

## The Prebiotic (Fiber) to Prevent Obesity and Its Complications

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### ABSTRACT:

Obesity is definitely not a solitary problem however a heterogeneous gathering of conditions with numerous causes. Body fat set in stone by a connection between hereditary, ecological and psychosocial factors acting through the physiological arbiters of energy admission and use. Albeit hereditary contrasts are of undoubted significance, the undeniable ascent in the pervasiveness of corpulence is best made sense of by behavioural and ecological changes that have come about because of technological advances.

Well known dietary methodologies for weight reduction have produced boundless interest and significant discussion. While energy balance stays the foundation of weight control (i.e., calories actually count), new eating regimens and books promising weight reduction by restricting specific food sources or macronutrients instead of energy are continually arising and raising a ruckus around town merchant list. Despite the fact that their names and approaches might change over the long haul, their essential reason has not. There are so many factors that affect pathophysiology of obesity.

In this emerging scientific era prebiotic and probiotic found a new pace that is significantly related to dysbiosis in gut microbiota. Changes in the microorganisms that are typically present in the stomach related framework may increase or decrease the risk of overweight and obesity. Regularly, these microbes assist the body in digestion and metabolism.

### INTRODUCTION:

The more fit body is, the more likely it goes through challenges over the long haul of life but in this hyper competitive life and day challenges, people have no time for healthy lifestyle and following the proper rule of nutrition and dietetic. As human survival is directly related to the nutrition. Appropriate nourishment is paramount for body to function at an optimal level. There is a wide array of nutrients, required for the proper functioning of body.<sup>1</sup>

#### What is obesity

The word obesity is derived from the Latin ob-esum, that means on account of having been eaten. Obesity, in a lay term means the same as stoutness but in moderately abusive overtones. In 1997 World Health Organization declared obesity a health hazard and added it in the category of disease.<sup>2</sup>

In 2000, World Health Organization (WHO) defined overweight and obesity as “the disease in which excess body fat has accumulated to such an level that health may be negatively affected”<sup>9</sup> and also defined that the practical definition of obesity is assessed on the level of body mass index (BMI).<sup>2-3</sup> The most recent of international classification for adult obesity developed by WHO is presented in Table 1.<sup>4-5</sup>

Table No.: 1.1

Table No.: 1.1 WHO Classification of obesity		
Classification	BMI (kg/m <sup>2</sup> )	Risk of Co morbidities
Underweight	<18.5	Low (but risk of other clinical problems increased)
Normal range	18.5 to 24.9	
Overweight	≥ 25	Average
Pre-obese	25.0 to 29.9	Increased
Obese class 1	30.0 to 34.9	Moderate
Obese class 2	35.0 to 39.9	Severe
Obese class 3	≥40.0	Very severe

Source- Report of a WHO Expert Committee. WHO Technical Report Series 854

### Obesity a disease?

By International Classification of Disease (World Health Organization, 1997) Obesity was declared as a disease (code E66).<sup>6</sup>

In 2000, World Health Organization (WHO) defined overweight and obesity as “the disease in which excess body fat has accumulated to such an extent that health may be adversely affected” and stated that the practical definition of obesity is lay on the level of body mass index (BMI).<sup>7</sup>

### Type of Obesity

There is a number of other types of depends on different factors.

Table No.: 1.2

Type of obesity	
According to Onset	(a) Insidious (b) Gradual (c) Rapid
Histopathological Classification	(a) Hyperplastic obesity- Increase in number of fat cell (b) Hypertrophic obesity- Increase in size of fat cell

<b>According to Severity</b>	(a) Mild (b) Moderate (c) Severe
<b>According to Etiology</b>	(a) Physiological – During pregnancy, delivery and lactation. (b) Water salt retention- Under diuretic treatment ( sudden increase in body weight) (c) Idiopathic (d) Hyper insulinism- Associated with over treatment of insulin hormone
<b>According to Pathology</b>	(a) Exogenous- Because of excess food intake. (b) Endogenous – (i) Forhlich’s syndrome (ii) Menopausal obesity (iii) Cushing’s syndrome
<b>According to distribution of Fat</b>	(a) Generalized- Fat in whole body. (b) Central (Android Obesity)- Apple shape obesity. (c)Gynoid Obesity (Girdle type)- Pear shape obesity. (d) Superior (Buffalo type) – Fat in the the face, neck arms and upper part of trunk. (e) Inferior type- Fat in lower parts of the body (f) Lipomatous type- Multiple lipomatosis and deposition of fat. (g) Breaches of trochanteric type- Fat only in buttock area.
<b>According to Body Fat Composition</b>	(a) Normal fat obese (b) Metabolically obese normal weight (c) Metabolically healthy obese (d)Metabolically unhealthy obese

