

IMPORTANCE OF OMEGA-6 TO OMEGA-3 RATIO IN OBESITY

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Abstract - The importance for a healthy lifestyle and prevention and control of obesity is recognised in this review, which has been done with regard to the balance between Omega 6 and Omega 3. It is now recognized that the necessary fatty acids of both the – omega-6 series (particularly linoleic acid and [LA] and arachidonic acid [AA]) and the omega-3 series (the most significant of which are linolenic acid [LNA], eicosapentaenoic acid [EPA]) are required for development and growth. Today, in western diets the intake of omega-6 is very high and intake of omega-3 is much lower. The imbalanced omega-6/omega-3 ratios in today's diet is as high as 20:1 and goes up to 40:1 and is seen as the onset of many prevailing diseases. The most common disease that can be found due to this imbalance in the fatty acids is obesity which is also said to be the one of the reasons for the onset of many more diseases.

Index Terms - Fatty acids, omega-6, omega-3, western diets, omega6/omega-3 ratio, obesity, imbalance, prevention, management.

INTRODUCTION

In 1963, Arild Hansen and his colleagues first noted that humans need to consume a certain amount of polyunsaturated fatty acids in order to maintain their health. This was the first time that a scientific study focused on the role of essential fatty acids in the body. Over the years, the field of essential fatty acids has continued to grow. It is now recognized that the necessary FAs of both the – omega-6 series (particularly linoleic acid and [LA] and arachidonic acid [AA]) and the omega-3 series (the most significant of which are linolenic acid [LNA], eicosapentaenoic acid [EPA] and docohexaenoic acid [DHA]) are required for development and growth[1].

Omega-3 fatty acids (such as alpha-linolenic acid) are polyunsaturated fats, a type of fat that our body can't make. The term "polyunsaturated" refers to their chemical structure, as "poly" means many and "unsaturated" refers to double bonds. Together they mean that omega-3 fatty acids have many double bonds. "Omega-3" refers to the position of the final double bond in the chemical structure, which is three carbon atoms from the "omega," or tail end of the molecular chain. Since the human body can't produce omega-3s, these fats are referred to as "essential fats," meaning that you have to get them from your diet[2]. Sources of omega 3 fatty acids from plant sources are edible seeds, walnut, algal oil, flaxseed oil, hemp oil, and from animal sources egg oil, fish oil, krill oil, squid oil [3].

Omega-6 fatty acids (such as linoleic acid) are a family of fats found in some plant oils and seeds. They are different from omega-3 fatty acids. Omega-6 fatty acids are found everywhere in the body. They help with the function of all cells. But too much omega-6 fatty acids can change the way cells react and have harmful effects on cells in the heart and blood vessels. Sources of omega-6 fatty acids grapeseed oil, pine nuts, sunflower oil, sunflower oil, corn oil, cottonseed oil, mayonnaise, tofu, almonds. The recommended ratio of omega-6 to omega-3 is between 3:1 and 2:1 but the modern diet ratio is as high as between 20:1 to 40:1 which can be seen as the onset of many disease in the individual[4].

ASSOCIATION OF OMEGA-6/OMEGA-3 AND OBESITY

The dysregulation of several organ systems, including the liver, pancreas and gastrointestinal system leads to the complicated illness known as obesity. The central nervous system's role in obesity is becoming more widely acknowledged as the number of people with the illness keeps rising. The western diet which is often high in omega-6 polyunsaturated fatty acids (PUFAs) but low in omega-3 PUFAs is one of the causes of obesity. This diet results in an unbalanced omega-6/omega-3 ratio of 20:1 as opposed to the advised ratio of 1:1 or 2:1. This excess of omega-6 PUFAs encourages pro-inflammatory and prothrombotic conditions which raises the risk of atherosclerosis, obesity and diabetes. [5]

High fat diets rich in omega-6 fatty acids have been shown to increase the risk of leptin resistance, diabetes, and obesity in humans and rodents[6]. In a human study done to find the association between the omega-6 to omega-3 ratio and type 2 diabetes mellitus showed the need to maintain the ideal omega-6 to omega-3 ratio as this ratio can serve as not only a predictive biomarkers in the management of the type 2 diabetes mellitus but can also be aid in prevention of type 2 diabetes mellitus in India[7]. In some human studies the level of AA (arachidonic acid) in adipose tissue is associated with the BMI and overweight status of children. High intake of omega-6 fatty acids during the perinatal period is associated with increased adiposity in the offspring. Recent studies have shown that perinatal exposure of mice to a high omega-6 fatty acid diet (similar to western diet) results in a progressive accumulation of body fat across generations, which is consistent with the fact that in humans, overweight and obesity have steadily

