

LE Magazine August 2003

ABSTRACTS

Muscle mass

Prevalence of sarcopenia and predictors of skeletal muscle mass in healthy, older men and women.

BACKGROUND: Sarcopenia refers to the loss of skeletal muscle mass with age. The objective of this study was to determine the prevalence of sarcopenia in a population of older, community-dwelling research volunteers. **METHODS:** Appendicular skeletal muscle mass was measured by dual x-ray absorptiometry in 195 women aged 64 to 93 years and 142 men aged 64 to 92 years. We defined sarcopenia as appendicular skeletal muscle mass/height² (square meters) less than two standard deviations below the mean for young, healthy reference populations. We used two different reference populations and compared prevalence in our population to that reported in previous studies. Body mass index (BMI) was calculated and physical activity and performance were measured with the Physical Activity Scale for the Elderly, the Short Physical Performance Battery, and the Physical Performance Test. We measured health-related quality of life by using the SF-36 general health survey. Serum estrone, estradiol, sex hormone-binding globulin, parathyroid hormone and 25-hydroxy vitamin D were measured in all participants and bioavailable testosterone was measured only in men. Leg press strength and leg press power were determined in men. **RESULTS:** The prevalence of sarcopenia in our cohort was 22.6% in women and 26.8% in men. A subgroup analysis of women and men 80 years or older revealed prevalence rates of 31.0% and 52.9%, respectively. In women, skeletal muscle mass correlated significantly with BMI and levels of serum estrone, estradiol and 25-hydroxy vitamin D; in men, it correlated significantly with BMI, single leg stance time, leg press strength, leg press power, SF-36 general health score, Physical Performance Test total score, and bioavailable testosterone levels. With the use of linear regression analysis, BMI was the only predictor of appendicular skeletal muscle mass in women, accounting for 47.9% of the variance ($p < .05$). In men, BMI accounted for 50.1%, mean strength accounted for 10.3%, mean power accounted for 4.1%, and bioavailable testosterone accounted for 2.6% of the variance in appendicular skeletal muscle mass ($p < .05$). **CONCLUSIONS:** Sarcopenia is common in adults over the age of 65 years and increases with age. BMI is a strong predictor of skeletal muscle mass in women and men. Strength, power and bioavailable testosterone are further contributors in men. These data suggest that interventions to target nutrition, strength training and testosterone replacement therapy should be further investigated for their role in preventing muscle loss with age.

J Gerontol A Biol Sci Med Sci 2002 Dec;57(12):M772-7

Epidemiology of sarcopenia among the elderly in New Mexico.

Muscle mass decreases with age, leading to "sarcopenia," or low relative muscle mass, in elderly people. Sarcopenia is believed to be associated with metabolic, physiologic and functional impairments and disability. Methods of estimating the prevalence of sarcopenia and its associated risks in elderly populations are lacking. Data from a population-based survey of 883 elderly Hispanic and non-Hispanic white men and women living in New Mexico (the New Mexico Elder Health Survey, 1993 to 1995) were analyzed to develop a method for estimating the prevalence of sarcopenia. An anthropometric equation for predicting appendicular skeletal muscle mass was developed from a random subsample ($n = 199$) of participants and was extended to the total sample. Sarcopenia was defined as appendicular skeletal muscle mass (kg)/height² (m²) being less than two standard deviations below the mean of a young reference group. Prevalences increased from 13% to 24% in persons under 70 years of age to >50% in persons over 80 years of age, and were slightly greater in Hispanics than in non-Hispanic whites. Sarcopenia was significantly associated with self-reported physical disability in both men and women, independent of ethnicity, age, morbidity, obesity, income and health behaviors. This study provides some of the first estimates of the extent of the public health problem posed by sarcopenia.

Am J Epidemiol 1998 Apr 15;147(8):755-63

Predictors of skeletal muscle mass in elderly men and women.