**Need of study**

Obesity is spreading at an alarming rate throughout the world and has become a global burden. The World Health Organization (WHO) has declared overweight as one of the top 10 health risks in the world and one of the top five in developed nations (WHO,2002).<sup>8</sup>

In global level total deaths because of NCD increased from 60.8% (2000) to 73.6% in (2019). Most of the world's population lives in countries where overweight and obesity kills more people than underweight.<sup>11</sup> In developing countries like India irrespective of prevalence of under nutrition and poverty there is a high rate of co-existence of under nutrition and obesity in population.<sup>9</sup>

Under the age of 5 years 39 million children are globally overweight or obese in 2020, and if we talk about 2016 data, in children and adolescents aged 5-19 years, prevalence of obesity

was over 340 million across the world. Kids are at expanded danger of creating type 2 diabetes; say the World Health Organization and International Diabetes Federation, however these kids are going to be future generation so the rapidly increasing prevalence of overweight and obesity is not only a societal burden but also an economic burden for administrations and services in developing nations.<sup>10</sup>

WHO 2002, Obesity is expanding at a disturbing rate all through the world and has turned into a pandemic also it has been declared as one of the top 10 health risk factors of mortality and morbidity worldwide and in developed countries 1 of the 5 health risk factor.<sup>11</sup> When identified with abundance, not only in developed countries but also countries with middle and low income getting hit by obesity in rapid manner.<sup>11-12</sup>

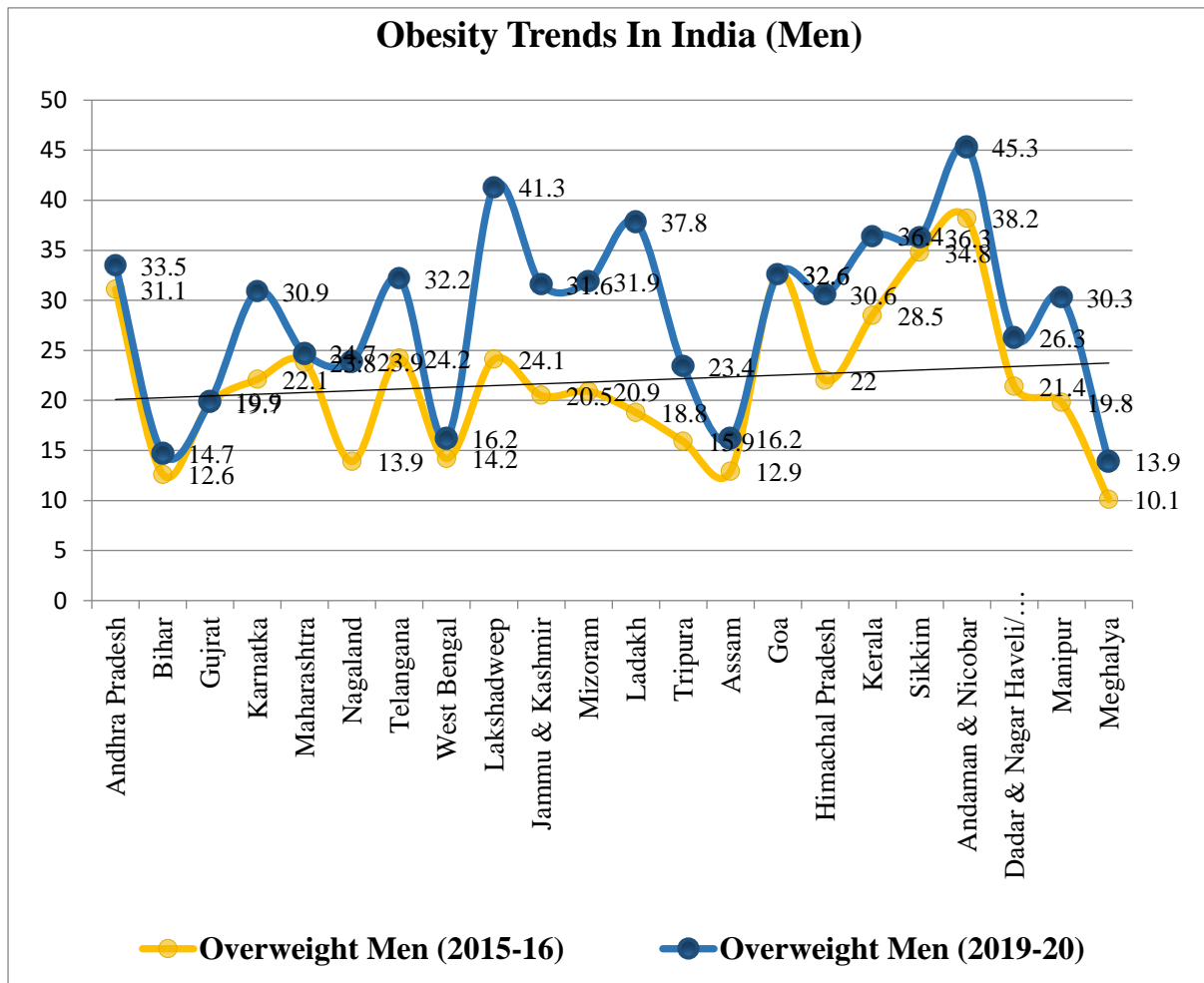
As of late the ongoing illness the study of disease transmission has acquired speed in India. The public authorities are making arrangements for a coordinated public program for the anticipation and control and for multi-sartorial strategy to improve the commitment of the wellbeing frameworks in exercises identified with ongoing infection counteraction and control.<sup>13</sup>

