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Effects of probiotic yogurt consumption on metabolic factors in individuals with nonalcoholic fatty liver disease

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ABSTRACT

The aim of this study was to investigate the effects of probiotic yogurt consumption on some metabolic factors in nonalcoholic fatty liver disease (NAFLD) patients. This double-blind, randomized, controlled clinical trial was conducted on 72 patients with NAFLD (33 males and 39 females) aged 23 to 63 yr. Subjects in the intervention group (n = 36) consumed 300 g/d of probiotic yogurt containing *Lactobacillus acidophilus* La5 and *Bifidobacterium lactis* Bb12 and those in the control group (n = 36) consumed 300 g/d of conventional yogurt for 8 wk. Fasting blood samples, anthropometric measurements, and dietary records (24 h/d for 3 d) were collected at baseline and at the end of the trial. Probiotic yogurt consumption resulted in reductions of 4.67, 5.42, 4.1, and 6.92% in serum levels of alanine aminotransferase, aspartate aminotransferase, total cholesterol, and low-density lipoprotein cholesterol, respectively, compared with control group. No significant changes were observed in levels of serum glucose, triglycerides, or high-density lipoprotein cholesterol in either group. Probiotic yogurt consumption improved hepatic enzymes, serum total cholesterol, and low-density lipoprotein cholesterol levels in studied subjects and might be useful in management of NAFLD risk factors.

Key words: nonalcoholic fatty liver disease, probiotic yogurt, metabolic factor

INTRODUCTION

Nonalcoholic fatty liver disease (**NAFLD**) is the most common form of chronic liver disease in the world and includes simple steatosis, nonalcoholic steatohepatitis, and fibrosis, which can finally develop to cirrhosis and even hepatocellular carcinoma (Lomonaco et al., 2013). The prevalence of this disorder in general population screening with ultrasonography is reported to be 20 to 30% (Bellentani et al., 2010). Its prevalence in the in Iranian population is estimated to be about 33% (Adibi et al., 2008). Individuals with NAFLD have a higher mortality rate than healthy people (Wong, 2008). Long-term studies suggest that the most common factor in mortality of NAFLD patients is cardiovascular disease (Rafiq and Younossi, 2009). Diabetes and dyslipidemias, as comorbidities of NAFLD, predispose patients with NAFLD to cardiovascular disease (Clark et al., 2002). An increased levels of total cholesterol (**TC**) in blood is considered as a strong risk factor for coronary heart disease (Nguyen et al., 2007). In general, each 1% reduction of the cholesterol level causes a 2.3% decrease in coronary-related risks. Therefore, lowering the cholesterol level can be an excellent solution in reducing cardiovascular diseases mortality (Baroutkoub et al., 2010). Dyslipidemia occurs in 20 to 80% of individuals with NAFLD (Day, 2004).

Current treatments for NAFLD include changes in diet, increased physical activity, medication, and surgery (Gill and Wu, 2006). In recent years, probiotics have been discussed as a potential alternative in the treatment of various diseases, including NAFLD (Lata et al., 2011).

The World Health Organization describes probiotics as live microorganisms that generate a health benefit on the host when administered in sufficient amounts (Metchnikoff, 1907; reprinted 2004). Metchnikoff, a Nobel Prize winner, was the first to propose probiotics as a useful factor in human health (FAO-WHO, 2001). The reported prophylactic and therapeutic effects of these microorganisms are as follows: balancing the intestinal microflora; reducing cholesterol levels; improving hypertension, diabetes, lactose intolerance, gastrointestinal diseases; promoting immune system; and lowering the risk of different types of cancer (Viana et al., 2007; Goldin and Gorbach, 2008; Kaur et al., 2009; Lye et al., 2009).

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It has been claimed that consumption of probiotic products significantly decreases serum cholesterol (Niazmand et al., 2010). Therefore, many studies have been performed to clarify the effect of fermented dairy products on serum cholesterol, but the cholesterol-lowering effects of probiotics have not yet been established (Xiao et al., 2003; Lewis and Burmeister, 2005; Greany et al., 2008; Ataie-Jafari et al., 2009; Sadrzadeh-Yeganeh et al., 2010). In most of these investigations, reductions in serum cholesterol were reported only in humans who consumed very high doses of fermented dairy products. Other interventions using "normal" doses of fermented milk product were unsuccessful in confirming such findings. Nevertheless, the possible advantages of probiotics dairy products on serum lipid profile remain under debate.