BACKGROUND: Elderly men and women lose muscle mass and strength with increasing age. Decreased physical activity, hormones, malnutrition and chronic disease have been identified as factors contributing to this loss. There are few data, however, for their multivariate associations with muscle mass and strength. This study analyzes these associations in a cross-sectional sample of elderly people from the New Mexico Aging Process Study. **METHODS:** Data collected in 1994 for 121 male and 180 female volunteers aged 65 to 97 years of age enrolled in The New Mexico Aging Process Study were analyzed. Body composition was measured using dual energy X-ray absorptiometry; dietary intake from three day food records; usual physical activity by

questionnaire; health status from annual physical examinations; and serum testosterone, estrone, sex-hormone binding globulin (SHBG), and insulin-like growth factor (IGF1) from radioimmunoassays of fasting blood samples. Statistical analyses included partial correlation and stepwise multiple regression. RESULTS: The muscle mass and strength (adjusted for knee height) decreased with increasing age in both sexes. The muscle mass was significantly associated with serum free-testosterone, physical activity, cardiovascular disease and IGF1 in the men. In the women, the muscle mass was significantly associated with total fat mass and physical activity. Age was not associated significantly with muscle mass after controlling for these variables. Grip strength was associated with age independent of muscle mass in both sexes. Estrogen (endogenous and exogenous) was not associated with muscle mass or strength in women. CONCLUSIONS: Age-related loss of muscle mass and strength occurs in relatively healthy, well-nourished elderly men and women and has a multifactorial basis. Sex hormone status is an important factor in men but not in women. Physical activity is an important predictor of muscle mass in both sexes.

Mech Ageing Dev 1999 Mar 1;107(2):123-36

Exercise training guidelines for the elderly.

The capacity of older men and women to adapt to increased levels of physical activity is preserved, even in the most elderly. Aerobic exercise results in improvements in functional capacity and reduced risk of developing Type II diabetes in the elderly. High-intensity resistance training (above 60% of the one repetition maximum) has been demonstrated to cause large increases in strength in the elderly. In addition, resistance training result in significant increases in muscle size in elderly men and women. Resistance training has also been shown to significantly increase energy requirements and insulin action of the elderly. PURPOSE: We have recently demonstrated that resistance training has a positive effect on multiple risk factors for osteoporotic fracture in previously sedentary postmenopausal women. METHODS: Because the sedentary lifestyle of a long-term care facility may exacerbate losses of muscle function, we have applied this same training program to frail, institutionalized elderly men and women. RESULTS: In a population of 100 nursing home residents, a randomly assigned high-intensity strength-training program resulted in significant gains in strength and functional status. In addition, spontaneous activity, measured by activity monitors, increased significantly in those participating in the exercise program whereas there was no change in the sedentary control group. Before the strength training intervention, the relationship of whole body potassium and leg strength was seen to be relatively weak ($r^2 = 0.29$, $P < 0.001$), indicating that in the very old, muscle mass is an important but not the only determining factor of functional status. CONCLUSIONS: Thus, exercise may minimize or reverse the syndrome of physical frailty, which is so prevalent among the most elderly. Because of their low functional status and high incidence of chronic disease, there is no segment of the population that can benefit more from exercise than the elderly.

Med Sci Sports Exerc 1999 Jan;31(1):12-17

Creatine supplementation improves muscular performance in older men.

