

Anthropometric study on the role of yogurt fermented with *Lactobacillus bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* in the prevention and treatment of obesity and related diseases**DOI:** <http://doi.org/10.26758/8.1.17>

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(2) Medical University of Sofia, Bulgaria, e-mail: aneliyakuzeva@gmail.comAddress correspondence to: Svetoslav Handjiev, e-mail: svhandjiev@gmail.com**Abstract**

Objectives. The role of yogurt, respectively probiotics, in the treatment and prevention of obesity has been discussed. The aim of our study was to investigate the effect of yogurt fermented with *Lactobacillus bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* (0.5% fat) in the treatment of patients with obesity.

Material and methods. A total of 57 subjects with central type obesity (21 men and 36 women) were enrolled in the study. The baseline characteristics of the sample (average values) were the following: age – 46.2 years, body mass index (BMI) – 35.4, fat mass – 39.4%, visceral fat – 14.1, waist circumference – 109 cm, hip circumference – 120.2, and sagittal diameter – 27 cm. All these obese patients underwent a dietary regimen, included 290g yogurt fermented with *Lactobacillus bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* for dinner during a 6-month period. The product consisted of proteins – 4.3g, carbohydrates (lactose) – 3.9g, fat – 0.5g, and 37 kilocalories per 100g product. At the beginning and at the end of the study, several anthropometric parameters have been measured using a bioimpedance device (Tanita 420).

Results. The study demonstrated the decrease of BMI with 9.8%, of fat mass with 9.6%, of visceral fat with 14%, as well as a decrease in waist circumference by 11.9%, of hip circumference by 5.8%, and of sagittal diameter by 10.3%.

Discussion: Probiotics are substances that regulate the normal intestinal flora, influence metabolism and have an effect on various diseases. Our studies were performed on the effect of *Lactobacillus Bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* on carbohydrate and lipid metabolism in obesity. The results indicated that the probiotics improved the impaired glucose and lipid metabolism. The probiotics affected the concentration of free radicals in the blood. Taken together, the results give a reason to assume that the effect of probiotics on oxidative stress in the mechanism of influence on the metabolism is important.

Conclusion. The regular consumption of yogurt fermented with *Lactobacillus bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* (0.5% fat) in the diet of obese patients leads to improvement of the studied anthropometric parameters as well as to significant decrease in the cardiovascular risk.

Keywords: anthropometric study; yogurt; probiotics; metabolic syndrome.

Introduction

Obesity is a chronic metabolic disease that leads to many co-morbidities and high prevalence of mortality (Yumuk et al., 2015; WHO, 2018). The incidence of obesity and related diseases increases constantly (see Figs. 1-4). The role of dairy products in the treatment and prevention of obesity has been discussed (Bogdanov, 2014; Martinez-Gonzalez et al., 2014; Ahn et al., 2015; Handjieva-Darlenska et al., 2015; Handjieva-Darlenska et al., 2016; Lamarche et al., 2016; Beck et al., 2017). The literature also highlighted the effect of yogurt, respectively probiotics, in the treatment and prevention of obesity (Bogdanov, 2014; Handjieva-Darlenska and Minkova, 2016; Santiago et al., 2016; Karimi et al., 2017).

Figure 1. Expected increase in the incidence of obesity.

