Drug and alcohol abuse can significantly damage the digestive processes of the body, and many addicts experience digestive problems such as constipation, diarrhoea, indigestion and poor appetite (Holford et al., 2008). The damage of the delicate inner lining of intestines caused by chronic alcohol or heroin abuse impairs the absorption of amino acids, vitamins and minerals (Holford et al., 2008). A healthy gut means a healthy brain too. The gut’s job is to extract nutrients from digested food, such as the amino acids from proteins to make neurotransmitters. Vitamins and minerals are needed to make them work properly, so having a healthy gut is key to getting the brain working properly. Addictive substances, mainly alcohol, caffeine, painkillers and heroin, can damage or even shut down the digestive processes, preventing the brain from being nourished properly. Conversely, a well-nourished brain means fewer withdrawal symptoms during the early stages of detoxification and higher possibility of achieving long-term recovery.

In many cases, dietary imbalances relating to amino acid, vitamins, healthy fats, good carbohydrates and proteins, can lead to a wide variety of medical problems such as cognitive impairment (memory), heart disease or diabetes. These are often accompanied by a host of psychological and behavioural issues. For many people struggling with drug dependence, learning about good nutrition is critical in the recovery process and is often instrumental in securing long-term success.

Users of different substances are confronted by different challenges. Alcohol is so calorie-dense (with seven calories per gram of alcohol it is second only to fat, with nine calories per gram) that drinkers often experience a sense of being sated. In fact, these ‘empty’ calories do not support the health of the body and over time produce a chronic state of malnutrition. Opiate or cocaine users are often so distracted by the cycle of getting high, crashing and looking for another high, that eating and self-care are severely neglected.

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In some worst cases (ie. severe addicts or when intestines are severely damaged), short-term intravenous nutritional therapy may be required in order to bypass a severely damaged gut. Generally (ie. when the addiction is not severe), a good diet with short-term nutritional supplementation should recover a poor gut and in turn revitalise the brain. Regular intake of good-quality, fresh food should provide enough macronutrients and micronutrients to help in maintaining a drug-free lifestyle.

During the initial phases of recovery, however, special emphasis should be placed on educating service users about changing dietary habits and moving from a junk food- and convenience food-based diet to a healthier diet, without falling into food deprivation. Indeed, caloric intake should be substantial but calories should be coming from fresh, good quality food like fruits, vegetables, fish, nuts and pulses rather than trans-fat-laden, highly processed convenience food like ready meals, fish and chips, cakes and sweets. The processing of food and addition of colorants and preservatives depletes food of essential micronutrients and in the case of fats, transforms natural, beneficial fatty acids into ‘synthetic’ molecules (trans-fats) that are not recognised by enzymes and may end up stored in fat cells or, worse, they may interfere with biochemical processes. On the other hand, fresh food, or food properly prepared and cooked, retains macro- and micronutrients, fibres and water that are essential for correct functioning of the body and mind.

The education process of choosing healthy and nutritious food should be carried out within the context of psychological and social re-education (Battaglia, 2008) because learning to eat properly is part of learning to care for oneself. Good nutrition, relaxation, and exercise all play an important role in successful detoxification from alcohol and drugs abuse. Learning to make healthy food choices is important to achieve a healthy lifestyle. Because they have neglected their diet for long time, addicts experience gastrointestinal disorders such as diarrhoea, constipation and an inability to digest foods properly, along with a poor appetite. As a result, they have a special need for foods that are high in nutrients to rebuild damaged tissues and organs and to regain appropriate functioning of the various systems including the nervous and gastrointestinal systems (Battaglia, 2008).

Carefully selected nutrition with the right types of high protein and high carbohydrate foods can make a big difference in coping with cravings during the early stage of recovery (Bonner et al, 2004). There are also important implications for mood, as deficiency of nutrients like amino acids, folic acid and the other B-complex vitamins also have a serious impact. Sugar and caffeine can generate mood swings, so intake of both should be reduced during the early stages of recovery (Holiford et al, 2008).

**Tyrosine and tryptophan**

Alcohol and drug use prevents the body from properly processing two important amino acids, tyrosine and tryptophan. They are responsible for the production of the neurotransmitters adrenalin, dopamine and serotonin. These compounds are essential for emotional stability, mental clarity and a general state of well-being (Bandaret & Lieberman, 1989). Decreased levels of these neurotransmitters negatively affect mood and behaviour. In fact, drug craving and other abstinence symptoms are the result of malfunctions of reward centres of the brain involving the neurotransmitters and the enzymes that control them. Research indicates that it is possible to reduce stress, depression and anxiety, as increase glucose and neurotransmitters receptor sensitivity, and to restore serotonin, dopamine, enkephalins, taurine and gamma-aminobutyric acid (GABA) with amino acid supplementation, which will give the client a generally improved feeling of well-being (Brown et al, 1990; Bonner et al, 2004).

