola and soybean oils; flaxseeds; and walnuts.
People with documented heart disease	Eat about a gram of EPA+DHA daily. This can come from oily fish or from fish-oil supplements.*
People with high triglycerides	Take 2-4 grams of EPA+DHA provided as fish oil supplements.*

* As always, you should discuss this with your physician, since in certain situations (like people on certain medications) there may be reasons to do things differently.

Vitamin D

Vitamin D is a very special problem in EB. It is a special concern for everyone in northern latitudes where making vitamin D in the skin can be poor many months out of the year. It is also a concern among those who drink little milk (or who use unfortified milk) and those who do not take vitamin supplements. **Vitamin D inadequacy has recently been discovered to be very common** in the northern part of the country and among people with dark skin, **and among those whose skin is often covered up or injured, and those who are usually indoors.**



Staying out of the sun.

Vitamin D deficiency increases risk of developing arthritis, MS, diabetes, muscle weakness, muscle pain, lung problems, osteoporosis and several types of cancer. It is now known that vitamin D has functions as an important steroid hormone in over 30 different tissues and according to a report in the Journal of the American Medical Association, there is now **“an unrecognized epidemic of unrecognized vitamin D deficiency in the northern part of the US.”**

In view of the importance of this issue, the **likelihood of special risk to people with EB, and the newest recommendations from expert groups, it is reasonable to assure an intake of 2000 iu daily in adults and older children with any risk factors for deficiency. People with EB have several risk factors.** This is not at all close to a toxic intake level, but it appears to be the amount needed to assure adequacy of blood levels in the conditions described. This is the amount, for example, that has been found to be needed by people who are never exposed to the sun in order to assure an adequate blood level of vitamin D. **My best guess is that people with severe EB will be in the same range.** Of particular interest is the emerging wide role of vitamin D in supporting the immune system, heart health, cancer prevention and autoimmune disease expression.

There is considerable movement in the health professional community toward increasing the currently recommended “RDA” level for vitamin D to this 1000-2000 iu for nearly everyone. For infants the usual amount recommended by the American Academy of Pediatrics for healthy children was recently increased to 400 iu, but because inadequacy is so detrimental it is very reasonable (and likely necessary) to provide more than 400 iu to the child with severe EB. Since it has not been studied specifically in this group, a physician should monitor a vitamin D level about once or twice a year to be sure that an adequate intake is being provided. A person with vitamin D deficiency will actually need a therapeutic dose (e.g. 50,000 iu every week for 8 weeks and then have the level re-checked.) Standard intake levels will not fill up the empty tank. Very few foods are naturally good sources of vitamin D. At present, it is added to milk, but rarely to yogurt, cheese or ice cream. All of this requires the use of supplemental vitamin D.

It appears that assuring adequacy of vitamin D can allow a much lower intake of calcium to be sufficient. [JAMA. 2005 Nov 9;294(18):2336-41] This is important in EB in part because some of the calcium supplements and certain dairy foods can contribute to constipation. Being able to take in less calcium but still meet one's nutrient needs may be very helpful. And, of course, adequacy of BOTH calcium and vitamin D are critical for dental and bone health. A recent report again pointed out that bone problems are common in the EB population, so we need to direct additional attention in that direction.

Bone mineralization in children with epidermolysis bullosa. Br J Dermatol. 2006 May;154(5):959-62.
Conclusions: Children with RDEB and JEB have low bone mass after adjusting for their smaller size, which may put them at risk for fragility fractures. Low bone mass was best predicted by the level of mobility, raising the hypothesis that improving activity or bone loading may be a potential preventive intervention in these children. However, as low bone mass may be multifactorial in these children, more detailed investigation of potential aetiological factors is required before interventions are planned.

Fortunately, providing adequate vitamin D is not difficult. Vitamin D supplements are readily available, crushable and inexpensive. They can be purchased in very large bottles at ware-house-type stores for very little money. Please see my "Top Five" handout for much more on this and specific suggestions of many ways to meet these intake goals.
(“My Current Top Five Easy Ways to Improve Your Family’s Nutrition.”)