As mentioned above, hepatic lipid homeostasis is disordered in NAFLD (Kneeman et al., 2012). To our knowledge, no reports are available on the effects of probiotic products, including yogurt, on metabolic status in NAFLD patients; hence, the current study was designed to investigate the effects of probiotic yogurt containing *Lactobacillus acidophilus* La5 and *Bifidobacterium lactis* Bb12, compared with conventional yogurt, on metabolic factors, including liver enzymes, fasting blood sugar (**FBS**), and serum lipid profile in individuals with NAFLD.

MATERIALS AND METHODS

Subjects

Seventy-two NAFLD subjects, aged 23 to 63 yr, with body mass index (**BMI**) ranging from 25 to 40 kg/m^2, were recruited in this double-blinded, randomized, controlled clinical trial from the Shykhoraeis polyclinic (Tabriz, Iran).

Recruitment was done via referral from a gastroenterologist. All participants had been diagnosed as new cases of NAFLD. The diagnostic criterion for NAFLD and its degree was ultrasonography. Exclusion criteria were presence of kidney disease, another type of liver disease, hepatitis B or C, inflammatory intestinal disease, thyroid disorders, immunodeficiency diseases, Wilson disease, or hemochromatosis; lactose intolerance; using tobacco or alcohol; taking nutritional supplements within the previous 3 wk or during the 8-wk study period; receiving cholesterol-lowering medication, estrogen, progesterone, or diuretics; being pregnant or breast feeding; and consuming probiotic yogurt or any other probiotic products within the previous 2 mo.

Sample size was determined based on primary information obtained from the study by Ejtahed et al. (2011) for FBS. Considering $\alpha = 0.05$ and a power of 80%, the sample size was computed as 30.49 ($\approx$31) per group (Pocock, 1983). This number was increased to 36 per group to accommodate the anticipated dropout rate.

Study Design and Measurements

This study was conducted on individuals with NAFLD (33 males and 39 females). Participants were randomly assigned into 2 groups using a block randomization procedure of size 4. The random sequence was generated by the study statistician using random allocation software. Randomization was stratified according to age, sex, and BMI. In total, 36 patients were entered in each group. During the 1-wk adjustment period, all patients refrained from eating yogurt or any other fermented food. Over 8 wk, the intervention and control groups consumed 300 g daily of probiotic or conventional yogurt, respectively. All subjects were told not to alter their usual dietary habits or lifestyle and to avoid consuming any yogurt other than that provided to them by the researchers throughout the 8-wk trial. The volunteers were also instructed to keep the yogurt under refrigeration.

The assignment of groups was blinded to investigators and subjects. In addition, the statistician was not aware of the allocation of participants to intervention and control groups. Probiotic and conventional yogurt containers were identical in appearance. Every week, the subjects would receive a week's supply of their probiotic or conventional yogurts (containing 2.5% fat) from researchers. Through weekly follow-ups by phone interview, compliance with the yogurt consumption was monitored once per week.

Recording of food consumption information (through 24-h dietary recall for 3 d), anthropometric measurements, and collection of fasting blood samples were done at the beginning and end of the trial. The 24-h dietary recall comprised 1 weekend day and 2 nonconsecutive weekdays. Three-day averages of energy and macronutrient intakes were analyzed by using Nutritionist 4 software (First Databank Inc., Hearst Corp., San Bruno, CA). All data were entered by trained dietitians.

Body weight was measured using a scale (Seca, Hamburg, Germany) with 0.5-kg accuracy while participants were without shoes and wearing light clothing. A tape was used to measure height with 0.5-cm accuracy while participants were without shoes. Body mass index was calculated using weight and height measurements (kg/m^2).

Blood samples were collected in the morning after a 12-h overnight fast. The blood sample was drawn from the antecubital vein in the arm. The serum samples