Clinical Nutrition News

Achieving goals in nutrition at the 34th ESPEN Congress
Barcelona, Spain

October 2012

Highlights from the 34th ESPEN Congress 2012

- Dr Alfonso Cruz-Jentoft (Spain) reported results of a new international nutrition study of community-living older people, ages 65 and older. The prevalence of sarcopenia was 57% in those with confirmed malnutrition (p 3).
- In Australian and New Zealand hospitals, only 64% of wards conducted malnutrition risk screening. In those that did, 1 in 3 patients was malnourished. More nutrition training is needed in Australasia, as elsewhere (p 4).
- Sarcopenic obesity is an emerging concern in nutritional care. A person with sarcopenic obesity has a high body weight, yet he or she has low muscle mass and is weak (p 6).
- “Which nutritional screening tool is best?” The answer is more difficult than you might expect (p 7).
- Dr T Nakao and colleagues (Japan) showed how nutritional therapy can prevent or postpone dialysis initiation in patients with stage 5 chronic kidney disease (p 8).
- Nutritional practices make good sense when the underlying mechanisms are revealed; ESPEN 2012 sessions reviewed the basic science behind the roles of prebiotics and probiotics in maintaining digestive health (p 10).

Clinical Nutrition News is a newsletter for health care professionals worldwide. Based on clinical nutrition congresses in Europe, Asia, and the Americas, we report news in the areas of nutrition advocacy, education, basic science, and clinical research and practice.

The Barcelona meeting was the 2012 premier scientific program of the European Society for Clinical Nutrition and Metabolism (ESPEN 2012). This year’s congress drew the highest-ever attendance for an ESPEN meeting—more than 3500 registrants from 88 countries.

This newsletter reviews hot topics from the 34th ESPEN Congress: why protein really matters for restoring and maintaining lean body mass; understanding sarcopenic obesity; 2012 updates on nutrition screening and assessment tools for hospitalized patients; and new insights about fiber and gastrointestinal health.

Abbott Nutrition played a principal role as a sponsor and participant at ESPEN 2012. The Abbott Nutrition Health Institute hosted a scientific session in which experts discussed how specific nutritional components can help prevent and treat sarcopenia, a condition of muscle loss that occurs with aging or disease. Abbott also hosted 6 meet-the-expert sessions where standout professionals discussed how nutritional intervention facilitates better outcomes for patients with diabetes, cancer, and kidney disease.
Abbott Nutrition Health Institute Symposium: Lean body mass and sarcopenia

Retention and recovery of lean body mass with aging and disease

Dr Abelardo Garcia de Lorenzo (Spain) set the stage for the Abbott Nutrition Health Institute Symposium by highlighting the challenges of managing age- and disease-related loss of lean body mass (LBM). The causes of LBM loss are complex. The main cause is a patient’s health status, which can in turn interfere with adequate intake, absorption, and metabolism of food, as well as with level of physical activity. Nutrition shortfall can be attributed to infection-related increases in metabolic needs, disease-specific catabolism, appetite loss, swallowing problems, absorption or digestion disorders, and gastrointestinal symptoms of feeding intolerance.

A low-LBM phenotype is common in a wide range of diseases and conditions—chronic obstructive pulmonary disease (COPD), congestive heart failure, renal disease, with surgery or critical illness, and in people over 65 years of age.\(^1\)

LBM, mostly skeletal muscle, serves as a reservoir of proteins and amino acids. When the body’s protein and energy needs are not met by dietary intake, muscle is broken down to provide amino acids. Such LBM breakdown has serious consequences, including impaired immune responses and poor wound healing. Clinically, such consequences are seen as increased risk for infections and pressure ulcers, and muscle weakness to the point that physical functionality is affected.\(^2\)

What can we do about loss of LBM due to aging and disease? Dr Garcia de Lorenzo advised nutrition and physical activity as key strategies to help maintain and recover LBM. This advice was underscored by other symposium presenters.