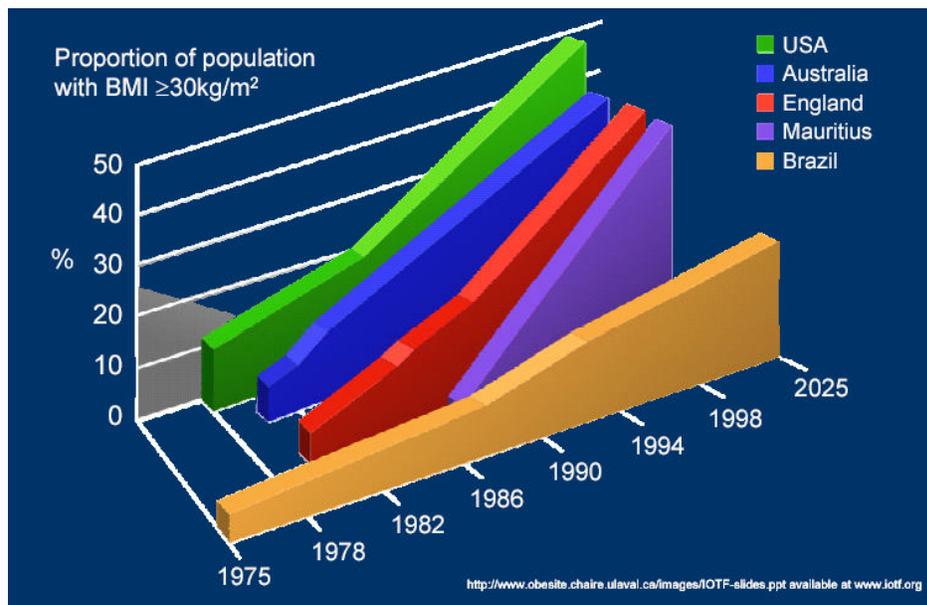


Figure 2. Expected increase in the incidence of diabetes.

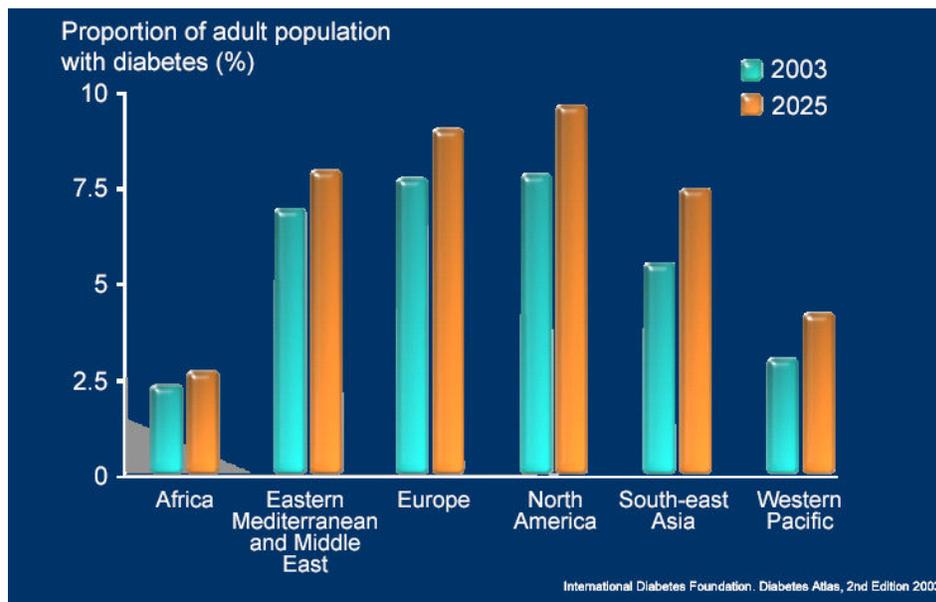


Figure 3. Overweight and obesity prevalence in schoolchildren. National survey on nutrition and nutritional status of schoolchildren in Bulgaria -1998, 2010-2011 (Source: Dimitrova, 2012).