Phenylalanine is a precursor of tyrosine that is then used to produce dopamine and noradrenaline. Supplementation with phenylalanine has been shown to elevate mood, increase confidence, motivation and energy levels, and indirectly decrease drug cravings (Ehrenpreis, 1983). Tyrosine supplementation has been indicated to increase energy and emotional/mental alertness (Bandaret et al, 1989).

Tryptophan is integral to the production of serotonin, which has a calming effect and is important for proper sleep. It is found in foods such as bananas, milk and sunflower seeds, as well as turkey meat. Increased intake of tryptophan has been shown to stabilise mood, improve sleep and reduce frequency and severity of alcohol withdrawal symptoms (Sahley & Birkner, 2001; Bonner et al, 2004). Additionally, a small pilot study reported tryptophan supplementation to ameliorate cognitive functions, particularly visual memory, in abstinent chronic alcohol abusers (Grotzkyj-Giorgi et al, 2009). Tryptophan is metabolised along three metabolic pathways. Serotonin and melatonin pathways are physiologically relevant because...
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they produce an important neurotransmitter (serotonin) and sleep hormone/antioxidant (melatonin). However, serotonin and melatonin pathways of tryptophan metabolism account only for ~10% of tryptophan degradation (Badawy, 2002). In fact, more than 90% of dietary tryptophan is metabolised along the kynurenine-nicotinic acid pathway (Badawy, 2002). The kynurenine-nicotinic acid pathway produces a number of physiologically active metabolites, collectively known as kynurenines. Kynurenines are neuroactive molecules, with some of them causing damage to the brain (kynurenic, quinolinic acid) and some others protecting neurons (kynurenic acid). Kynurenines act on N-methyl-D-aspartate (NMDA) and nicotinic acid (NA) receptors. NMDA receptors are particularly important because it is involved in the process of long-term potentiation and depression, two physiological mechanisms involved in modulating learning behaviour and memory formation (Sweat, 2003). Several animal studies have indicated that chronic and acute alcohol use interfere with tryptophan-serotonin metabolism (Badawy & Evans, 1973). Acute and chronic alcohol abuse increases cerebral serotonin concentration (LeMarquand et al, 1994a; 1994b). During alcohol withdrawal, cerebral serotonin concentrations drop dramatically (Badawy et al, 1980), thus increasing possibility of alcohol withdrawal symptoms. Recent research indicates that alcohol withdrawal symptoms may be caused by decreased serotonin levels but also by kynurenines. Kynurenines concentration during alcohol withdrawal increases, particularly those with neurotoxic activities (Morgan, 1991).

Tryptophan supplementation during early stages of alcohol detoxification may reduce the number and intensity of withdrawal symptoms and possibly improve cognitive functions of abstinent chronic alcohol abusers (Grotzkyj-Giorgi et al, 2009). A pilot study reported tryptophan supplementation to reduce alcohol withdrawal symptoms by acting on kynurenine pathway of tryptophan metabolism (increase of neuroprotectant kynurenic acid) and to ameliorate cognitive functions, particularly visual memory, in 60 abstinent chronic alcohol abusers enrolled in a detoxification programme (Grotzkyj-Giorgi et al, 2009). Concentrations of the neuroprotective kynurenine kynurenic acid increased after tryptophan supplementation. This study also demonstrated that adding selected micronutrients (B-vitamins, antioxidant vitamins and minerals) to tryptophan supplementation improved cognitive outcomes and increased the level of neuroprotectant kynurenic acid (Grotzkyj-Giorgi et al, 2009).

In summary, amino acid therapy together with multivitamin and mineral supplementation should be considered during the early stages of alcohol and drugs recovery and possibly continued by following a healthy diet.

No drug currently in wide use – medical or recreational – addresses the root cause of neurotransmitter imbalance. Medical drugs merely stimulate temporary excessive release of pre-existing neurotransmitter stores or block the action of adrenalin, for example. They do not increase the production of neurotransmitters. How can they, without supplying the building materials – the amino acids? Optimising the intake of the relevant amino acids, vitamins, minerals and essential fatty acids is the long-term way out of addiction.

However important a correct amino acid and multivitamin supplementation might be, it should be remembered that nutritional supplementation is not an instant cure-all. This therapy is not a substitute for good nutrition or other aspects of healthy living (exercise, relaxation etc). That is why it is called supplementation and not substitution. Indeed, increased amino acid intake should be included into a wider nutritional strategy including the right intake of micronutrients (vitamins and minerals) and macronutrients (low glycaemic index carbohydrates, good quality proteins and fatty acids) and water.

