

## Distorted fatty acid metabolism and metabolic syndrome

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### Abstract

Metabolic Syndrome, is a collection of risk factors that increases the chances of developing excessive body fat, heart disease, stroke and diabetes and it is primarily the result of recent abrupt dietary life style changes, more particularly distorted fatty acid intake. Our prehistoric food consisted of 1:1 ratio of omega-6 to omega-3 fatty acid. But today our diet has skewed ratio of 20:40:1. Both linoleic acid omega-6 and alpha-linolenic acid omega-3 fatty acids are essential fatty acids. Excessive omega-6 and paucity of omega-3 fatty acid is almost a global phenomenon. Obesity is a worldwide epidemic responsible for 5% of global mortality. The risks of developing other key metabolic disorders like diabetes, hypertension and cardiovascular diseases (CVDs) are increased by obesity, causing a great public health concern. A series of epidemiological studies and animal models have demonstrated a relationship between the importance of vitamin B12 (B12) and various components of metabolic syndrome. High prevalence of low B12 levels has been shown in European (27%) and South Indian (32%) patients with type 2 diabetes (T2D). A longitudinal prospective study in pregnant women has shown that low B12 status could independently predict the development of T2D five years after delivery. Likewise, children born to mothers with low B12 levels may have excess fat accumulation which in turn can result in higher insulin resistance and risk of T2D and/or CVD in adulthood. However, the independent role of B12 on lipid metabolism, a key risk factor for cardiometabolic disorders, has not been explored to a larger extent. In this review, we provide evidence from pre-clinical and clinical studies on the role of low B12 status on lipid metabolism and insights on the possible epigenetic mechanisms including DNA methylation, micro-RNA and histone modifications. Although, there are only a few association studies of B12 on epigenetic mechanisms, novel approaches to understand the functional changes caused by these epigenetic markers are warranted. This has led to the dominance of inflammatory pathway in modern man and is primarily responsible in phenomenal increase in incidences and severity of chronic degenerative diseases. Omega-3 nutritional security and lowering of intake omega-6 fatty acid, correcting the imbalance is urgent need of the day. Therefore, our goal has been to bring back primary essential omega-3 fatty acid, alpha-linolenic acid, into the food chain. Flax seed is the richest source of vegetarian, omega-3 fatty acid. We have

developed technologies, to increase production and productivity of flaxseed; to extract omega-3 oil and soft gel capsules from flaxseed devoid of antinutrients; to stabilize omega-3 fatty acid in emulsion to fortify milk and milk products; omega-3 enriched poultry feed mix for the production omega-3 enriched egg and chicken meat; omega-3 flour mix for bakery products etc. Our pioneering efforts, through well researched and validated "FLAX BIO\_VILLAGE" concept, aims at attaining omega-3 nutritional security and correct the omega-6:omega-3 imbalance, to effectively tackle metabolic syndrome.

This work is partly presented at 4<sup>th</sup> International Conference on Tumor & Cancer Immunology and Pediatric-oncology 2020, July 22, 2020

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