“Conditionally Essential Nutrients”

In the study of nutrition, a substance is said to be “essential” if one has to take it in from outside. Substances that are classified as “non-essential” are needed just as much in the body, but we usually have the ability to make enough ourselves and therefore we do not have to eat them. However, it is well known that some substances can become essential in certain conditions, like when one needs to continually heal wounds. We can make enough of a substance for running things under normal circumstances, but when there is higher than average demand related to a severe health condition, the amount we can make for ourselves is simply inadequate to do the job. These substances are therefore regarded as “Conditionally Essential.” Many substances fall into this category, including the amino acids **arginine** and **glutamine**, and the **nucleotides** used to make DNA for the center of every new cell.

Carnitine is a conditionally essential substance made of two amino acids needed for the body to make useable energy out of body fat or dietary fat. Several cases of serious and sometimes fatal heart damage (“cardiomyopathy”) from carnitine inadequacy have been reported specifically in children with EB, underscoring the importance of assuring adequacy, and not just assuming it.

Lethal cardiomyopathy in epidermolysis bullosa associated with amitriptyline. Arch Dis Child. 2005. Aug;90(8):871-2. Dilated cardiomyopathy in dystrophic epidermolysis bullosa: a lethal complication of epidermolysis bullosa. Eur J Anaesthesiol. 2002 Sep;19(9):689-90. Dilated cardiomyopathy in dystrophic epidermolysis bullosa. Arch Dis Child. 2000 Jul;83(1):59-63. Review.

Alpha lipoic acid is an antioxidant but it also has an important role in making energy out of food. [For all you science people out there, alpha lipoic acid is part of the TCA cycle in two separate reactions.] It is also the subject of considerable interest in wound healing and nerve function, especially in diabetes. Similarly, it may evolve that there may be applications

for **CoQ-10** (ubiquinone), another antioxidant substance that is also active in an energy production pathway. As yet I have seen **nothing specific to EB** in the scientific literature on this topic, but they may turn out to be substances of considerable interest here, too, as they have been in other health conditions.

Research in using these substances to improve wound healing in general has been on-going for many years, and in many cases very promising results have been obtained. Some special tube-feeding products designed specifically to encourage wound-healing already incorporate generous amounts of some of these conditionally essential nutrients in their formulations. However, much is not yet known about the circumstances in which supplementing these substances would have the greatest likelihood of helping, the amounts that may be needed, the safety of using them in various situations, and the cost. This exciting topic is too big to include in detail here, but you will be seeing more attention to these conditionally essential substances in the news.

Dental Issues

Dental problems are common in EB, and they can result in pain, tooth loss, tooth decay, enamel issues, eating problems, and malnutrition. Even brushing with a soft brush or swab may contribute to injury in the mouth. A dentist should be consulted to determine if some protective treatments might be useful (such as coatings or fluoride treatments) and for guidance on safe cleaning of the teeth and gums. Inadequate vitamin D is a big contributor to the poor bone and tooth formation and osteoporosis often seen with severe EB.

Without adequate vitamin D the calcium in the diet is poorly absorbed. That means that what might look like a good amount of calcium intake on paper will actually not be enough to meet the body's requirements.



Saliva and some foods are more alkaline or “acid-neutralizing” in nature and they may help decrease the bacterial “acid bath” to which teeth are exposed when any carbohydrate is eaten (as discussed earlier in the section on carbohydrate additives.) Cheese, with its high calcium and low carbohydrate content has been shown to decrease cavities in rats fed sugar water when the feeding was followed by a bit of cheese. Similarly, sugar-free gum or similar products that increase production of (alkaline) saliva have been found to decrease cavities in a number of situations. Whether these approaches are useful or safe (or constipating) for an individual with EB has not been studied, but there may be something using similar principles that could be helpful.