### **Obesity burden in India**

WHO set up the Commission on ending Childhood Obesity in May 2014 because a rapid increase was noticed among infants and children obesity. In 2016, the Commission proposed a set of recommendations to successfully tackle childhood and adolescent obesity in different contexts around the world.<sup>14</sup>

A comparison study on body fat during late childhood and adolescence period between Indian and data from NHANES (National Health and Nutrition Examination Survey – USA) and the New York Pediatric Rosetta Study concluded that Indian children gained more body fat than US Children during pre-puberty period.<sup>15</sup>

In the Indian scenario obesity is prevailing in rural and urban area varying because of different factor such as geographical condition, life style and dietary pattern and habits. As compared to low socioeconomic state like Chandigarh and Goa prevalence of obesity is high in high socioeconomic state like Jharkhand, Chhattisgarh, Madhya Pradesh and Bihar. High rate of obesity in these states (i.e., more than 30% in both the sexes) are only because of sedentary life style pattern and consumption of foods which are high in calorie and fat (NFHS-4). In this chain also in southern states of India like Andhra Pradesh, Kerala and Pondicherry, frequent cases of obesity can be seen in 25% of population. Apart from the children, the NFHS 5 findings highlight that there has been a rise in obesity in adults in comparison to NFHS-4. In men the disease prevalence went up to 22.9 per cent (NFHS-5) from 18.9 per cent (NFHS-4).<sup>16</sup>