Health conditions associated with loss of LBM

A low-LBM phenotype is common in a wide range of diseases and conditions—chronic obstructive pulmonary disease (COPD), congestive heart failure, renal disease, with surgery or critical illness, and in people over 65 years of age.\(^1\)

LBM loss, % Total | Associated complication | Associated mortality, %
--- | --- | ---
10 | • Impaired immunity  
• Increased risk of infection | 10 |
20 | • Decreased healing  
• Increased weakness  
• Increased risk of infection  
• Thinning of skin | 30 |
30 | • Too weak to sit  
• Pressure ulcers  
• Pneumonia  
• Lack of healing | 50 |
40 | • Death, usually from pneumonia | 100 |

Reprinted by permission of Demling.
Optimal protein intake promotes muscle anabolism in the elderly

Dr Elena Volpi (USA) reviewed clinical research evidence about maintaining LBM in older people by promoting optimal protein intake. She began, “It is fundamental for meals to provide protein for muscle synthesis.” Results of a clinical study by Houston and colleagues clearly demonstrated that older adults who ate more protein were significantly less likely to lose muscle over time. Dietary protein intake can thus be considered a modifiable factor that is important for preserving LBM. Recommended protein intakes may, therefore, need to be raised in older people in order to maintain nitrogen balance and to protect them from sarcopenic muscle loss. It has been reported by Paddon-Jones and colleagues that ingestion of approximately 25 to 30 g of protein per meal maximally stimulates muscle protein synthesis in both young and old individuals. However, muscle protein synthesis is blunted in older people when the quantity of protein is less than approximately 20 g per meal.

According to Dr Volpi, it is common in the US to consume about half of the daily protein in the dinner meal. However, with evidence of a 25-30 g protein intake threshold for muscle protein synthesis in older people, she advised that this population will likely benefit from eating protein evenly distributed through the day, e.g., 30 g at breakfast, 30 g at lunch, and 30 g at dinner.

HMB prevents loss of muscle during bed rest

Dr Nicolaas Deutz (USA) highlighted problems older adults experience when they are hospitalized. Not only do they usually stay longer in hospitals than younger people, but they also experience adverse consequences such as loss of mobility and decline in their ability to perform activities of daily living. Dr Deutz noted, “An older adult who is bedridden for 10 days can lose as much as 1 kg of leg muscle mass and experience a related decline in strength.”

To help prevent or offset such losses, geriatric nutritionists have variously tried increasing protein intake (> 1.0 g/kg body weight/day), therapeutic doses of essential amino acid mixtures, and supplementation with branched-chain amino acids (leucine, isoleucine, and valine). A new strategy uses oral doses of β-hydroxy-β-methylbutyrate (HMB), a metabolite of the amino acid leucine, to protect against loss of muscle mass.

In a study by Deutz et al, daily meals plus 2 oral doses of HMB (1.5 g/ dose) were given to older women (average age, 67 years) on 10 days of bed rest; control subjects received isocaloric meals and oral placebo treatments. At the end of the bed rest interval, study participants continued to receive HMB or placebo, and they also underwent rehabilitation for 8 weeks with resistance exercise training 3 days per week. Dual-energy x-ray absorptiometry (DXA) was used to measure total lean mass, and knee extensor...
testing measured strength. HMB treatment provided full protection against loss of total lean mass, while placebo-treated individuals lost ~2 kg of total lean mass. During exercise rehabilitation, older adults in the HMB-treated group gained nearly 0.2 kg of total lean mass over baseline, while placebo-treated older adults did not regain any additional total lean mass over baseline values.

HMB thus appears to be a promising treatment for preservation of muscle mass during bed rest, especially for older adults who are vulnerable to debilitating effects of muscle loss.

Malnutrition and sarcopenia in older adults

Dr Alfonso Cruz-Jentoft (Spain) described early results from an ongoing clinical trial that he and colleagues are conducting on nutritional treatment for older, community-living people with malnutrition and sarcopenia. The study profiled older men and women (n=800; over 65 years, average age 76.6 years) living in 8 countries across Europe and North America. Participants were evaluated for the often-overlapping conditions of malnutrition and sarcopenia by established criteria. Malnutrition was confirmed in 643 men and women, with approximately 76% having low physical performance and/or strength and 57% with low skeletal mass index, thus meeting suggested criteria for sarcopenia. Many of those with sarcopenia were overweight or obese, with 19% representing the condition of sarcopenic obesity. On review of dietary intake, 34% of subjects had insufficient protein intake (<0.8 g/kg body weight/day). Serum analysis revealed that 30%, and 26% had deficient vitamin D, levels (<20 ng/mL) and Vitamin B levels (<350 pg/mL), respectively. The final phase of this clinical study will examine response of these adults to treatment with complete and balanced oral nutrition supplements with or without HMB.