PURPOSE: Creatine supplementation has been shown to enhance muscle strength and power after only five to seven days in young adults. Creatine supplementation could therefore benefit older individuals because aging is associated with a decrease in muscle strength and explosive power. METHODS: We examined the effects of seven days of creatine supplementation in normally active older men (59 to 72 year) by using a double-blind, placebo-controlled design with repeated measures. After a three-week familiarization period to minimize learning effects, a battery of tests was completed on three occasions separated by seven days (T1, T2, and T3). After T1, subjects were matched and randomly assigned into creatine (N = 10) and placebo (N = 8) groups. After T2, subjects consumed supplements (0.3 g x kg⁻¹ x d⁻¹) for seven days until T3. All subjects were tested for maximal dynamic strength (one-repetition maximum leg press and bench press), maximal isometric strength (knee extension/flexion), upper- and lower-body explosive power (6 x 10-s sprints on a cycle ergometer), and lower-extremity functional ability (timed sit-stand test and tandem gait test). Body composition was assessed via hydrostatic weighing, and blood samples were obtained to assess renal and hepatic responses and muscle creatine concentrations. RESULTS: No significant increases in any performance measures were observed from T1 to T2 with the exception of isometric right-knee flexion in the placebo group indicating stability in the testing protocols. Significant group-by-time interactions indicated the responses from T2 to T3 were significantly greater ($P < \text{or} = 0.05$) in the creatine compared with the placebo group, respectively, for body mass (1.86 and -1.01 kg), fat-free mass (2.22 and 0.00 kg), maximal dynamic strength (7 to 8 and 1% to 2%), maximal isometric strength (9 to 15 and -6% to 1%), lower-body mean power (11% and 0%) and lower-extremity functional capacity (6 to 9 and 1% to 2%). No adverse side effects were observed. CONCLUSION: These data indicate that seven days of creatine supplementation is effective at increasing several indices of muscle performance, including functional tests in older men without adverse side effects. Creatine supplementation may be a useful therapeutic strategy for older adults to attenuate loss in muscle strength and performance of functional living tasks.

Med Sci Sports Exerc 2002 Mar;34(3):537-43

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ABSTRACTS

Creatine supplementation combined with resistance training in older men.

PURPOSE: To study the effect of creatine (Cr) supplementation combined with resistance training on muscular performance and body composition in older men. **METHODS:** Thirty men were randomized to receive creatine supplementation (CRE, N = 16, age = 70.4 +/- 1.6 yr) or placebo (PLA, N = 14, age = 71.1 +/- 1.8 year), using a double blind procedure. Cr supplementation consisted of 0.3-g Cr.kg(-1) body weight for the first five days (loading phase) and 0.07-g Cr.kg(-1) body weight thereafter. Both groups participated in resistance training (36 sessions, three times per week, three sets of 10 repetitions, 12 exercises). Muscular strength was assessed by 1-repetition maximum (1-RM) for leg press (LP), knee extension (KE), and bench press (BP). Muscular endurance was assessed by the maximum number of repetitions over three sets (separated by one-min rest intervals) at an intensity corresponding to 70% baseline 1-RM for BP and 80% baseline 1-RM for the KE and LP. Average power (AP) was assessed using a Biodex isokinetic knee extension/flexion exercise (three sets of 10 repetitions at 60 degrees.s(-1) separated by one-min rest). Lean tissue (LTM) and fat mass were assessed using dual energy x-ray absorptiometry. **RESULTS:** Compared with PLA, the CRE group had significantly greater increases in LTM (CRE, +3.3 kg; PLA, +1.3 kg), LP 1-RM (CRE, +50.1 kg; PLA +31.3 kg), KE 1-RM (CRE, +14.9 kg; PLA, +10.7 kg), LP endurance (CRE, +47 reps; PLA, +32 reps), KE endurance (CRE, +21 reps; PLA +14 reps), and AP (CRE, +26.7 W; PLA, +18 W). Changes in fat mass, fat percentage, BP 1-RM and BP endurance were similar between groups. **CONCLUSION:** Creatine supplementation, when combined with resistance training, increases lean tissue mass and improves leg strength, endurance and average power in men of mean age 70 years.

Med Sci Sports Exerc 2001 Dec;33(12):2111-7

Biochemical and physiological evidence that carnosine is an endogenous neuroprotector against free radicals.

