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Saheli Das
Researcher, Department of Food and Nutrition, Swami Vivekananda University, Barrackpore, West Bengal, India

Shubhankshi Das
Senior Dietician, Heart Failure Counsellor, Diabetic educator, Kolkata Heart Lung Centre and Research Institute, West Bengal, India

Sohini Bhattacharya
M.Sc. Applied Nutrition, WBUHS, West Bengal, India

Prathiksa Pramanik
Researcher, Department of Food and Nutrition, Swami Vivekananda University, Barrackpore, West Bengal, India

Khan Farhana Mahreen
Assistant Professor and Head, Department of Home Science, IIFST, Aurangabad, Maharashtra, India

Correspondence
Khan Farhana Mahreen
Assistant Professor and Head, Department of Home Science, IIFST, Aurangabad, Maharashtra, India

Dietary modification for weight management: A review

Saheli Das, Shubhankshi Das, Sohini Bhattacharya, Prathiksa Pramanik and Khan Farhana Mahreen

Abstract
Obesity has become a global epidemic, contributing to various health complications and reducing overall quality of life. Dietary modification stands as a cornerstone in weight management strategies. This review article aims to comprehensively examine the role of dietary modifications in weight management, exploring various dietary approaches, their mechanisms, effectiveness, and practical implications.

Keywords: Obesity, weight management, dietary modification, low-calorie diets, macronutrient manipulation, intermittent fasting, dietary patterns, personalized nutrition

1. Introduction
The prevalence of obesity has reached alarming levels worldwide, necessitating effective weight management strategies (Baker *et al*., 2022) [2]. Dietary modification remains one of the primary interventions for achieving sustainable weight loss (Koliaki *et al*., 2018) [10]. This review examines the diverse dietary approaches employed in weight management, including low-calorie diets, macronutrient manipulation, intermittent fasting, and dietary pattern modifications.

1.1 Low-Calorie Diets
Low-calorie diets restrict energy intake to induce weight loss. These diets typically involve reducing calorie consumption below maintenance levels while ensuring adequate nutrient intake (Abete *et al*., 2006) [1]. Various iterations of low-calorie diets, such as the Mediterranean diet, the DASH diet, and the ketogenic diet, have been studied for their efficacy in promoting weight loss and improving metabolic health (Handu and Piemonte, 2022) [7].
Low-calorie diets induce weight loss primarily through creating a caloric deficit, wherein energy expenditure exceeds energy intake (Kurpad *et al*., 2005) [11]. This negative energy balance triggers the mobilization of stored fat for energy, leading to reductions in body weight and fat mass (Dulloo *et al*., 2004) [5]. Additionally, LCDs may influence various hormonal pathways involved in appetite regulation, metabolic rate, and fat metabolism, contributing to their weight loss efficacy (Thom and Lean, 2017) [24].

1.1.1 Effectiveness of Low-Calorie Diets
Numerous studies have demonstrated the effectiveness of low-calorie diets in promoting weight loss and improving metabolic parameters. Short-term LCD interventions have been shown to produce rapid initial weight loss, primarily from reductions in fat mass (Whytock *et al*., 2021) [26]. However, long-term adherence to LCDs remains challenging, often resulting in weight regain over time (Saris, 2001) [21]. Nonetheless, when combined with behavioral interventions and lifestyle modifications, LCDs can yield sustainable weight loss outcomes.

1.2 Macronutrient Manipulation
Manipulating the macronutrient composition of the diet, particularly focusing on carbohydrates, fats, and proteins, has gained attention in weight management (Martinez *et al*., 2014) [14]. Low-carbohydrate diets, for instance, restrict carbohydrate intake to promote fat oxidation and reduce insulin secretion, leading to enhanced satiety and weight loss. Similarly, high-protein diets have been shown to increase thermogenesis, preserve lean body mass, and promote satiety, thereby facilitating weight loss (Shah and Garg, 1996) [22].

Obesity has become a global health concern, necessitating effective interventions to promote weight loss and reduce associated health risks (Chan and Woo, 2010) [4] Macronutrient manipulation offers a versatile approach to weight management, allowing for tailored dietary strategies based on individual needs and preferences (Baker *et al*., 2022) [2]. Understanding the mechanisms by which macronutrient composition influences metabolism and body weight is essential for optimizing dietary interventions.