Dr Cruz-Jentoft concluded, “We anticipate that results of this long-term intervention study will help to guide management of nutrition-related sarcopenia in the near future.”

Nutrition Awareness and Advocacy

Malnutrition in Australian hospitals

Ms Ekta Agarwal (Australia), a clinical and research dietitian, presented results of Australasian Nutrition Care Day. As is the case around the world, malnutrition was common yet under-recognized and under-treated. For the study, dietitians from 56 hospitals in Australia and New Zealand completed a 24-hour survey of nutritional status and dietary intake of adult hospitalized patients (n=3122 patients in 370 wards of 56 hospitals; mean age 65 ± 18 years). Nutritional risk was usually evaluated using the Malnutrition Screening Tool; participants ‘at risk’ underwent nutritional assessment using Subjective Global Assessment. Nutrition risk screening was conducted in 64% (n = 234) of the wards, i.e., nearly 40% of patients were not screened. Of those who were screened, 41% were “at risk” of malnutrition, and the overall prevalence of malnutrition was 32%. Fifty-five percent of malnourished participants and 35% of well-nourished participants consumed less than half of the food offered during the audit. “Not hungry” was the most common reason for not eating everything offered during the audit. Only about half of the wards referred patients at nutrition risk to dietitians and used a nutrition intervention protocol, and nutrition risk rescreening was conducted only in 14% of the wards.

Ms Agarwal concluded, “A large number of acute care hospital wards in Australia and New Zealand do not comply with evidence-based practice guidelines for nutritional management of malnourished patients.” Such findings call for nutrition education and other concerted efforts to update hospital nutrition practices.
How nutrients speak to muscle

Prof Yves Boirie (France) delivered ESPEN’s prestigious Cuthbertson Lecture this year. In a luminous presentation, Prof Boirie reviewed the complex pathways for regulation of muscle protein synthesis and breakdown. Even though rates of muscle protein turnover are relatively low—1% to 2% per day—muscle protein synthesis and breakdown are highly regulated.

Given the importance of muscle to physical function and quality of life, it is not surprising that synthesis and breakdown of muscle proteins are precisely controlled processes.

Food-derived nutrients, hormones, cytokines, and exercise are well-known regulators of protein balance. Protein synthesis is supported by a high-protein diet, leucine and other bioactive amino acids, omega-3 polyunsaturated fatty acids, and antioxidants. Hormones that signal for protein synthesis and promote anabolism are insulin, insulin-like growth factor, vitamin D, and testosterone. In addition, exercise promotes muscle protein synthesis.

On the other hand, dietary components such as saturated fatty acids and their metabolites (ceramide) increase protein catabolism and/or block synthesis. Inflammatory cytokines elicit signals for protein breakdown, as do sedentary lifestyle and immobilization or bed rest.

Other processes also impose limits on muscle protein maintenance. Aging is characterized by anabolic resistance to insulin-stimulated protein synthesis, which appears to result from a defect in a signaling pathway (S6 kinase). Lipid infiltration into muscle, as occurs in obesity, also impairs protein synthesis.

Muscle, or lean body mass, is critical to health and wellbeing. The natural history of lean body mass involves (1) building muscle in childhood and young adulthood, (2) maintaining peak muscle in mid-life, and (3) minimizing loss as older adults. When regulation of muscle protein goes awry, as with wasting diseases and aging, excessive protein loss can lead to serious functional consequences such as loss of mobility, falls, and disability.

Prof Boirie advised, “For targeted treatment of age- and disease-related muscle loss, it is vital to understand the science of how protein synthesis and degradation are regulated.”