1. Carnosine, anserine and homocarnosine are endogenous dipeptides concentrated in brain and muscle whose biological functions remain in doubt. 2. We have tested the hypothesis that these compounds function as endogenous protective substances against molecular and cellular damage from free radicals, using two isolated enzyme systems and two models of ischemic brain injury. Carnosine and homocarnosine are both effective in activating brain Na, K-ATPase measured under optimal conditions and in reducing the loss of its activity caused by incubation with hydrogen peroxide. 3. In contrast, all three endogenous dipeptides cause a reduction in the activity of brain tyrosine hydroxylase, an enzyme activated by free radicals. In hippocampal brain slices subjected to ischemia, carnosine increased the time to loss of excitability. 4. In in vivo experiments on rats under experimental hypobaric hypoxia, carnosine increased the time to loss of ability to stand and breath and decreased the time to recovery. 5. These actions are explicable by effects of carnosine and related compounds which neutralize free radicals, particularly hydroxyl radicals. In all experiments the effective concentration of carnosine was comparable to or lower than those found in brain. These observations provide further support for the conclusion that

Cell Mol Neurobiol 1997 Apr;17(2):259-71

Dental hygiene

Periodontal disease, tooth loss and incidence of ischemic stroke.

BACKGROUND AND PURPOSE: Periodontal and other infections have been suggested as potential risk factors for stroke. This study evaluates periodontal disease and tooth loss as risk factors for ischemic stroke. **METHODS:** The study population consisted of 41,380 men who were free of cardiovascular disease and diabetes at baseline. Periodontal disease history was assessed by mailed validated questionnaires. During 12 years of follow-up, stroke incidence was assessed and subclassified by use of medical history, medical records, and imaging reports. Hazard ratios (HRs) were adjusted for age, amount smoked, obesity, alcohol, exercise, family history of cardiovascular disease, multivitamin use, vitamin E use, profession, baseline reported hypertension and hypercholesterolemia. Sex and socioeconomic status were inherently controlled for by restriction. Confounding variables were updated in the analyses for each two-year follow-up interval. **RESULTS:** We documented 349 ischemic stroke cases during the follow-up period. Men who had ≤ 24 teeth at baseline were at a higher risk of stroke compared to men with ≥ 25 teeth (HR=1.57; 95% CI, 1.24 to 1.98). There was little evidence of an increased risk with recent tooth loss during follow-up. A modest association was seen between baseline periodontal disease history and ischemic stroke (HR=1.33; 95% CI, 1.03 to 1.70). Addition of dietary factors to the model changed the HR only slightly. **CONCLUSIONS:** Our results suggest that periodontal disease and fewer teeth may be associated with increased risk of ischemic stroke.

Stroke 2003 Jan;34(1):47-52

Systemic release of endotoxins induced by gentle mastication: association with periodontitis severity.

BACKGROUND: Periodontitis has recently been identified as a potential risk factor for systemic pathologies such as cardiovascular disease, the hypothesis being that periodontal pockets could release pro-inflammatory bacterial components, for instance endotoxins, into the bloodstream. It is known that the oral cavity can be a source of circulating bacteria, but this has never been shown for bacterial endotoxins, and no evidence exists so far that the risk of systemic injury is related to the severity of periodontitis. The aim of the present study was to test the influence of gentle mastication on the occurrence of endotoxemia in patients with or without periodontal disease. **METHODS:** A total of 67 subjects were periodontally examined and grouped according to their periodontal status. This classification was based on an original index of severity of periodontal disease (periodontal index for risk of infectiousness, PIRI) aimed at reflecting the individual risk of systemic injury from the periodontal niches. Thus, the patients were classified into three risk groups: low, PIRI = 0; n = 25; moderate, 1 < or = PIRI < or = 5, n = 27; and high 6 < or = PIRI < or = 10, n = 15. Blood samples were collected before and 5 to 10 minutes after a standardized session of gentle mastication for detection of circulating endotoxins. Blood samples were tested with a chromogenic limulus amoebocyte lysate assay. **RESULTS:** Overall, blood levels of endotoxin after mastication were found to be significantly higher than before mastication (0.89 +/- 3.3 pg/ml versus 3.0 +/- 5.8 pg/ml; P= 0.0002). Likewise, the incidence of positive endotoxemia rose from 6% before mastication to 24% after mastication (P = 0.001). When accounting for the PIRI index, endotoxin levels and positive endotoxemia proved to be significantly higher in patients with severe periodontal disease than in the subjects with low or moderate periodontitis. **CONCLUSIONS:** Gentle mastication is able to induce the release of bacterial endotoxins from oral origin into the bloodstream, especially when patients have severe periodontal disease. This finding suggests that a diseased periodontium can be a major and underestimated source of chronic, or even permanent, release of bacterial pro-inflammatory components into the bloodstream.