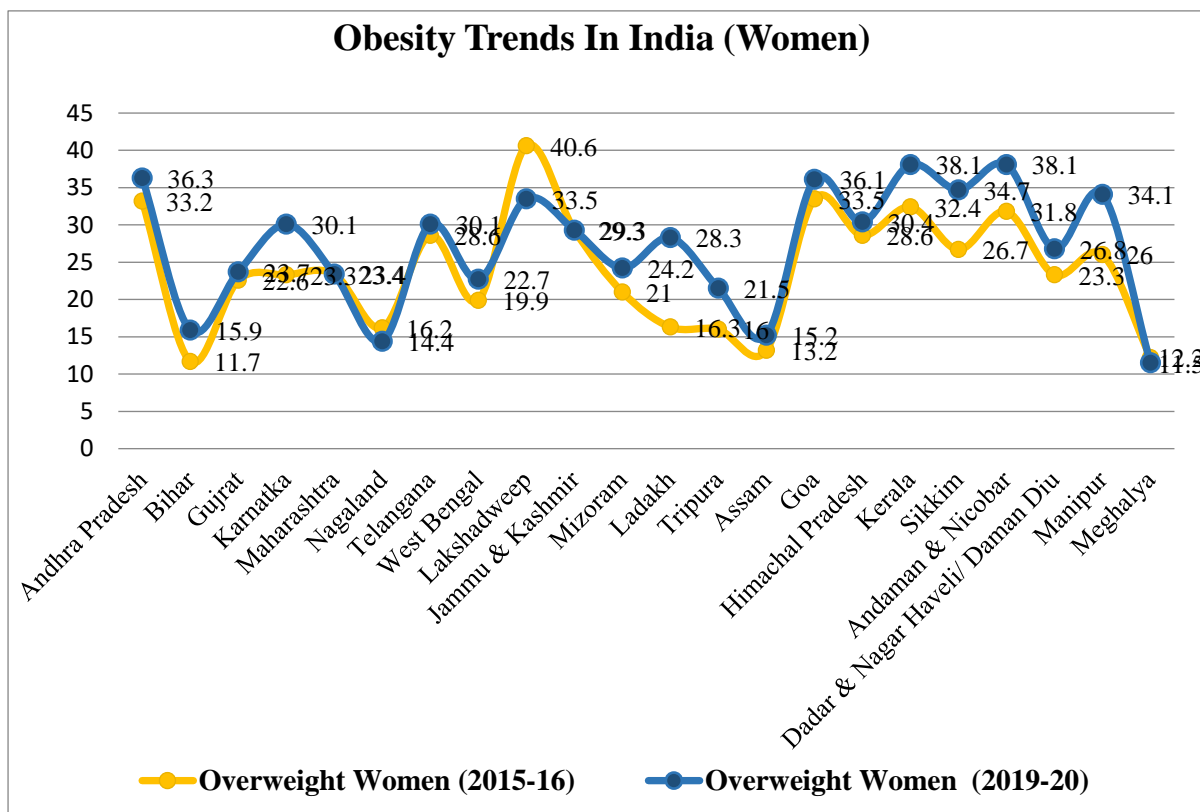


Graph No.: 1.1

Overweight and obesity are a growing health problem in India. According to National family health survey India-3 (NFHS-3), 13% of women aged 15-49 years and 9% of men 15-49 years were overweight or obese in 2005-06. Consequence of overweight prevalence was higher in urban areas than rural areas and found less in people who have adopted in agriculture or manual work.<sup>17</sup>

In this pandemic of obesity, the prevalence rate of obesity in India is frequently increasing as compare to worldwide. According to NFHM report in time span of 1998 -2015, the prevalence overweight is increasing in a higher rate from 8.4% to 15.5% among women and over the same period the prevalence of obesity increased from 2.2% to 5.1%.<sup>18-19</sup>

As per the survey findings, 16 states and Union Territories registered an increase in obesity among women while 19 states and UTs registered an increase in obesity in men. Some of the worst performing states and UTs are Karnataka, Manipur, Sikkim, Ladakh and Lakshadweep recording 7-12 % increase in obese women and 5-11% increase in obese men in NFHS-5.



Graph 1.2

### Role of Gut Microbes in Human Health

Intestinal bacteria play a crucial role in maintaining immune and metabolic homeostasis and protecting against pathogens. Dysbiosis, “an imbalance in microbiota structure and/or function that disrupts host-microorganism homeostasis,” is an emerging feature of many NCDs. The health-promoting effect prompted by the type of gut microbes like bifidobacteria and lactic acid bacteria is due to the growth inhibition of harmful bacteria, stimulation of immune function, lowering of gas distention problem, improve digestion, and absorption of essential nutrient and synthesis of vitamins.<sup>20-21</sup>

### Gut microbiota and Obesity

Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides, and insulin resistance.<sup>22</sup> Indeed, there is growing evidence that the gut microbiota and its bacterial genome (the microbiome) affect the nutrient acquisition, energy regulation, and fat storage. Nutrients load affects gut microbiota composition which is also associated with energy harvesting from the diet.<sup>23</sup>

One of the benefits of having Good bacteria are beneficial us in many ways, first, they use that fiber which escaped during digestion in the gut as a source for their own survive

secondly they metabolize otherwise non-digestible fibers from foods, they produce those short-chain fatty acids that help us in many ways.<sup>24</sup>

Bacteria in the colon produce a carbohydrate-active enzyme which makes them capable to ferment some complex carbohydrates <sup>25</sup> and the outcome of this is the production of three SCFSs, propionate, butyrate, and acetate which are found in proportion in 1:1:3 in GIT, and work as metabolites.<sup>26</sup>