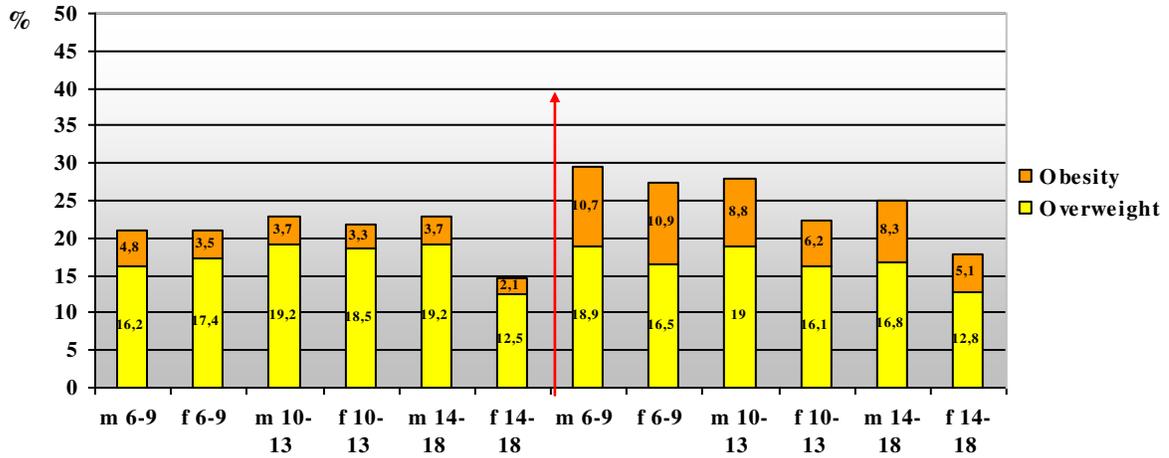
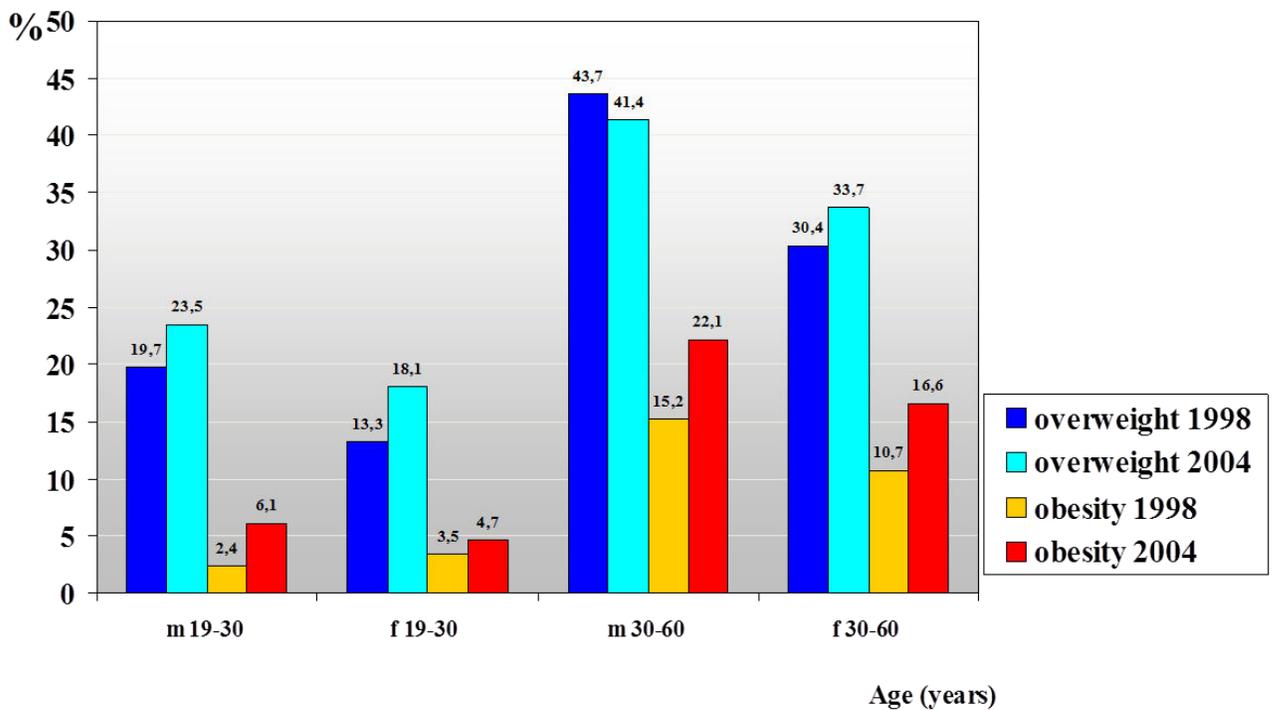


Figure 4. Prevalence of Overweight and Obesity among adults (19-60 years old). National Monitoring of Dietary Intake and Nutritional Status, 1998, 2004 (Source: Dimitrova, 2012).