Given the importance of muscle to physical function and quality of life, it is not surprising that synthesis and breakdown of muscle proteins are precisely controlled processes. Complicated intracellular signaling pathways, including multiple transcription factors, regulate muscle protein synthesis and breakdown. The Akt/mTOR pathway and its downstream targets, S6K1 and 4E binding protein, are activated for muscle hypertrophy and inhibited in conditions of muscle atrophy. Similarly, the ubiquitin-proteosome and lysosomal pathways are activated during times of muscle protein breakdown.

Prof Boirie cautioned, “When the breakdown exceeds synthesis, as in disease and aging, muscle protein levels decline.”

---

**Diagram: Protein synthesis in muscle cells**

- **Insulin**
  - Anabolic substrates
    - Omega-3 PUFAs
    - Antioxidants
    - Vitamin D
  - Testosterone
  - Exercise

- **Amino acids**
  - Positive regulators
    - Permissive effects
  - Negative regulators
    - Inhibitory effects

- **Anti-anabolic substrates**
  - Saturated FAs
  - Ceramide

- **Cytokines**
  - Immobilization

Muscle protein synthesis is regulated by a wide range of factors, including nutrients from food, hormones, cytokines, and exercise. FA, fatty acid; PUFA, polyunsaturated fatty acid.

Reprinted by permission of Boirie.
Journal club: most-cited papers from Clinical Nutrition

In an ever-popular session, authors presented summaries of their papers, which have achieved the status of “frequently cited” in Clinical Nutrition, the official journal of ESPEN. Each of these papers merits presentation for a journal club or as part of a grand rounds session at your hospital.


Dr Krishna Varadhan (UK) introduced the program called Enhanced Recovery After Surgery (ERAS) as a relatively new approach to pre- and post-surgical care. The ERAS pathway was developed to lower patients’ stress responses to surgery and speed up recovery. In the frequently-cited paper by Varadhan and colleagues, a meta-analysis, the reason for analyzing studies of major elective colorectal surgery was to compare outcome differences for patients managed within an ERAS pathway with those of patients treated with conventional peri-operative care. Only randomized, controlled trials with head-to-head comparisons of ERAS versus conventional care were selected; 6 trials with a total of 452 patients were included. Studies examined adherence to a total of 12 ERAS recommendations for peri-operative care, e.g., pre-operative counseling, no pre-operative fasting (provision of clear carbohydrate-enriched liquids until 2-hours before surgery), avoidance of peri-operative fluid overload, use of non-opioid analgesia, and early post-operative feeding and mobilization. Based on this meta-analysis, high adherence to ERAS recommendations significantly reduced the length of stay and complication rates after major elective colorectal surgery without compromising patient safety.

Dr Varadhan concluded, “Our challenge now is to integrate what we know about ERAS into routine practice.”


Nutritionist Karin Schindler (Austria) presented results of an all-important study of nutrition practices across Europe and in Israeli hospitals, based on results from nutritionDay data collection in 2007 and 2008. The goal of her research was to increase recognition and treatment of under-nutrition in hospitalized patients. A one-day survey was conducted in 1217 units from 325 hospitals in 25 countries with 21,007 patients. Screening practice, the type of tools used and whether energy requirements and intake are assessed and monitored were surveyed using standardized questionnaires.

Results showed that more than 50% of the units in the different regions used a screening routine, which was usually performed with locally developed methods and less often with national tools, the Nutrition Risk Screening-2002, or the Malnutrition Universal Screening Tool. Study results showed that 27% of the patients were subjectively classified as being “at nutritional risk.” Independent factors influencing the classification of nutritional risk included age, BMI <18.5 kg/m\(^2\), unintentional weight loss, or reduced food intake in the previous week and on nutritionDay. Almost half of all patients in the survey did not reach their energy goal on nutritionDay.

Ms Schindler noted that hospitalized patients at nutritional risk are almost twice as likely to receive nutritional support if they are screened on admission or if a dietitian is involved in their care. Visit www.nutritionday.org to learn how to take part in an upcoming survey; nutritionDay is now a worldwide survey of hospital nutrition practice.
Clinical Nutrition Research and Practice

What is fatty muscle, and why does it matter?