And of course, the development of healthy teeth is also very dependent on our ability to assure adequacy of the many nutrients involved in tooth production, including not only calcium, phosphorus and fluoride but vitamin D, magnesium and vitamin C as well. Vitamin D issues were addressed earlier. Vitamin C is extremely important for the

connective tissue that keeps teeth attached to the jaw and for wound healing, but it is best to avoid regularly chewing or sucking on vitamin C supplements because vitamin C is itself acidic (“ascorbic acid”) and it can contribute to tooth decay when in direct contact with teeth for a period of time. Swallowing it in pill form does not have the acidifying effect on teeth, and as part of a meal eaten orally the effect is also less.

Anemia

Anemia (low hemoglobin in blood) is a common problem in EB and in any condition with a major inflammatory component. Sometimes this kind of anemia is called “the anemia of chronic disease” because it is not just a “nutritional” anemia. In this situation, inadequate iron may not be the problem at all. As described earlier, high production of free radicals from inflammation can damage red blood cells so they have a much shorter functional life. So, even if iron is available, the body’s production of new red blood cells just can’t keep up with the red blood cell destruction from free radical damage. The red blood cell breaking is called “hemolysis.” As described earlier, providing generous antioxidant protection and decreasing inflammation via altering the omega-6 to omega-3 fat ratio will help red blood cells live longer to do their work.

Iron deficiency can certainly cause anemia. Iron absorption, iron sources and iron-related constipation issues were discussed earlier. People do not normally “lose” much iron unless there is blood loss, but a significant amount can be lost in the sloughing of skin from wounds or intestinal injury. Therefore, actual requirements for iron will be higher in severe EB. Blood tests for “**ferritin**” can normally help the physician determine if iron **stores** are truly low, but unfortunately, chronic inflammation can cause the ferritin level to be artificially elevated. The doctor can use other evaluations (like **iron saturation**) to determine whether or not a person’s body is truly “iron hungry” or if it is just having trouble keeping up with red blood cell production for other reasons. **These different causes should result in different therapeutic approaches. Just adding more and more supplemental iron in this situation may not only be unhelpful but it can contribute to problems like constipation, and increased free radical production.**

In addition to iron deficiency and the anemia caused by red blood cells breaking, anemia can develop because of inadequacy of several other nutrients, including folic acid, vitamin B12, vitamin C, copper, zinc and protein. For that reason, just adding supplemental iron to a person’s diet is unlikely to solve the problem. Assuring adequacy of all of these nutrients is central to the prevention of anemia. As with the zinc issues described earlier, iron from meats is much better absorbed than the iron used in supplements, and the presence of meat also makes the supplement iron be better absorbed. (See my iron and zinc handout.)

Therapeutic diets that eliminate certain foods or entire food groups are in need of careful attention to the nutritional adequacy provided by the foods remaining. This includes special diets for allergies, celiac disease (“gluten-sensitive enteropathy”), autism, or the ketogenic diet for seizure control and also those that have eliminated many foods because of texture problems as may occur in EB. It is critical that the nutritional adequacy of the diet is not compromised. Sometimes small adjustments in the foods offered can solve any problems caused

by food group limitation, but in the more restrictive diets it is virtually impossible to obtain appropriate levels of vitamins and minerals without careful supplementation. **As the nutrient content of supplement products on the market can be quite variable, it is reasonable to have the diet and supplement plan evaluated carefully by a credentialed nutrition professional (e.g. an RD – a Registered Dietitian) using a computer analysis program.**

Such programs are available in many hospitals and clinics and in many university settings. They allow for the clinician and the family to be very sure that there are no accidental nutrient inadequacies or excesses in the feeding regimen that could harm the child's overall health. Most computer programs in stores that sell health products and vitamin supplements, however, are inadequate for the kind of careful micronutrient assessment that is needed in this situation, and in addition, they are often primarily programmed to promote and increase sales of particular nutrition products. Appropriate supplementation can be quite inexpensive and as effective as the higher priced products. Often various products are promoted as much superior simply because the individual promoting it is also selling it.

Drug/Nutrition Interactions

Like anyone else with a serious medical condition, people with EB may use a number of medications with important nutritional implications. A short list of medications with important nutrition interactions is shown below. For the details on the nature of these particular drug interactions, please see my handout on “Nutrition for Special Needs Kids.”