1.2.1 Mechanisms of Macronutrient Manipulation

Carbohydrates, fats, and proteins play distinct roles in energy metabolism, satiety regulation, and nutrient partitioning, influencing body composition and weight regulation. Low-carbohydrate diets, for instance, promote fat oxidation and reduce insulin secretion, leading to enhanced satiety and metabolic benefits. High-protein diets increase thermogenesis, preserve lean body mass, and promote satiety, contributing to greater weight loss and weight maintenance (Hopkins and Blundell, 2016) [9].

1.2.2 Effectiveness of Macronutrient Manipulation

Numerous studies have demonstrated the effectiveness of macronutrient manipulation in promoting weight loss and improving metabolic parameters. Low-carbohydrate and high-protein diets have been shown to produce greater initial weight loss and fat loss compared to conventional low-fat diets. Moreover, macronutrient manipulation may confer metabolic advantages, such as improved insulin sensitivity, lipid profile, and inflammatory markers (Martinez *et al*., 2014) [14].

1.3 Intermittent Fasting

Intermittent fasting involves cycling between periods of eating and fasting, with various fasting protocols, such as alternate-day fasting, time-restricted feeding, and periodic fasting. Intermittent fasting exerts beneficial effects on metabolic health, including improved insulin sensitivity, reduced inflammation, and enhanced fat metabolism, contributing to weight loss and body composition improvements (Longo and Panda, 2016) [13].

Obesity rates continue to rise globally, necessitating effective interventions to address weight-related health concerns. Intermittent fasting, characterized by cycles of eating and fasting, has emerged as a promising approach for achieving weight loss and metabolic benefits. Understanding the physiological mechanisms underlying intermittent fasting and its various protocols is crucial for optimizing its implementation in clinical and community settings (Wolfenden *et al*., 2019) [27].

1.3.1 Mechanisms of Intermittent Fasting

Intermittent fasting induces metabolic adaptations that promote fat oxidation, ketogenesis, and cellular repair processes (Li *et al*., 2018) [12]. During fasting periods, cellular energy sensing pathways are activated, leading to increased autophagy, mitochondrial biogenesis, and improved metabolic flexibility. Additionally, intermittent fasting modulates hormone levels, including insulin, ghrelin, and leptin, which regulate appetite, energy expenditure, and fat metabolism (Smith *et al*., 2018) [23].

1.3.2 Variations of Intermittent Fasting: Intermittent fasting encompasses a variety of fasting protocols, including alternate-day fasting, time-restricted feeding, and periodic fasting. Alternate-day fasting involves alternating between fasting days and ad libitum eating days. Time-restricted feeding restricts daily eating windows, typically ranging from 16 to 8 hours. Periodic fasting involves longer fasting periods, such as extended fasting for 24 hours or more, performed intermittently (Rynders *et al*., 2019) [19].

1.3.3 Efficacy of Intermittent Fasting

Numerous studies have demonstrated the effectiveness of intermittent fasting in promoting weight loss, reducing body fat, and improving metabolic health markers (Patterson *et al*., 2015) [17]. Short-term intermittent fasting interventions have been shown to produce comparable or greater weight loss outcomes compared to continuous energy restriction diets. Moreover, intermittent fasting may confer additional health benefits, including improved insulin sensitivity, reduced inflammation, and enhanced cognitive function (Harris *et al*., 2018) [8].

1.4 Plant additives of functional food for weight management

1.4.1 Anti-obesity effect of Chia Seeds

Chia Seeds (*Salvia hispanica* L.) has an excellent chemical composition, biological properties, dietary importance and medicinal uses. Depending on specific species and cultivation area it turns white to Black in colour. White chia seeds have a richest source of omega -3 fatty acid than black ones (Gabal, 2024) [6]. It contains phenolic acid, flavonoids, Isoflavones, carotenoids and epicatechin. Low level of phytates and tanins are also present. Chia seeds has 9.4 gm of dietary fibre per 25 gm servings. Fibre helps to control satiety, reduce energy intake and promote weight loss (Nieman *et al*., 2009) [16].

1.4.2 Anti-obesity effect of Green Tea

Green tea is most popular beverages in whole world. It is found from *Camellia sinensis* plant. The main healthy components of green tea are catechins. There are four types catechins such as epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC) and epigallocatechin-3 gatte (EGCG). Among them EGCG is found in largest quantity. Green tea has anticarcinogenic, anti-inflammatory, anti-microbial and antioxidential affect in human body (Reygaert, 2017) [18]. Research has been shown that catechins and epigallocatechin of green tea are used in cell culture and animal models of obese patient to reduce adipocyte and differentiation and proliferation, lipogenesis, fat mass, body weight, fat absorption, plasma level of triglycerides, free fatty acids, cholesterol, glucose, insulin and leptin as well as to increase beta oxidation and thermogenesis. Green tea works on adipose tissue, liver, intestine and skeletal muscle to conducting its anti-obesity effects (Wolfram *et al*., 2006) [15].