Sarcopenic obesity is an emerging concern in nutritional care. A person with sarcopenic obesity has a high body weight, yet he or she may have low muscle mass and be weak. At ESPEN 2012, Dr Marjolein Visser (Netherlands) showed that muscle weakening is due to both quantity and quality of the muscle tissue. In people who are overweight or obese and inactive, muscle mass declines, as does the quality of the muscle.

According to Dr Visser, multiple studies have shown that intermuscular fat affects both muscle strength and function. Results of the longitudinal Health ABC study demonstrated that as people age, the increase in muscular fat infiltration can be as much as 20% over 5 years. Likewise, obesity increases fatty muscle; the more fat in the body, the more likely it will be in the muscle. In addition, inactivity increases the deposition of intermuscular fat. Even in healthy young adults, 4-weeks of leg inactivity can cause a 20% increase in intermuscular fat.

Dr Visser reported her findings from an epidemiological study of muscle and fat in older men and women (age 70-79 years). Lower muscle mass (smaller cross-sectional thigh muscle area) and greater fat infiltration into the muscle were both associated with increased risk of mobility loss, as was lower knee extensor strength. The association between low muscle mass and functional decline seemed to be a function of low muscle strength.

Nutrition screening and assessment

Update on nutrition screening in hospitalized patients

In an ESPEN session on nutrition screening, Dr Marian van Bokhorst (Netherlands) asked a simple question, “What screening tool is best?” The answer was more difficult than she expected. First of all, she found 39 different validated screening tools supported by 94 studies. Next she deduced that there is no “gold standard” for identifying malnutrition, only a “semi-gold standard,” the Subjective Global Assessment (SGA). She also advised that the best screening tool depends on what you want to know—nutritional status, predict outcome, or predict response to treatment. And finally, the best tool depends on the population you are screening—geriatric patients, surgical patients, renal patients, outpatients, or others.

Dr van Bokhorst noted, “When it comes to selecting a screening tool, no one size fits all.” She suggested narrowing the field to the top 5 relevant tools, then choose the tool that best fits your needs. Some frequently-used tools are MST, MUST, NRS-2002, NRI, and MNA.

ESPEN nutrition expert Dr Claude Pichard (Switzerland) added, “Screening with whatever tool you choose is better than not screening at all.”

Dr Marion van Bokhorst (Netherlands) reviewed nutrition screening tools.
New strategies to assess body composition

Two ESPEN presentations described new ways to predict nutritional risk and clinical outcomes: (1) phase angle (PhA) determination by bioimpedence analysis (BIA), and (2) BIA determination along with handgrip strength and gait speed.

Dietitian Ursula Kyle (USA) described how the phase angle is a useful tool to determine hospital patients’ nutritional, morbidity, and mortality risks. PhA is a non-invasive, objective, direct, and quick (less than 2 min) measure. While the biological meaning of PhA is not fully understood, it is considered an indicator of membrane integrity and distribution of water in intracellular and extracellular spaces. Kyle and colleagues designated a low PhA cutoff value as < 5.0 Ω for men and < 4.6 Ω for women. Her study results showed that PhA was lower in hospitalized patients than in non-hospitalized age-, sex-, and height-matched healthy controls. Importantly, low PhA was a sensitive and specific predictor of malnutrition risk, hospital length of stay, and death within 30 days.

Sports and nutrition specialist Renske van Harmelen (Netherlands) presented results of her study in older people on whether BIA could be used as a practical alternative to DXA for determination of appendicular muscle mass, which is one criterion for diagnosis of sarcopenic obesity. A diagnosis of sarcopenia was based on low muscle mass in combination with low strength and/or low function. Study results demonstrated that BIA was a practical and reliable tool for diagnosis of sarcopenic obesity; BIA is easier and more available than DXA.

Nutrition and chronic kidney disease

What’s new in renal nutrition?

Three new research studies from Japan highlight the importance of appropriate nutrition for people with chronic kidney disease (CKD). Study results show that appropriate nutrition can help prevent or delay the need for dialysis, and can also increase the likelihood of long-term survival once dialysis is initiated.

