

Chapter 53

Functional Foods for Treatment and Prevention of Obesity and Its Associated Disorders

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ABSTRACT

Obesity has now become an epidemic affecting wide variety of population across the world. It is associated with a cluster of cardiovascular diseases and other related metabolic disorders such as diabetes, hypertension, and cancer which is mainly caused due to the dysbiosis in the energy intake and expenditure. Researchers have found a wide variety of functional foods from different sources which help in combating and prevention of obesity and its related diseases. Recent advancement in nutritional science has led to the development of several functional foods with low glycemic index. The present chapter highlights about the problems related to obesity and the importance of various functional foods which have great potential to be incorporated in our daily diet to curb the menace of obesity.

INTRODUCTION

Obesity is considered as the lack of energy balance in the body which results in increase of weight. It is considered as the fifth leading factor for the mortality rate across the world. Around 2.8 millions of people die every year due to obesity related complications. The diseases associated with obesity are diabetes (44%), heart disease (23%), and different types of cancer (41%) (Cencic & Chingwaru, 2010). Obesity has been associated with chronic inflammation mediated by increase in production of cytokines such as tumor necrosis factor (TNF)- α , interleukin (IL)-6, and monocyte chemo attractant protein (MCP)-1 derived from adipose tissue (Hotamisligil, Shargill, & Spiegelman, 1993). Among the developing countries the number of overweight individuals have tripled in the last 30 years due to improper diet (over and under nutrition), and requires proper attention (Keats & Wiggins, 2014). The major risk factors which contribute to obesity are: 1) change in life style; 2) diet; 3) lack of physical activity, and;

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4.) increase in sedentary life style. The cost for treatment of obesity in US was estimated to be around \$147 billion (Finkelstein, Trogdon, Cohen, & Dietz, 2009). Very few drugs are available in the market for the treatment of obesity especially for treating advanced stage of obesity (Miller, 2013). Prolonged or long-term usage of these drugs is associated with the potential health hazards as a result there is a great need to search for alternative foods or anti-obesity agents which can serve the purpose of combating the obesity and its menace (Berthoud, Lenard, & Shin, 2011). The efficiency of dietary and naturally available bioactive compounds in modulating the pathophysiology of obesity is under consideration. Several functional foods or nutraceuticals are being developed by food industry which holds great potential to meet the health-conscious consumers. Functional foods are defined as the food components which can provide health benefits to the host (Sunkara & Verghese, 2014). These foods not only provide vital nutrients but also enhance the biological active components of the body to impart health benefits.

Obesity leads to increase in number and size of adipocytes differentiated in to pre-adipocytes. Functional foods regulate adipocyte differentiation by inducing cell cycle arrest and increase apoptosis (Rayalam, Della-Fera, & Baile, 2008). Obesity management must target both energy intake and expenditure and should have the ability to induce satiety, reduce appetite increase lipid metabolism and induce thermogenesis. Increasing the satiety levels will help in decreasing the energy intake and absorption in the gut mediated by the complex interaction of neural and hormonal interactions (Wynne, Stanley, McGowan, & Bloom, 2005). Fibers enhance the satiety levels by increasing gastric load and emptying time by increasing the levels of cholecystokinin and reduce ghrelin (Serrano, Cassanyé, & Portero-Otin, 2012). The lipase inhibitors in the intestine prevent fat digestion and absorption and thus help in weight management. It was reported that polyphenols, anthocyanins, tannins present in tea and di-caffeoyl quinic acids (di-CQA), caffeine from coffee displayed inhibitory effect on several digestive enzymes (maltase, sucrase and lipase) thus help in post-prandial hyperglycemic and hyper-insulinemia (Murase, Yokoi, Misawa, Ominami, Suzuki, Shibuya, & Hase, 2012). Body weight can be regulated by increasing the energy expenditure. Brown adipocytes regulate heat production by uncoupled proteins at mitochondria, while capsaicin induce thermogenesis by increasing lipid metabolism and can be used as anti-obesity agent (Rayalam, Della-Fera, & Baile, 2008). Food components which can target the inflammatory regulators such as C-Jun amino-terminal kinase (JNK), and nuclear factor (NF)-kB plays a vital role in controlling obesity related pathologies (Hirai, Takahashi, Goto, Lin, Uemura, Yu, & Kawada, 2010).

The present chapter highlights about various pathophysiology factors, metabolic diseases associated with obesity, and their treatment by the application of functional foods. The role and mechanism of action of different functional foods in regulating obesity, cholesterol and triacylglycerol levels will be highlighted. Apart from the above the future prospects of various functional foods in combating obesity will be discussed.

BACKGROUND

Obesity is considered as one of the major global burden for several chronic diseases and disorders. It was estimated that around 1 billion adults are suffering with overweight problem and among them 300 million people are clinically obese (WHO, 2010). Obesity is a serious socioeconomic problem affecting all age groups. Individuals suffering with obesity has nearly doubled in past 30 years (WHO, 2010; Hil & Peter, 2002). The major diseases associated with obesity are listed in Table 1. Efficient systematic strategies for the prevention and treatment of obesity is key aspects. Functional foods are similar to

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