increased in the last decades and emerge earlier in life[8]. High omega-6/omega-3 fatty acids in umbilical cord red blood cell (RBC) membrane phospholipids was associated with high subscapular skin-fold thickness at 3 years of age[9]. Omega-6 fatty acids increase cellular triglyceride content by increasing membrane permeability while omega-3 fatty acid reduce fat deposition in adipose tissues by suppressing lipogenic enzymes and increasing beta oxidation[10]. A high dietary content diet of omega-6 elevates the endocannabinoids level (endogenous lipid based retrograde neurotransmitter that bind to cannabinoid receptors) and increases the risk of developing obesity, owing to increase in the adipogenic properties (ability to store lipid).

According to study done by Alvheim the aim of study was to determine how dietary linoleic acid (LA) affected the levels of the endocannabinoids 2-arachidonoylglycerol (2-AG) and anandamide in mice fed a low-fat diet and how this affected the mice's ability to gain weight. For six weeks, three groups of mice were given either a low-fat control diet or two different experimental diets containing 2.5% or 7.5% LA. In addition to measuring the amounts of 2-AG and anandamide in various tissues, the mice's changes in body weight were also tracked. Higher levels of linoleic acid have been observed to cause greater weight gain than diets with lower levels of LA. Increasing the dietary LA from 1 to 8% of energy increased liver endocannabinoid levels, which increased the risk of developing obesity, even in a low-fat diet. The mice with chronically low levels of omega 3 PUFAs have significantly reduced DHA concentrations in their brain phospholipids and higher amounts of alpha 2AG from AA compared to those with sufficient Omega 3 PUFA content in their diet. Furthermore, omega-3 PUFA supplementation of mice with 10% weight DHA-rich fish oil for 4 weeks led to higher brain DHA levels compared to mice on a low omega-3 PUFA diet, and led to a significant decrease in brain 2-AG and brain AA. In this way the dysregulation of cannabinoid system, improved insulin sensitivity and decreased central fat levels have been reversed through a nutritional approach with dietary Omega 3 PUFA[11].

In order to evaluate the effects of Omega-6 and Omega-3 fatty acids on obesity development and treatment, some studies have been carried out in rats. A diet with a high ratio of Omega 6 to Omega 3 has been shown to increase endocannabinoid signalling and related neurotransmitters, although some studies have shown different results. In turn, this can lead to increased inflammation, energy metabolism and mood, all of which may contribute to obesity. It is recommended to reduce the intake of omega 6 and consume more Omega 3 as part of your diet in order to inhibit pro-adipogenic pathways and support weight loss. In order to achieve optimal health, the preferred ratio of Omega 6 to Omega 3 is 2:1, which is in line with the developmental aspects of nutrition. It is important to note that, due to the excessive amount of omega 6, and insufficient amounts of omega 3, there are often imbalanced levels of Omega 6 in Western diets. This imbalance can contribute to the prevalence of obesity, diabetes, and other related disorders. According to research, a balance between these two fatty acids may affect gene expression, cellular signal transduction pathways and cell membrane composition with respect to specific mechanisms involved in the effects of Omega 6 and Omega 3 on obesity. In other words, a higher intake of omega 6 could result in an increased production of arachidonic acid that is precursors to inflammatory signals. On the other hand, omega-3 can be converted to anti-inflammatory signalling molecules, which can help to counteract the effects of omega-6[12].

CONCLUSION

We can see excessive amount of omega-6 fatty acids as well as very high omega-6 to omega-3 ratio is found in today western diets which ultimately leading us obesity and many diseases including cardiovascular disease, interfere with the growth and development. The time has come to bring ω-3 fatty acids back into the diet and reduce food consumption ω-6 fatty acids by changing cooking oils and eating less meat and more fish. Diet composition must also change to reflect evolutionary aspects of nutrition and population genetics. The scientific evidence for balancing the ratio of ω-6 to ω-3 is strong and important for normal growth and development and for the prevention and treatment of obesity and related diseases, including diabetes, cardiovascular disease and cancer. This balance best can be achieved by decreasing the intake of the oils rich in omega-6 fatty acids that are corn oil, sunflower oil, safflower oil, cotton seed oil and soyabean oil and by increasing the intake of oils that are rich in omega-3 fatty acids like canola oil, flaxseed oil, perilla oil, chia oil and olive oil as they are particularly low in omega-6 fatty acids. The other way to get enough omega-3 fats in a healthy ratio is to consume at least two serving of fatty fish per week along with whole foods to meet your omega-3.

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