Nutritional therapy can prevent or postpone dialysis initiation in stage 5 CKD patients. Dr T Nakao and colleagues (Japan) recruited consecutive CKD patients (n=77) to a study when their glomerular filtration rate decreased to 14 mL/min. The clinical team, including physicians and registered dietitians, advised all patients to follow a low-protein (< 0.6 g/kg body weight/day) and low-salt diet (< 6 g salt/day), facilitated by individualized dietary counseling once a month. Patients who adhered to the recommended diet lived significantly longer (P < 0.001) without needing dialysis than did non-adherent patients (dialysis requirement at 1 year was 0% for adherent vs 19.2% in non-adherent patients; 8.3% vs 38.6% at 2 years; and 14.9% vs 61.2% at 3 years).

Stage 5 CKD patients who adhered to a low-protein, low-salt diet lived significantly longer without needing dialysis.

<table>
<thead>
<tr>
<th>Sarcopenia criterion is met if the patient’s value is below the cutoff point below</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measure</strong></td>
<td><strong>Criterion</strong></td>
<td></td>
</tr>
<tr>
<td>BIA for appendicular muscle mass (kg)</td>
<td>Muscle mass</td>
<td>8.5</td>
</tr>
<tr>
<td>DXA for appendicular muscle mass (kg)</td>
<td>Muscle mass</td>
<td>7.23</td>
</tr>
<tr>
<td>Handgrip strength (kg)</td>
<td>Muscle strength</td>
<td>32</td>
</tr>
<tr>
<td>4-meter gait speed (m/sec)</td>
<td>Function</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Dialysis patients are at high risk of malnutrition and its consequences. Protein-energy wasting (PEW), a condition resulting in severe loss of muscle, is prevalent among chronic kidney disease patients on hemodialysis. Drs Y Kanazawa and T Nakao (Japan) studied a population of consecutive patients attending 4 outpatient dialysis clinics (n=210) in Tokyo and found 1 in 7 patients (14.8%) had PEW, based on criteria of the International Society of Renal Nutrition and Metabolism (ISRNM). According to the ISRNM, 3 of the following 4 criteria must be met for a PEW diagnosis: (1) biochemical measure of serum albumin < 3.8 g/dL; (2) body mass index < 18.5 kg/m\(^2\) (3) muscle mass reduction, as determined by mid-arm muscle circumference area > 10% lower than a reference population (4) unintentionally low dietary intake, as < 24 kcal/kg body weight/day, < 0.6g protein/kg body weight/day. Adequate and appropriate nutritional intake is key to maintaining activities of daily living and survival of hemodialysis patients. Dr S Miyake and colleagues (Japan) measured body composition and reviewed dietary intake of 7-year survivors on dialysis 3-times a week (n=42). For these stable dialysis patients, the research team concluded that adequate energy intake was key to maintaining activities of daily living, as well as to survival. They also suggested that dietary omega-3 fatty acids may play an important part, likely by reducing inflammation and its harmful effects.

Role of high-protein, inflammation-modulating nutrition

In 2008, there were nearly 14 million new cases of cancer worldwide; the global burden is expected to rise to more than 21 million by the year 2030. For people with cancer, nutrition plays a prominent role: nutritional status is a disease indicator, a target of multi-modal treatment, and a factor that affects response to therapy and patient survival. At a meet-the-expert session hosted by Abbott Nutrition, Ms Mary Ann Cockram, MS, RD, LD, (USA) noted that moderate-to-severe weight loss occurs in 30% to 80% of cancer patients, depending on the tumor type. Weight loss is often the first symptom noticed by a patient with cancer. Inflammation related to a tumor itself or to the body’s response to a tumor leads to diminished appetite, metabolic changes, loss of muscle and fat tissues, and impaired capacity for physical activities. Together these conditions are called cancer cachexia, which has been formally described and defined by an international consensus group.

