

# Effect of Multispecies Probiotic Supplements on Metabolic Profiles, hs-CRP, and Oxidative Stress in Patients with Type 2 Diabetes

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## Key Words

Probiotics · Metabolic profiles · High-sensitivity C-reactive protein · Oxidative stress · Type 2 diabetes

## Abstract

**Background:** We are aware of no study that has indicated the effects of daily consumption of multispecies probiotic supplements on metabolic profiles, high-sensitivity C-reactive protein (hs-CRP), and oxidative stress in diabetic patients. **Objective:** This study was designed to determine the effects of multispecies probiotic supplements on metabolic profiles, hs-CRP, and oxidative stress in diabetic patients. **Methods:** This randomized double-blind placebo-controlled clinical trial was performed on 54 diabetic patients aged 35–70 years. Subjects were randomly assigned to take either a multispecies probiotic supplement (n = 27) or placebo (n = 27) for 8 weeks. The multispecies probiotic supplement consisted of 7 viable and freeze-dried strains: *Lactobacillus acidophilus* ( $2 \times 10^9$  CFU), *L. casei* ( $7 \times 10^9$  CFU), *L. rhamnosus* ( $1.5 \times 10^9$  CFU), *L. bulgaricus* ( $2 \times 10^8$  CFU), *Bifidobacterium breve* ( $2 \times 10^{10}$  CFU), *B. longum* ( $7 \times 10^9$  CFU), *Streptococcus thermophilus* ( $1.5 \times 10^9$  CFU), and 100 mg fructo-oligosaccharide. Fasting blood samples were taken at baseline and after intervention to measure

metabolic profiles, hs-CRP, and biomarkers of oxidative stress including plasma total antioxidant capacity and total glutathione (GSH). **Results:** Between-group comparisons of fasting plasma glucose (FPG) revealed that consumption of probiotic supplements prevented a rise in FPG ( $+28.8 \pm 8.5$  for placebo vs.  $+1.6 \pm 6$  mg/dl for probiotic group,  $p = 0.01$ ). Although a significant within-group increase in serum insulin and low-density lipoprotein cholesterol levels was found in both the probiotic group and the placebo group, the changes were similar between the two groups. We observed a significant increase in HOMA-IR (homeostasis model of assessment-insulin resistance) in both the probiotic group ( $p = 0.02$ ) and the placebo group ( $p = 0.001$ ); however, the increase in the placebo group was significantly higher than that in the probiotic group ( $+2.38$  vs.  $+0.78$ ,  $p = 0.03$ ). Mean changes in serum hs-CRP were significantly different between the two groups ( $-777.57$  for the probiotic group vs.  $+878.72$  ng/ml for the placebo group,  $p = 0.02$ ). Probiotic supplementation led to a significant increase in plasma GSH levels compared to placebo ( $240.63$  vs.  $-33.46$   $\mu\text{mol/l}$ ,  $p = 0.03$ ). **Conclusion:** In conclusion, multispecies probiotic supplementation, compared with placebo, for 8 weeks in diabetic patients prevented a rise in FPG and resulted in a decrease in serum hs-CRP and an increase in plasma total GSH.

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## Çoklu Türlü Probiyotik Takviyelerinin Tip 2 Diyabetli Hastaların Metabolik Profilleri, hs-CRP ve Oksidatif Stresleri Üzerine Etkisi

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### Özet

**Bilimsel arka plan:** Günlük çoklu probiyotik tüketiminin diyabetik hastalardaki metabolik profilleri, yüksek hassasiyetli CRP (hs-CRP) ve oksidatif stresleri üzerindeki etkileri henüz hiçbir çalışmada araştırılmadığı fark edilmiştir.

**Amaç:** Bu çalışmanın amacı çoklu probiyotik takviyelerin Tip 2 diyabetli hastaların metabolik profilleri, hs-CRP ve oksidatif stres üzerine etkisini araştırmaktır. **Metot:** Bu randomize, çift kör, plasebo kontrollü klinik çalışma 35-70 yaş arası 54 diyabetik hasta üzerinde yapılmıştır. Hastalar, 8 hafta boyunca ya çok türlü bir probiyotik takviyesi (n = 27) ya da plasebo (n = 27) almak üzere randomize bir şekilde 2 gruba ayrılmışlardır. Çoklu probiyotik takviyesi, 7 canlı ve dondurularak kurutulmuş suştan oluşmuştur: Lactobacillus acidophilus (2 × 10<sup>9</sup> CFU), L. casei (7 × 10<sup>9</sup> CFU), L. rhamnosus (1.5 × 10<sup>9</sup> CFU), L. bulgaricus (2 × 10<sup>8</sup> CFU), Bifidobacterium breve (2 × 10<sup>10</sup> CFU), B. longum (7 × 10<sup>9</sup> CFU), Streptococcus thermophilus (1.5 × 10<sup>9</sup> CFU) ve 100 mg frukto-oligosakkarit. Metabolik profilleri, hs-CRP, plazma toplam antioksidan kapasitesi ve toplam glutatyon (GSH)

dahil olmak üzere oksidatif stresin biyobelirteçlerini ölçmek için başlangıçta ve müdahaleden sonra açlık kan örnekleri alınmıştır. **Bulgular:** Açlık plazma glikozunun (FPG) gruplar arası karşılaştırmaları, probiyotik takviye tüketiminin FPG'de bir artışı önlediğini ortaya koymuştur (+28.8 ± 8.5 plasebo için vs. +1.6 ± 6 mg/dl probiyotik grup, p = 0.01). Hem probiyotik grupta hem de plasebo grubunda serum insülin ve düşük yoğunluklu lipoprotein kolesterol düzeylerinde grup içi önemli bir artış bulunmasına rağmen, değişiklikler iki grup arasında benzer tespit edilmiştir. Hem plasebo grubu (p=0.001) hem probiyotik grubunda (p=0.02) HOMA-IR lerinde anlamlı bir artış gözlemlenmiştir, ancak bu artış plasebo grubunda probiyotik kontrol grubuna göre anlamlı olarak daha yüksek tespit edilmiştir (+2.38 vs. +0.78, p = 0.03). Serum hs-CRP'deki ortalama değişiklik her iki grup arasında anlamlı olarak farklı ölçülmüştür (-777.57 probiyotik grup vs. +878.72 ng/ml plasebo grup, p = 0.02). Probiyotik takviyesi, plaseboya kıyasla plazma GSH seviyelerinde önemli bir artışa yol açmıştır plasebo (240.63 vs. -33.46 µmol/l, p = 0.03). **Sonuç:** Sonuçta diyabetik hastalara 8 hafta süre boyunca yapılan çoklu suşlu probiyotik takviyesinin hastaların açlık kan şekerlerinin yükselmesini önlediği, serum hs-CRP seviyesinin azalmasına yol açtığı ve total plazma glutatyon seviyesini artırdığı gösterilmiştir.