1.5 Dietary Pattern Modifications

Beyond individual macronutrients, dietary patterns play a crucial role in weight management. Traditional dietary patterns, such as the Mediterranean diet and the DASH diet, emphasize whole foods, fruits, vegetables, and lean proteins while limiting processed foods, sugar, and saturated fats. These dietary patterns have been associated with lower obesity risk, improved weight management outcomes, and reduced risk of chronic diseases (San-Cristobal *et al*., 2020)

[20]. Dietary fibre is essential nutrient and associated with heath supporting and lowering the risk of several diseases mainly for Obesity (Barber *et al*., 2020) [3]. The daily intake of prebiotics in a designed diet has a major influence on GM by decreasing gut permeability, bacterial translocation, and reducing LPS-induced inflammation. However, this diet increases SCFAs and bifidogenesis in the gut, leading to lower TC levels, lipogenesis, LDL triglycerides, and adiposity, eventually resulting in lower risk of cardiovascular diseases (Varzakas *et al*., 2018) [25].

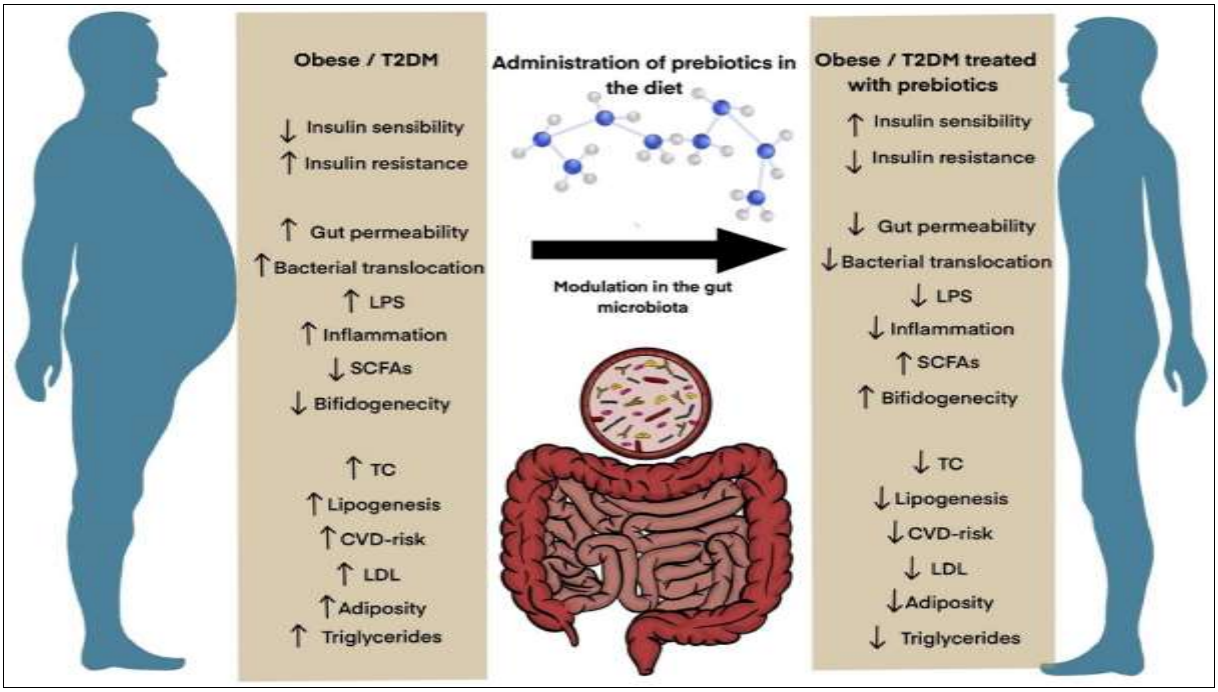

Fig 1: Probiotic against obesity

2. Conclusion

Dietary modification represents a fundamental approach in weight management, encompassing a spectrum of dietary strategies ranging from low-calorie diets and macronutrient manipulation to intermittent fasting and dietary pattern modifications. While each dietary approach has its unique mechanisms and benefits, personalized and sustainable dietary modifications are key to achieving successful weight management outcomes.

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