Cancer cachexia can worsen as patients progress through various stages—from precachexia to cachexia syndrome to refractory cachexia. BMI, body mass index

Reprinted by permission of Elsevier.
Cachexia can worsen as patients progress through various stages—from pre-cachexia to cachexia to refractory cachexia and ultimately to death. The severity of cancer cachexia is classified according to the degree of muscle depletion, as well as fat loss, combined with ongoing weight loss and inflammation. Severe muscle loss can lead to loss of physical function and even disability. Such loss of lean body mass is of further concern because it can limit treatment tolerance and worsen prognosis.

Because inflammation is a prominent component of cancer cachexia, the associated loss of lean body mass cannot be reversed by conventional nutritional support. Oral nutrition supplements for cancer patients are formulated with special ingredients (i.e., omega-3 fatty acid, eicosapentaenoic acid, EPA, known to lower cytokine-mediated inflammation), thereby offering a novel solution for treatment of inflammation-driven cachexia with malnutrition.

In a recent study, high-energy, high-protein oral nutritional supplement containing EPA was shown to improve lean body mass and quality of life in patients with non-small-cell lung cancer.

Oral nutrition supplements formulated with special ingredients for cancer patients offer a novel solution for prevention and treatment of inflammation-driven cachexia with malnutrition.

Basic Science Research in Nutrition

Certain nutritional practices make good sense when the underlying mechanisms are revealed. Several sessions at ESPEN 2012 reviewed the basic science behind the roles of prebiotics and probiotics in maintaining digestive health.

Prebiotics, probiotics, and health

Prebiotics are non-digestible food ingredients, usually fibers, that stimulate the growth of bacteria in the digestive system in ways that are beneficial to health. Probiotics are the live bacteria that live in the gut and provide health benefits to the host, such as *Lactobacillus, Bifidobacterium*, and more than 400 other species. In a healthy adult, there are more bacterial cells in the intestine (100 trillion or $10^{14}$) than there are cells in the rest of the body.

Symbiotic life with our microbes

Dr Henrike Hamer (Netherlands), an expert on functional foods, pointed out, “Short chain fatty acids (SCFAs) play an important role in intestinal homeostasis and in overall health.” Symbiotic bacteria in the intestinal lumen break down dietary fibers by fermentation to produce SCFAs.

Of the SCFAs (acetate, propionate and butyrate), butyrate is the main end-product. Butyrate is an important energy source for cells of the intestinal epithelium, providing more than 60% of the energy supply for cells of the large intestine. In addition, butyrate exerts potent effects on a variety of colonic functions. Butyrate inhibits inflammation as in colitis; protects against cancer by decreasing oxidative stress and inhibiting carcinogenic processes; and maintains epithelial cells as a defense barrier.

Such observations underscore the importance of fiber in the human diet. A lack of luminal SCFAs or an inability to use butyrate as a metabolic fuel may lead to a nutritional deficiency of the colonic epithelium, resulting in mucosal atrophy and ultimately to “nutritional” colitis. Risk for colon cancer is also expected to increase under such conditions.
Dr Hamer concluded, “Much of our understanding of butyrate and other SCFAs comes from in vitro evidence and from animal models. Although difficult to perform, more human studies are needed.” In fact, Hamer and colleagues recently reported on a study in healthy human volunteers, which demonstrated a reduction of oxidative stress in the colon when butyrate enemas were used.38

**Short-chain fatty acids in the intestine**

Dr Koen Venema (Netherlands) described how he and his research colleagues use computer-driven gastrointestinal models called TIM to study digestion and fermentation in vitro. TIM-1 simulates the digestive processes of the stomach and small intestines. TIM-2 represents the colon and includes a rich microbial gut-derived flora.

For colon studies, stable non-radioactive isotopes ($^{13}$C) are incorporated into carbohydrate substrates such as starch, inulin, and fructooligosaccharides (FOS). By following the isotopic label, it is possible to model what substrates are used and by which resident bacteria. The model can be varied to represent normal and pathological conditions, e.g., healthy infants and older people, and obese individuals. Based on insights from TIM studies, along with follow-up human studies, Dr Venema anticipated a time when “fecal transplantation” will be part of a new clinical strategy to treat intestinal disease.
References