History

Even since the end of 19th century, the Russian scientist and pioneer immunologist Ilya Ilyich Mechnikov (or Elie Metchnikoff, as his name is often written), investigating the factors that could enhance or decrease health and longevity, advanced the idea of the harmful intestinal bacteria as the source of the inflammatory process; the thermal preparation of all fruits and vegetables and the regular consumption of yogurt or other types of sour milk were proposed as solutions for the intestinal putrefaction that precipitated the aging process. He emphasized, in particular, the positive, neutralization effect of the so-called Bulgarian Bacillus from the Bulgarian yogurt upon intestinal microbiome, as proven by the health and longevity of the highlanders who include large amounts of soured milk in their diet.

The actual discovery of the *Lactobacillus bulgaricus* is due to Stamen Grigoroff, a Bulgarian student who studied medical science in Geneva, Switzerland. Immediately after he identified the bacteria that cause the milk to curdle, his professor, Léon Massol wrote to Prof. Ilyja Mechnikoff at the Institut "Louis Pasteur", announcing the great scientific results. His discovery was presented in the paper entitled "Étude sur le lait fermenté comestible: le "Kissélo-mléko" de Bulgarie" and published in *Revue médicale de la Suisse romande: organe officiel de la Société médicale de la Suisse romande*, issue 10, dated 20.10.1905, Genève, Georg & G., Libraires-Éditeurs. Librairie de L'Université. Then, it was validated by Metchnikoff, who invites the young scientist to Paris; his assistants, Luerssen and Kuhn, were those who in 1908 gave to this microorganism the designation of Lacto bacterium Bulgaricum – the Bulgarian lactic bacteria.

Subsequently, the benefits of yogurt consumption have been the subject of numerous studies, eventually leading to the establishment of a Bulgarian school. For obtaining his medical degree of Doctor of Medicine in Toulouse, Radush Titkov defended in 1905 a thesis regarding the healthy properties of yogurt. Prof. Assen Zlatarov, who got his Ph.D. in Chemistry and Physics at the prestigious Grenoble University, called the yogurt "an elixir of long-life".

Academician Tasho Tashev, the dean of Bulgarian nutrition science, and his school (1980-2001) investigated the role of dairy foods in the prevention and treatment of the gastrointestinal and metabolic diseases (von Sanchsen, 2006; Handjieva-Darlenska, 2016).

Aim

The aim of our study was to investigate the effect of yogurt fermented with *Lactobacillus bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* (0.5% fat) in the treatment of patients with obesity and related diseases.

Material and methods

A total of 57 subjects with central type obesity (21 men and 36 women) were enrolled in the study. The study took place in the National Transport Medical Hospital as part of the BARORD's (Bulgarian Association for Study of Obesity) activities. The participants were volunteers who took part in the study for 6 months and were consulted every 2 weeks throughout the study as part of the outpatient clinics.

The methods involved anthropometrical measurements to determine the initial status of patients and to evaluate the results of the dietary regimen imposed to all the obese patients.

All obese patients underwent a dietary regimen, included 290g yogurt fermented with *Lactobacillus bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* for a 6-month period which

replaced their regular dinner. The product consisted of proteins – 4.3g, carbohydrates (lactose) – 3.9g, fat – 0.5 g, and 7 kilocalories per 100g yogurt product.