J Periodontol 2002 Jan;73(1):73-8

Effect of long-term exposure to fluoride in drinking water on risks of bone fractures.

Findings on the risk of bone fractures associated with long-term fluoride exposure from drinking water have been contradictory. The purpose of this study was to determine the prevalence of bone fracture, including hip fracture, in six Chinese populations with water fluoride concentrations ranging from 0.25 to 7.97 parts per million (ppm). A total of 8,266 male and female subjects > or =50 years of age were enrolled. Parameters evaluated included fluoride exposure, prevalence of bone fractures, demographics, medical history, physical activity, cigarette smoking and alcohol consumption. The results confirmed that drinking water was the only major source of fluoride exposure in the study populations. A U-shaped pattern was detected for the relationship between the prevalence of bone fracture and water fluoride level. The prevalence of overall bone fracture was lowest in the population of 1.00-1.06 ppm fluoride in drinking water, which was significantly lower (p < 0.05) than that of the groups exposed to water fluoride levels > or =4.32 and < or =0.34 ppm. The prevalence of hip fractures was highest in the group with the highest water fluoride (4.32-7.97 ppm). The value is significantly higher than the population with 1.00-1.06 ppm water fluoride, which had the lowest prevalence rate. It is concluded that long-term fluoride exposure from drinking water containing > or =4.32 ppm increases the risk of overall fractures as well as hip fractures. Water fluoride levels at 1.00-1.06 ppm decrease the risk of overall fractures relative to negligible fluoride in water; however, there does not appear to be similar protective benefits for the risk of hip fractures.

J Bone Miner Res 2001 May;16(5):932-9

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Xylitol candies in caries prevention: results of a field study in Estonian children.

All field studies have unequivocally reported significant reductions in dental caries occurrence associated with the use of chewing gum containing xylitol. No other xylitol products besides chewing gum have so far been tested in field trials. A five-year follow-up study with two- or three-year xylitol consumption periods began in Estonia in 1994 with 740 10-year-old children in 12 schools at baseline examinations. For the study, three clusters each including three to five schools were formed on the basis of baseline caries experience. The products were used under the supervision of the teachers three times per day during school days but not during weekends or during the three-month summer holiday. The daily dose of xylitol was 5 g in all groups. The children were examined every year in September by two experienced clinicians. Dental caries was recorded according to WHO criteria. After three years, all xylitol groups showed a highly significant 35% to 60% reduction in caries incident, compared with the corresponding control groups. The differences between candies, between candies and chewing gum, and between two- and three-year users in the xylitol groups were non-systematic, indicating no trends between the groups. The results suggest that not only xylitol chewing gum but also xylitol candies are effective in caries prevention, and that a school-based delivery system seems to offer a practical way to distribute and control the use of the xylitol products.

Community Dent Oral Epidemiol 2000 Jun;28(3):218-24

Glutamine

Branched-chain amino acid supplementation and the immune response of long-distance athletes.