**Prebiotic(Fiber)**

Soluble fibers are more viscous and better fermented by gut microbes; they decline the pace of glucose and lipid (fat) assimilation and ingestion, increases satiety, and lower LDL cholesterol that is a well-known factor for coronary illness.<sup>27</sup> Insoluble fibers are gradually and not completely fermented and digested in the colon, creating waste mass and gas, an aid for colon wellbeing.<sup>28</sup>

Table No.: 1.3

**Type of Fiber**

Fiber	Occurrence	Chemical nature	Source
<b>Insoluble Fiber</b>			
<b>Cellulose</b>	Cell wall of constituent	Cellulose is a polysaccharide made up of glucose. Due to difference in the chemical structure, cellulose is not acted upon by amylases present in the digestive juices. Cellulose is poorly fermented.	Whole wheat flour, root vegetables, legumes, peas, outer covering of seeds.
<b>Hemi-cellulose</b>	Secretions, cell wall material	Hemicelluloses are polysaccharides containing pentoses, hexoses and uronic acid. Fermentability by micro flora is influenced by structure and type of sugar.	Bran, Whole grain.
<b>Lignin</b>	Woody parts of plants	Part of the plant cell wall and contributes to the structural rigidity of plants. Insoluble in water, and is not digested by colonic bacteria.	Mature root of vegetable such as carrot, fruits with edible seeds, strawberries.

<b>Soluble Fiber</b>			
<b>Pectins</b>	Intracellular cementing material	Pectin is water soluble and in the presence of sucrose and citric acid pectin forms a gel. Completely metabolized by colonic bacteria.	Apple, guavas, citrus fruits, carrots, strawberries, berries and seeds.
<b>Gums</b>	Secreted at the site of the plant injury by specialised secretory cells.	Gums are composed of variety of sugar and sugar derivatives. Highly fermented by colonic bacteria.	Gum, arabis, oatmeals, barley, legumes.
<b>Inulin Oligofructose</b>	Found in roots or rhizomes.	Completely metabolized by colonic bacteria.	Onion, garlic, banana, beets or chicory roots.
<b>Resistant starch</b>	Starch in cell walls of plants.	Helps in weight management by increasing fullness. Highly fermented	Unripened banana, oatmeal, legume.

**Mechanism of action of Prebiotic**

Gut microbes assists human body by energy harvest and the associated short-chain fatty acid production which might be very helpful in obesity management. The gut microbiota also influences the expression of host genes, namely of those that are expressed in the intestine and control fatty acid absorption, oxidation, and storage. One such target is angiotensin-related. Butyrate a short chain fatty acid produce by bacteria in gut can activate intestinal gluconeogenesis (IGN) via a cAMP-dependent mechanism with beneficial effects on glucose and energy homeostasis.<sup>29</sup> Propionate is increasingly thought to be an important molecule in satiety signalling due to interaction with the gut receptor (G protein-coupled receptor, GPR) GPR41 and GPR43.<sup>30</sup> It is also an energy source of epithelial cells, but it also transferred to the liver where it also plays a role in gluconeogenesis.

**Dietary intervention and obesity**

Dietary pattern changes and modification is most reliable and effective treatment for overweight and obesity. Weight loss dietary pattern varies from changes of energy limitation, macronutrients, food sources, and dietary intake designs. Caloric limitation is the normal pathway for weight reduction, however various eating pattern might prompt weight reduction by changed metabolism and works by different mechanism, including by working with dietary adherence.



While dietary and way of lifestyle modification stay a basic initial phase in weight reduction therapies, most scientific research clearly demonstrates the importance of the environment, particularly the dominant contribution of food intake and physical inactivity to weight gain.<sup>31</sup>

A meta-analysis of randomized clinical control trails on trial level conducted by S. B. Jonathan, et al. in 2015, the study was targeted to analyze a comparing effect of low carbohydrate diet and low-fat diet on obese subjects. 17 studies on the effect of dietary intervention on obesity were included in the study. Both diets had a significant reduction on weight loss but people with low carbohydrate diet reported significantly significant reduction on weight loss and also a reduction in the risk of (ASCVD) atherosclerosis cardiovascular disease. Some other meta-analysis on the effect of low carbohydrate diet also concluded same result with the reduction of weight, blood pressure, and lipid profile. Weight decrease was 94.8 to 86.6 kg for low carbohydrate diet and 94.1 88.2kg for low fat diet.<sup>32</sup>

The expanding westernization, urbanization and motorization happening in many nations all throughout the world is also related with changes in the eating behaviour towards one of high fat, high energy food dietary pattern and a stationary way of life. There are an assortment of practices and other host factors that potentially affect a populace's degree of obesity. The worldwide financial and social load and metabolic condition requests practical, essential changes in way of life and food habits. Still much work needs to be done to comprehend for the cure of obesity and its related metabolic issues that are emerging as a growing burden on society and on administration.

