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Structure Activity Relationships (SARs) Among Fatty Acids

Implications for Differential Toxicity Associated with Palmitic Acid

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Fatty acids as a group have historically been classified as possessing identical properties and from the broad health standpoint have been believed to hold negative implications toward societal outcome and disease. In essence, it has been believed that "one fatty acid is the same as another". It is also quite common for many to classify "fats" as generally negative when discussing one's health status and diet. This misconception has been perpetuated by the growing incidence of obesity and the subsequent focus on proper dietary interventions.

However, research with fatty acids over the past decade has provided a quite different picture; whereby the specific structures of different fatty acids are responsible for yielding at times completely opposite and potent pharmacologic and physiologic actions. When speaking of prescription drugs, this concept is embodied in the well-known term, Structure Activity Relationships (SARs) and indicates that small changes in chemical structure can lead to quite different actions of a specific drug, even taking it from beneficial to toxic with minute alterations in chemical makeup. There is now ample evidence that such SARs are also applicable to the natural products of fatty acids and these differences are being increasingly appreciated.

One of the most universal differentials amongst the fatty acids is the virtual "black and white" association of toxic actions in a variety of body systems from the presence of Palmitic Acid (C16:0). Palmitic Acid exists in high concentration in Sea Buckthorn as well as coconut oil. Coconut oil in many scientific publications produces negative effects, because of the high content of saturates in its composition (>80%). In publications from many different international research groups, Palmitic Acid has been shown to have toxic effects on pancreatic beta cells, leading to a greater chance for insulin resistance and subsequent development of diabetes mellitus. Indicative of the intense specificity of SARs with this group of compounds, MUFAs (monounsaturated fatty acids) such as Oleic Acid (C18:1) and Palmitoleic Acid (C16:1) not only act in an opposite and beneficial manner, which is to preserve and promote beta cell growth and action, but they also directly counteract the negative effects of C16:0. Translated, this means that completely opposite actions are displayed by just the presence of a single double bond in the chemical structures (i.e., Palmitic {C16:0} contrasted to Palmitoleic {C16:1}). Thus, such SAR activity is far more understood than previously thought and actually parallels some of the SARs that have been exploited within the traditional pharmaceutical world.

Recently, the same differential picture between the saturated fatty acid (Palmitic Acid) and the MUFA class of compounds has been demonstrated for the responsiveness of T-cells to antigenic stimulation. The ability of T-cells to combat foreign substances is hampered by the presence of Palmitic Acid and is reversed and/or unencumbered by a MUFA, in this case, Oleic Acid (C18:1). This led the authors to postulate that this could be a mechanism within obesity of being less able to ward off infections.

The practical implications of these specific differences in pharmacologic actions of fatty acids are potentially relevant in the dietary supplement industry where contents of Palmitic Acid are high. This exists with products isolated from Sea Buckthorn, which when combined with seed and pulp sources, contains a Palmitic Acid (C16:0) content of 44.7%, almost two times higher than the more beneficial fatty acid, C16:1 in such preparations. With support from the scientific literature, it appears prudent to separate as much as possible the presence of this proven "bad fatty acid" from the "good fatty acids" that are intended to be delivered for specific human health purposes.

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