OBJECTIVE: Intense long-duration exercise has been associated with immunosuppression, which affects natural killer cells, lymphokine-activated killer cells, and lymphocytes. The mechanisms involved, however, are not fully determined and seem to be multifactorial, including endocrine changes and alteration of plasma glutamine concentration. Therefore, we evaluated the effect of branched-chain amino acid supplementation on the immune response of triathletes and long-distance runners. **METHODS:** Peripheral blood was collected prior to and immediately after an Olympic Triathlon or a 30k run. Lymphocyte proliferation, cytokine production by cultured cells, and plasma glutamine were measured. **RESULTS:** After the exercise bout, athletes from the placebo group presented a decreased plasma glutamine concentration that was abolished by branched-chain amino acid supplementation and an increased proliferative response in their peripheral blood mononuclear cells. Those cells also produced, after exercise, less tumor necrosis factor, interleukins-1 and -4, and interferon and 48% more interleukin-2. Supplementation stimulated the production of interleukin-2 and interferon after exercise and a more pronounced decrease in the production of interleukin-4, indicating a diversion toward a Th1 type immune response. **CONCLUSIONS:** Our results indicate that branched-chain amino acid (BCAA) supplementation recovers the ability of peripheral blood mononuclear cells proliferate in response to mitogens after a long distance intense exercise, as well as plasma glutamine concentration. The amino acids also modify the pattern of cytokine production leading to a diversion of the immune response toward a Th1 type of immune response.

Nutrition 2002 May;18(5):376-9

Therapeutic considerations of L-glutamine: a review of the literature.

The most abundant amino acid in the bloodstream, L-glutamine fulfills a number of biochemical needs. It operates as a nitrogen shuttle, taking up excess ammonia and forming urea. It can contribute to the production of other amino acids, glucose, nucleotides, protein and glutathione. Glutamine is primarily formed and stored in skeletal muscle and lungs, and is the principal metabolic fuel for small intestine enterocytes, lymphocytes, macrophages and fibroblasts. Supplemental use of glutamine, either in oral, enteral or parenteral form, increases intestinal villous height, stimulates gut mucosal cellular proliferation and maintains mucosal integrity. It also prevents intestinal hyperpermeability and bacterial translocation, which may be involved in sepsis and the development of multiple organ failure. L-glutamine use has been found to be of great importance in the treatment of trauma and surgery patients, and has been shown to decrease the incidence of infection in these patients. Cancer patients often develop muscle glutamine depletion, due to uptake by tumors and chronic protein catabolism. Glutamine may be helpful in offsetting this depletion; however, it may also stimulate the growth of some tumors. The use of glutamine with cancer chemotherapy and radiotherapy seems to prevent gut and oral toxic side effects, and may even increase the effectiveness of some chemotherapy drugs.

Altern Med Rev 1999 Aug;4(4):239-48

Plasma-amino acid profiles in sepsis and stress.

Sepsis has been associated with specific plasma amino acid patterns. Sixty-five patients were prospectively investigated as to whether these patterns are indeed sepsis specific, or specific for metabolic stress without concomitant sepsis, or associated with the presence of organ failure. Virtually all amino acid levels were decreased by 10% to 30% (p less than 0.05), whereas cystine and phenylalanine were significantly elevated. These changes were more pronounced in severe sepsis. Organ failure was not associated with significantly altered amino acid profiles. No differences were found between sepsis and stress without signs of sepsis. In addition, imminent death was not associated with aberrant amino acid profiles. We conclude that sepsis and metabolic stress are associated with changes in plasma amino acid profiles, but that such changes are aspecific and therefore poor indicators of disease severity.

Ann Surg 1989 Jan;209(1):57-62

Glutamine: clinical applications and mechanisms of action.