### **Dietary Management**

Cutting calories and following better eating routines are crucial to beating obesity. Despite the fact that anyone might shed pounds rapidly from the get go, consistent weight reduction over the long haul is viewed as the most secure method for getting in shape and the most effective way to keep it off for all time.

### **Premise of dietary recommendation**

The concept and principle of dietary standards and suggestions includes calorie limitation, macronutrient proportion, and rectification in eating habits, and all based on calorie limitation depends on making a negative energy balance. An individualized hypo-caloric diet with decrease of 500 kcal from required energy brings an ideal weight reduction of half kg each week. The everyday calorie shortfall is determined by the evaluation of patient's age, sex, BMI, current calorie intake, and physical activity pattern.<sup>33</sup>

There is no best weight-loss diet. Dietary changes to treat obesity include some basic principles:

- **Cutting calories**

The way to weight reduction is lessening the number of calories that anybody takes in. The initial step is to audit average eating and drinking propensities to perceive the number of calories that typically goes in and from where it can scale back. Conclude the number of calories that need to require in every day to get in shape, yet a normal sum is 1,200 to 1,500 calories.<sup>34</sup>

- **Feeling full on less**

A few food varieties such as high glycemic diet , fats and processed food varieties that contain a lot of calories for a little piece than its satiety qualities, whereas, fruits and vegetables furnish a bigger piece size with less calories. By eating bigger segments of food sources that have less calorie, decrease food cravings, adds to feel fulfilled and satisfied at the end.<sup>35</sup>

- **Making healthier choices**

To make general eating regimen better, should eat more plant-based food sources, like organic products, vegetables and whole grains.<sup>36</sup> Additionally stress lean protein sources like beans, lentils and soy and from animal source- lean meats.<sup>37</sup> Fish is also a healthier choice, can be consumed two times every week.<sup>38</sup> Salt and added sugar should also be in limited amount.<sup>39</sup> Eating limited quantities of fats, that come from heart-healthy sources (unsaturated fats), for example, olive, canola and nut oils.<sup>40</sup>

- **Restricting certain foods**

Particular type of dietary patterns, limit or restrict specific food groups, like high-carbohydrate or high fat diet plan. Restricting beverages or dispensing with them by and large is a decent way to begin cutting calories.

- **Meal replacements**

These plans propose supplanting one or two meal with their products for example, low-calorie shakes or supper bars and practice good eating habits snacks and a sound adjusted third feast that is low in fat and calories. Temporarily, this kind of diet can assist with getting more fit. Yet, these weight control plans probably won't show how to change your general way of life. So, you might need to remain on the eating regimen if you have desire to keep your weight off.

There is nothing like handy solutions. There are many kinds of tempting fad diet plans that looks very enticing but the truth, notwithstanding, is that there are no enchanted food varieties or convenient solutions. Prevailing fashion diets might help temporarily, however the drawn-out results don't seem, by all accounts, to be any better compared to different eating regimens.<sup>41</sup>

## CONCLUSION:

Over the last decade, the nutrition transition, increasing westernization, urbanization and mechanization occurring in most countries around the world is associated with changes in the diet towards one of high fat, high energy-dense foods and a sedentary lifestyle result in obesity.

Many factors together, including carbohydrate type, fiber, protein, fat, food form and method of preparation, total calorie consumption determine the GI of any food and all these factors less or more contributes in the emergence of obesity.

Obesity is a multifactorial disease, with both individual and environmental factors influencing dietary adherence. Dietary approaches with a reduction in energy intake that have led to success at weight loss have focused on macronutrient composition and food patterns. In this evolutionary era there are a variety of strategies and tools with personalized plans and exercise, that individuals suffering with overweight and obesity can use for the management of extra body weight, among them clinically accepted and most reviewed low-energy-dense eating patterns is easiest way to achieve sustainable and satisfying nutritional goals.

Obesity leads increased risk of wide range of metabolic diseases, as in this study it can be seen that prebiotic controls obesity in significant way so this diet can also have some beneficial effects in subjects at risk of disease due to an unhealthy lifestyle especially unhealthy dietary pattern.

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