Good quality proteins can be sourced from fish, and oily fish has an added bonus: it provides polyunsaturated fatty acids (PUFAs or omega fats). PUFAs are essential fatty acids (they must come from the diet). Omega fats (omega-3 and omega-6 fatty acids) are building blocks of cerebral membranes together with phospholipids and cholesterol. Their presence is essential to maintain membrane fluidity. Membrane fluidity, in turn, guarantees a correct signal transduction in the synapses. Most addictive substances strip the brain of essential fats. Research has shown that relapses among cocaine- and alcohol-dependent people over the course of two years was significantly lowered with an increased intake of omega-6 and omega-3 foods (Buydens-Branchey et al, 2003a; 2003b). Equal quantities of omega-6 and omega-3 essential fats should be introduced with the diet as higher intake of omega-6 fats has been linked to a host of diseases,
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among them chronic abstinence symptoms (also linked to omega-3 deficiency) (Holford et al, 2008).

Among micronutrients, B-vitamins and antioxidant vitamins (A, E and C) are particularly important because they play crucial roles in brain physiology. The latter protect the brain from the attacks of free radicals. These are a natural byproduct of the endogenous metabolism for which the body is protected by endogenous and exogenous mechanisms. Endogenous antioxidant system includes glutathione and other enzymatic systems. Exogenous, diet-derived antioxidants are the vitamins A, E and C. Unfortunately, brain cells require more diet-derived antioxidants than other organs because they are low in antioxidants defences (Zaidi et al, 2004) so high intake of antioxidants is amenable to protecting our brain from free radicals attack.

However, both antioxidants systems require substrate molecules derived from food (glutathione is synthesised from three amino acids). As a part of the intracellular, diet-derived antioxidant network, vitamin C acts in concert with other low-molecular-weight compounds, including glutathione and vitamin E, as well as antioxidant enzymes (Cohen, 1994). To date, an increasing body of evidence reports vitamin C as playing an important role in the antioxidant network in the brain (Spector & Lorenzo, 1973; Grunewald, 1993). Particularly, it has been suggested that vitamin C plays an essential role in protecting extracellular compartment from free radicals attack (Rice, 2000).

Alongside the neuroprotection exerted by endogenous antioxidant enzymes, micronutrients (vitamins and minerals) are particularly important to protect neurobiological structures associated with reward pathways and cognitive functions. Particularly, vitamin B1 (thiamine) plays a central role in preventing the development of Wernicke-Korsakoff psychosis, a neurodegenerative disorder affecting mainly alcoholics (Cook et al, 1998; Thomson et al, 2002; Bonner et al, 2004). People with Korsakoff syndrome suffer from severe memory impairments. Memory dysfunction is a very debilitating condition; fortunately, while Korsakoff syndrome is a virtually irreversible condition, the prodromal stage of it, Wernicke encephalopathy, is a reversible condition caused by a marked deficiency of the water-soluble vitamin thiamine (vitamin B1). When blood concentration of thiamine is brought back to physiological levels with a rapid intravenous infusion of high-concentration thiamine, symptoms quickly subside and permanent brain impairment is avoided (Bonner, 2006).

Generally, the vitamin B complex is essential for the overall cerebral cognitive performance (Bonner et al, 2004) as a lack of pyridoxine (vitamin B6) and riboflavin (vitamin B2) overloads the gamma-amino butyric acid (GABA) shunt, thus resulting in an excess of glutamate production and neuronal death caused by a glutamate overexcitement (excitotoxicity).

Thiamine, together with the other vitamins B, vitamins A, C, E and zinc, form a complex network of exogenous (diet-derived) antioxidant protection, which has been demonstrated to be essential in preventing age-related and alcohol-caused neurodegeneration, by acting in close collaboration with the endogenous antioxidant protection systems, such as the glutathione system (Casadesus et al, 2002; Esposito et al, 2002). In summary, whatever the addiction, nutrition should be considered a powerful ally in the process of recovery, particularly during the initial stages of detoxification. A varied diet rich in good carbohydrates, good quality proteins (lean meat, fish and vegetable proteins), fresh fruit and vegetables, essential fats (oily fish, nuts) and plenty of water should be considered and utilised as a tool to help the recovery process.

Food provides the vast majority of metabolic co-factors essential for the correct functioning and recovery of brain structures, an example of which can be the case of Wernicke-Korsakoff encephalopathy. This is just one example of how (mal)nutrition can play a big role in the development and perpetuation of brain and cognitive dysfunctions often observed in addicts, and how simple changes in dietary habits (or, in more serious cases, nutritional supplementation) may produce a big difference in mental well-being and in recovery of brain functions during alcohol and drugs recovery.

References


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