Supplementation of the conditionally essential amino acid glutamine may be beneficial for individuals who are highly stressed and have minimal energy and protein reserves. This includes elderly individuals, postoperative patients, individuals with cancer and very low birthweight infants. Individuals who are undergoing treatment with catabolic glucocorticoids may also benefit. Unfortunately, confusion exists as to situations in which glutamine may be beneficial because a clearly defined "glutamine deficiency syndrome" has not been described as for some other nutrients. In this review, we will discuss how glutamine affects protein metabolism under certain stressful conditions, how it affects intestinal mucosal integrity and how this might relate to sepsis and systemic inflammation. We will also discuss nutrients that are closely related to glutamine such as glutamate, nucleotides, arginine, glucosamines, and ornithine alpha-ketoglutarate and how and why they might be used as substitutes for glutamine.

Curr Opin Clin Nutr Metab Care 2002 Jan;5(1):69-75

Glutamine supplementation in bone marrow transplantation.

An increasing number of clinical investigations have focused on supplementation of specialized enteral and parenteral nutrition with the amino acid glutamine. This interest derives from strong evidence in animal models and emerging clinical data on the efficacy of glutamine administration following chemotherapy, trauma, sepsis and other catabolic conditions. Glutamine has protein-anabolic effects in stressed patients and, among many key metabolic functions, is used as a major fuel/substrate by cells of the gastrointestinal epithelium and the immune system. These effects may be particularly advantageous in patients undergoing bone marrow transplantation (BMT), who exhibit post-transplant body protein wasting, gut mucosal injury and immunodeficiency. Studies to date indicate that enteral and parenteral glutamine supplementation is well tolerated and potentially efficacious after high-dose chemotherapy or BMT for cancer treatment. Although not all studies demonstrate benefits, sufficient positive data have been published to suggest that this nutrient should be considered as adjunctive metabolic support of some individuals undergoing marrow transplant. However, BMT is a rapidly evolving clinical procedure with regard to the conditioning and supportive protocols utilized. Thus, additional randomized, double-blind, controlled clinical trials are indicated to define the efficacy of glutamine with current BMT regimens.

Br J Nutr 2002 Jan;87 Suppl 1:S9-15

Glutamine: essential for immune nutrition in the critically ill.

Critically ill patients on intensive care units are at an increased risk of sepsis, which is a major cause of mortality in these patients. Recent evidence suggests that impairment of the functioning of the immune system contributes to the development of sepsis in such patients. In particular, monocytes show reduced expression of HLA-DR antigen, associated with impaired antigen presenting capability and decreased phagocytic activity; lymphocytes show decreased proliferation in response to mitogens and T-helper cells show a shift in the Th1/Th2 ratio consistent with impaired immunity. The amino acid glutamine becomes conditionally essential in the critically ill, yet such patients frequently have a marked deficiency of glutamine; the reasons for this are still unclear. Glutamine is required by the cells of the immune system both as a primary fuel and as a carbon and nitrogen donor for nucleotide precursor synthesis. In vivo studies have demonstrated that glutamine is essential for optimal immune cell functioning for monocytes, lymphocytes and neutrophils. A number of trials of patients fed by the enteral or parenteral route have shown improved infectious morbidity when supplemented with glutamine. However, the exact mechanism of glutamine action in these patients remains to be determined.

Br J Nutr 2002 Jan;87 Suppl 1:S3-8

Can glutamine modify the apparent immunodepression observed after prolonged, exhaustive exercise?

Glutamine is an important fuel for some cells of the immune system. In situations of stress, such as clinical trauma, starvation, or prolonged, strenuous exercise, the concentration of glutamine in blood is decreased, often substantially. In endurance athletes this decrease occurs concomitantly with relatively transient immunodepression. Provision of glutamine or a glutamine precursor has

been found to decrease the incidence of illness in endurance athletes. To date, it has not been established precisely which aspect of the immune system is affected by glutamine feeding during the transient immunodepression that occurs after prolonged, strenuous exercise. However, there is increasing evidence that neutrophils may be implicated.

Nutrition 2002 May;18(5):371-5

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