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Dietary fiber and obesity management - a review

Abstract

Dietary fiber is heterogeneous and indigestible plant subunit, which has been widely used as a complementary or alternative agent in obesity management while obesity is considered as a risk factor for morbidity and mortality. At present times, reduction in fiber intake has been surprisingly found due to change in food habit and life style, even the amount is so far below the recommended level. Recently, extracted fibers from plant sources have been incorporated into meal whereas the benefits include not only obesity management but also management of cardiovascular diseases, blood sugar, digestive and general illness. This paper focuses a review on the role of different types of dietary fiber and supplements on body weight and obesity management.

Keywords: dietary fiber, obesity, weight management, soluble fiber, insoluble fiber

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Introduction

Physiological description of fiber implies that dietary fiber is a plant subunit that is not being degraded to absorbable subunits in the small intestine by alimentary enzymes found in human beings.[1] Generally, dietary fibers are non-starch polysaccharides including cellulose, hemicellulose, lignin, pectin, gum and mucilage and non-polysaccharide (lignin). Health benefits of the consumption of fiber rich foods ranging from prevention and treatment of obesity, reduction of blood glucose and cholesterol level, glycemic regulation, and prevention of intestinal diseases, like constipation, hemorrhoid, diverticular disease and colon cancer.[2] According to recommended dietary allowances (RDA), the dietary fiber of 35g/day is recommended for healthy adults.[3] A recent study shows the gradual reduction of dietary fiber consumption and much lower intake of dietary fiber 25g/day in Western countries has been reported.[4] On the contrary, epidemiologic and cross-sectional studies indicate that lower intake of dietary fiber is associated with obesity development.[5]

Obesity is one of the risk factors for morbidity and mortality including type 2 diabetes, cardiovascular, osteoarthritis, malignant and metabolic diseases while the number of obese people is increasing with time.[6] Nguyen et al.,[7] reported that approximately 1.5billion adults are overweight or obese around the world, and obesity is being concerned as a global epidemic.[8] It is clear that obesity is a medical issue, which results in more cost on health care systems in both developing and developed countries.[9] Moreover, treating obesity through weight management is very important but notoriously difficult. According to the nutritional point of view, there is an association between dietary fiber intake and weight management. In this article, we emphasize on the role of dietary fiber intake regarding obesity management.

Role of fiber in weight management

Properties of dietary fiber

Dietary fiber is a diverse group of polysaccharides and each of them has a unique chemical structure with distinguishing physical properties, like water-holding capacity, adsorption, fermentability, and viscosity. Physiologic behavior of fiber largely depends on both of chemical structure and physical properties.[10] A simpler classification of dietary fiber based on solubility and fermentability is shown in Table 1. According to Galisteo et al.,[11] short chain fatty acids from colonic fermentation of soluble fiber possess beneficial effects on lipid metabolism with cardiovascular disease prevention, mucosal differentiation and mucosal barrier function. In contrast, insoluble fibers have low fermentability with passive water-attracting properties that promote the fecal bulk, softening & laxation.[12]

Table 1 Different types of dietary fiber.[13,14]

Name	Solubility	Fermentability	Source
Cellulose	Insoluble	Slow degradation	All plant cell walls
Hemicellulose	Insoluble/soluble	Quick degradation than cellulose	Matrix of all plant cell walls
Lignin	Insoluble	No degradation	Woody plant tissue
Pectin	Soluble	Rapid degradation	Ripe fruits
Gum	Soluble/dispersible	Rapid degradation	Legumes
Mucilage	Soluble/dispersible	Rapid degradation	Seeds

Dietary fiber intake and weight management

Several epidemiological studies show an inverse relationship between dietary fiber intake and weight loss[15,16] that is strongly supported by cross-sectional studies. Drewnowski[17] stated that fiber content has a great impact on the palatability of food and possibly reduces energy intake. Liu et al.,[18] observed an inverse correlation between whole-grain ingestion and change in body weight of middle-aged women. In many studies, greater satiety due to an intake of dietary fiber has been reported compared with simple sugars and digestible polysaccharides.[19] Pereira et al.,[20] stated several factors of greater satiety, like modulation of gastric motor function, blunting of postprandial glucose and insulin response and physical properties of fiber including viscosity, gel formation and bulking. Fibers have the ability to displace the energy from other nutrients by adding bulk and weight to the meal. Likewise, fiber-rich diets achieving through fiber incorporation into meals result in low energy density compared with high-fat diets.[20] Although fiber is an invisible component in any food, it is becoming the most appreciated ingredient for incorporating into meals. According to Solan,[21] fiber has been ranked number five among the top functional food concepts in 2007. Now, dietary fibers from different sources, like apple, pea, citrus fruit, sugar beet and soy are popular to incorporate into meal for their nutritional, functional and technological properties.

Weight management through consumption of fruits and vegetables

Fruits and vegetables contribute both of soluble and insoluble fibers to the meal. Insoluble fibers including lignin, cellulose, and hemicellulose are found in cell wall and skin of fruits and vegetables while soluble fibers, like pectin, gum and mucilages are mostly found in skin.[22] It has been reported that consumption of both soluble and insoluble fibers increase satiety. Howarth et al.[19] stated that decrease in energy density by 10% and weight loss of 1.9kg over 3.8months resulted from the consumption of additional fiber 14g/day. Considering previous findings it is undoubtedly true that increased consumption of fruits and vegetables would reduce energy density and body weight.

Energy density is the amount of energy exerted by a food (kcal/g or kJ/g) where fat is the most energy dense nutrient (9kcal/g) compared with carbohydrate (4kcal/g) and protein (4kcal/g). Most of the fruits and vegetables contain a high amount of water and low-fat content consequently, they possess low energy density.[22] Several researchers have developed an inverse relationship between the addition of fruits and vegetables to meal and energy density.[23,24] Moreover, an addition of fruits and vegetables to the meal enhances satiety due to the higher moisture content and low energy density.

Conclusion

The change in life style with more addiction to fast foods has remarkably reduced the consumption of fruits, vegetables, and legumes. This is because the amount of fiber in diet chart has been found far below the recommended level in any modern society. Most of the studies evaluated multiple benefits of fiber intake on weight reduction along with obesity management where obesity is a risk factor for cardiovascular, diabetics, malignant and metabolic diseases. Considering the benefits of fiber intake, researchers are showing their interest to develop fiber enriched food products by incorporating fruits, vegetables or extracted fiber from different sources into the meal. A focus on obesity management by adding more fruits and vegetables as well as fiber rich products in the diet chart should be recommended.

Conflicts of interest

The authors declare no conflict of interest.

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