- Seizure (epilepsy) medications like phenobarbital, valproate (Depekene®,) phenytoin (Dilantin®,) and Tegretol®
- Anti-inflammatory (Hydrocortisone)
- Infection treatment (many antibiotics)
- Broncho-dilator for asthma (Theophyllin)
- Anidepressants: Serotonin Re-uptake Inhibitors, Zoloft®)
- Stomach Acid Reducers:
 - (H2 blockers: Zantac®, Tagamet®, ranitidine and cimetidine)
 - (Proton Pump Inhibitors: Prilosec®, Nexium® Protonix® Pepcid® Prevacid®)
- Diabetes medication (Glucophage®, Metformin)
- ADHD control (Methylphenidate, Ritalin®)
- Amytriptaline

Drugs can also affect intake by causing nausea, vomiting, constipation, taste changes, lethargy, or altered appetite. In EB it is important to know that narcotic pain medications often cause severe constipation and appetite loss. When these drugs are necessary, plan ahead to minimize the development of constipation as described earlier.

Herbal remedies and the term “Dietary Supplement”

“Herbal remedies” are not nutrients but many people have been given the

impression that they are. They are often marketed as “dietary supplements” because by law, the people selling them do not have to prove that their product is safe or effective. It is a loophole in the Food and Drug Administration’s laws that many people are unaware of. People assume that in America a company could not package and sell health products that were inadequately tested (or not tested at all.) But although labeled as “dietary supplements” in order to avoid having to test them, these products are often actually in the category of drugs and medications, not food. This is because whether they are in a natural state or packaged as a pill, the implied goal of using them is to achieve some pharmacologic reaction like pain relief, treatment for diseases, cancer prevention, etc.

For people with complex medical conditions and especially those who must use medications of various types, there can be significant and dangerous interactions when unknown to the physician, herbal products (or any “over-the-counter” products) are added to the mix. As one example, the herbal supplement “St. John’s wort” which has been promoted as a “natural antidepressant with no side effects” actually interacts with a wide variety of medications and causes the medications to stop working sooner than they should. This effect of St. John’s wort has been found with medications for heart disease, HIV/AIDS, birth control pills, and drugs that prevent the rejection of transplanted organs. Very serious injury has resulted.

This is just one example of why it is very important to discuss the use of ANY herbal product or “dietary supplement” with your primary care provider. “Natural” products certainly CAN have side effects – after all, some of the most potent (and also dangerous) drugs actually come from plants. For example, digitalis (an important heart medicine) comes from the foxglove plant, and even heroin, cocaine and marijuana are “herbal” products. Here is a recent comment on the problem from the scientific literature:

<p>Herbal product-drug interactions mediated by induction. Br J Clin Pharmacol. 2006 Jun;61(6):677-81. Despite their common use, it is not widely recognized that herbal medicines can alter the efficacy of coadministered prescription drugs. Constituents in herbs interact with nuclear receptors to enhance metabolizing enzyme and/or transporter activity leading to reduced drug concentrations. Although St John's wort was the first and most frequently reported source of induction-style herb-drug interactions, this knowledge has not yet changed its current availability. This type of interaction is likely to be relevant to other herbal products. Caregivers need to be aware of the issues and options for therapeutic management.</p>

When looking at the label of a product that is being marketed as a “dietary supplement,” ask yourself whether this substance is a nutrient (that is . . . is it part of your diet? . . . of your dinner? . . . like a vitamin would be) or are they are really promoting a substance as having certain medicinal properties? Interestingly, the label may say (or imply) that a substance has been used for generations for depression or sleeplessness or hair loss or cancer prevention, or heart disease, etc. etc. It often very clearly implies that a product is a proven useful and safe product for solving a particular health problem.

