*British Journal of Nutrition* (2015), **114**, 706–712
doi:10.1017/S0007114515002469


# Supplementary heat-killed *Lactobacillus reuteri* GMNL-263 ameliorates hyperlipidaemic and cardiac apoptosis in high-fat diet-fed hamsters to maintain cardiovascular function

Wei-Jen Ting[1], Wei-Wen Kuo[2], Chia-Hua Kuo[3], Yu-Lan Yeh[4,5], Chia-Yao Shen[6], Ya-Hui Chen[7], Tsung-Jung Ho[8], Vijaya Padma Viswanadha[9], Yi-Hsing Chen[7]† and Chih-Yang Huang[1,10,11,*†]

[1]*Graduate Institute of Basic Medical Science, China Medical University, Taichung-40402, Taiwan, ROC*
[2]*Department of Biological Science and Technology, China Medical University, Taichung-40402, Taiwan, ROC*
[3]*Laboratory of Exercise Biochemistry, Department of Sports Sciences, University of Taipei, Taipei-11153, Taiwan, ROC*
[4]*Department of Pathology, Changhua Christian Hospital, Changhua-50002, Taiwan, ROC*
[5]*Jen-Teh Junior College of Medicine, Nursing and Management, Miaoli-35664, Taiwan, ROC*
[6]*Department of Nursing, Mei Ho University, Pingtung-91202, Taiwan, ROC*
[7]*Research and Development Department, GenMont Biotech Incorporation, Tainan-74144, Taiwan, ROC*
[8]*Chinese Medicine Department, China Medical University Beigang Hospital, Beigang-65152, Taiwan*
[9]*Department of Biotechnology, Bharathiar University, Coimbatore-461046, India*
[10]*Graduate Institute of Chinese Medical Science, China Medical University,Taichung-40402, Taiwan, ROC*
[11]*Department of Health and Nutrition Biotechnology, Asia University, Taichung-41354, Taiwan, ROC*

*(Submitted 30 March 2015 – Final revision received 28 May 2015 – Accepted 4 June 2015 – First published online 3 August 2015)*

Obesity and hyperlipidaemia increase the risk of CVD. Some strains of probiotics have been suggested to have potential applications in cardiovascular health by lowering serum LDL-cholesterol. In this work, high-fat diet-induced hyperlipidaemia in hamsters was treated with different doses ($5\times10^8$ and $2{\cdot}5\times10^9$ cells/kg per d) of heat-killed *Lactobacillus reuteri* GMNL-263 (Lr263) by oral gavage for 8 weeks. The serum lipid profile analysis showed that LDL-cholesterol and plasma malondialdehyde (P-MDA) were reduced in the GMNL-263 $5\times10^8$ cells/kg per d treatment group. Total cholesterol and P-MDA were reduced in the GMNL-263 $2{\cdot}5\times10^9$ cells/kg per d treatment group. In terms of heart function, the GMNL-263 $2{\cdot}5\times10^9$ cells/kg per d treatments improved the ejection fraction from 85·71 to 91·81 % and fractional shortening from 46·93 to 57·92 % in the high-fat diet-fed hamster hearts. Moreover, the GMNL-263-treated, high-fat diet-fed hamster hearts exhibited reduced Fas-induced myocardial apoptosis and a reactivated IGF1R/PI3K/Akt cell survival pathway. Interestingly, the GMNL-263 treatments also enhanced the heat-shock protein 27 expression in a dose-dependent manner, but the mechanism for this increase remains unclear. In conclusion, supplementary heat-killed *L. reuteri* GMNL-263 can slightly reduce serum cholesterol. The anti-hyperlipidaemia effects of GMNL-263 may reactivate the IGF1R/PI3K/Akt cell survival pathway and reduce Fas-induced myocardial apoptosis in high-fat diet-fed hamster hearts.

Key words: **Hyperlipidaemia: LDL-cholesterol: *Lactobacillus reuteri* GMNL-263 (Lr263): Heart protection**

It was recently proven that cumulative exposure to hyperlipidaemia during early adulthood increases the risk of CVD in a dose-dependent manner[1]. In fact, prolonged exposure to decreased LDL-cholesterol beginning in early life significantly reduces the risk of CVD[2].

Recently, some strains of probiotics, such as multi-strain probiotic capsules (*Streptococcus thermophilus*, *Lactobacillus plantarum*, *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, *Bifidobacterium lactis*, *Bifidobacterium longum* and *Bifidobacterium breve*), were reported to significantly reduce serum cholesterol, waist circumference and body weight in adults with a BMI > 25 kg/m$^2$ during an 8-week treatment[3,4]. In addition, *Lactobacillus reuteri* NCIMB 30242, a probiotic associated with cardiovascular health, claims to clinically lower LDL-cholesterol levels by 11·6 % in hyperlipidaemic adults, and it has been approved by Health Canada[5,6].

**Abbreviations:** %FS, fractional shortening; EF, ejection fraction; HSP27, heat-shock protein 27; P-MDA, plasma malondialdehyde.

***Corresponding author:** C.-Y. Huang, fax +886-4-22032295, email cyhuang@mail.cmu.edu.tw
†These authors contributed equally to this paper.

British Journal of Nutrition