The classification of patients in the obesity weight classes was made considering the body mass index developed by Adolphe Quetelet and recommended by WHO for estimating body fat mass. It is calculated by dividing the subject's mass by the square of his or her height. Any BMI ≥ 35 or 40 signals severe obesity; a BMI of ≥ 35 or 40–44.9 or 49.9 represents morbid obesity; a BMI of ≥ 45 or 50 indicates a super obese. However, since the BMI does not reveal the body fat distribution, other measurements regarding body fat percentage had to be done.

Body height was measured using an anthropometer in the upright position.

Some parameters such as body weight, body mass index, body fat mass, visceral fat, lean body mass were assessed using a bioimpedance device (Tanita 420).

Sagittal diameter was measured using a caliper.

Results

The baseline characteristics of the sample (average values) were the following: age – 46.2 years, body mass index (BMI) – 35.4, fat mass – 39.4%, visceral fat – 14.1, waist circumference – 109 cm, hip circumference – 120.2 cm, and sagittal diameter – 27 cm.

The study demonstrated the decrease of BMI with 9.8%, of fat mass with 9.6%, of visceral fat with 14%, as well as a decrease in waist circumference by 11.9%, of hip circumference by 5.8%, and of sagittal diameter by 10.3% (see Table 1).

Moreover, at the end of treatment, we observed an improvement trend in the values of blood sugar, total cholesterol, triglycerides as well as of the systolic and diastolic blood pressure.

Table 1. Changes in physical parameters following treatment

<i>Parameter</i>	<i>BMI</i>	<i>FM (%)</i>	<i>LBM (%)</i>	<i>LBM /FM</i>	<i>VF</i>	<i>W (cm)</i>	<i>H (cm)</i>	<i>W/H</i>	<i>Sag. diameter</i>
<i>Before treatment</i>	36.1	40.7	59.3	1.45	13	109.5	122.6	0.90	24.7
<i>After Treatment</i>	32.2	36.2	63.8	1.80	11	98	114.6	0.87	22.8

Discussions

Probiotics are substances that regulate the normal intestinal flora, influence metabolism and have an effect on various diseases. Our studies were performed on the effect of *Lactobacillus bulgaricus* and *Bifidobacterium animalis* subsp. *lactis* on carbohydrate and lipid metabolism in obesity. The results indicated that the probiotics improved the impaired glucose and lipid metabolism. The probiotics affected the concentration of free radicals in the blood. Taken together,

the results demonstrate the effect of probiotics on oxidative stress in the mechanism of influencing carbohydrate and lipid metabolism.

Our study emphasizes the significance of yoghurt and other dairy product in the prevention and management of metabolic and cardiovascular diseases, which is in concordance with other results found in the literature (Dimitrova, 2012; Milici and Neagu, 2014; Borys et al., 2015; Ivey et al., 2015; Pashova-Baltova et al., 2015; Santiago et al., 2016; Mohammadi-Sartang et al., 2018).

The production of fermented foods is based on the use of starter cultures, for eg. lactic acid bacteria, which initiate the rapid acidification of the raw material, i.e. the milk. A series of studies on the properties of lactic acid producing bacteria have reported suitable strains for inclusion in functional (starter) cultures and fermented products; among them we list *L. bulgaricus* strains with established in-vitro immunomodulatory effect, *L. helveticus* - producer of bioactive peptides with ACE-inhibitory activity, *L. Gasseri* - with a strong adhesion to the epithelial cells of the gastrointestinal tract and cholesterol-lowering effect.

Recently, new starter cultures of lactic bacteria are developed, which may contribute to microbial safety or provide one or more organoleptic, technological, nutritional or health benefits. Examples are the lactic acid bacteria that produce antimicrobial substances, sugar polymers, sweeteners, aromatic compounds, vitamins or enzymes useful or having probiotic properties (Leroy and De Vuyst, 2004).

Conclusion

The regular consumption of yogurt fermented with *Lactobacillus bulgaricus* and *Bifidobacterium animalis subsp. lactis* (0.5% fat) in the diet of obese patients leads to improvement of the studied anthropometric parameters as well as to significant decrease in the cardiovascular risk.

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