However, look closely at the **small print** and you will usually find a **legal disclaimer** that says something like this: “The claims on the label have not been evaluated by the FDA” and “The use of this product is not intended to prevent, diagnose, treat, cure, or help any health problem.” [Hmmm . . . Then why did you name this product “*Cancer-Free?*”] Anyway, we all need to **read labels closely, and be sure to show any product**

you are taking (or considering taking) to your health care provider, as many of these substances can interact with other medications, or they may present special problems for folks with particular health problems.

Another technique used by “dietary supplement” marketers is to label a product as “supporting” or “promoting” the health of some body system. This is a special type of legal claim – a “function” claim” – because it really just states that the nutrient has a role in some bodily function. An example would be saying “Vitamin B2 has a role in energy metabolism.” (It does.) However, although that statement is true, it does not necessarily follow that one’s intake of the substance is likely to be inadequate and in need of supplementation, or that taking extra will “give you energy.” (It won’t.) They usually fail to note that the amount needed by an individual is already adequate in most situations or that it can easily be provided with a small diet adjustment or an inexpensive general supplement as described earlier. It also implies (but will not outright state) that taking more of the substance than usual would be beneficial for treating problems with the body function it “supports.”

For example, I once saw a sign on a table in a store displaying a very expensive protein powder that said: “Protein is Essential for LIFE!” Now, that is certainly true ... with no protein we would not survive. Same with oxygen and water! ☺ However, in this case the implication was clearly that one had better be on the safe side and buy protein supplements, since the alternative appears to be death. However, there was no mention of the fact that most Americans eat about three times the amount of protein they need just from food, and there is no need at all for most of them to take extra supplemental protein.

So, while in this case eating the protein powder would generally not be harmful, I am always irritated by the use of baseless fears or tricky wording to sell expensive and questionably helpful health and nutrition products. When these techniques are used to trick people already struggling with serious medical conditions, I find it unconscionable.

This kind of tricky marketing also has a tendency to make health care professionals “throw the baby out with the bath water.” When there is so much that is “iffy” in the marketing of nutrition (or non-nutrition products labeled as “dietary supplements”) the use of truly helpful and scientifically sound nutrition information does not get the attention it deserves.

So, now I’ll get down off my soapbox and summarize all this rambling:

Summary:

Providing optimal nutrition for the individual with EB can:

- promote healing of wounds.
- optimize physical, intellectual and psychological development.
- prevent serious complications like osteoporosis.
- decrease problems like constipation, anemia and poor dental health.
- optimize immune function to reduce the incidence/severity of illness
- decrease pain due to inflammation or nutritional inadequacy

- optimize the safety and effectiveness of any medications used
- facilitate the care of the individual
- improve the quality of life of the individual and caretakers

These goals will only be realized when health professionals are able to take a close look at this important aspect of care. Please feel free to share this paper with others, including your health care professionals.

I was very pleased to meet many people in the EB community at the conference in Nashville, and I am grateful for the opportunity to learn more about living with this condition. I wrote this paper as the result of that experience. However, please remember that this entire paper is just my best guess (based on the most recent scientific literature) about aspects of nutrition may be helpful for people with severe EB. **It does not represent the official recommendations of any facility or organization, and it is intended to be used only with the involvement and approval of one’s primary health care provider.** (Sounds like one of those tricky legal disclaimers, doesn’t it? – Well, it sort of is one because people’s health conditions are just too variable for the suggestions included here to be optimal for all, and there is still a lot to be learned. **So, please think of this paper as just a little well-intentioned meddling from your Aunt Cathy.**

Also remember that this paper was written in June of 2006 . . . check the MeritCare Website [www.meritcare.com] for updates. Just type my name in the search box and then pick “Cathy Breedon’s handouts.”

You can also find the other papers there that I referred to earlier as sources of more specific nutrition details. You will also find more of my “Best Guess” information there about nutrition for other health conditions that someone in your family may be dealing with, such as diabetes, multiple sclerosis, celiac disease and hemochromatosis.

Cathy B.



Baby elephants courtesy of:

www.wildlife-pictures-online.com

www.africaguide.com

www.iucn.org

www.lowryparkzoo.com/baby_elephant/photos.html