MICROBIOME PLUS+™
ADVANCED OBESITY

Proviva Pharma
The healthy living company.

A MORE COMPLETE METABOLIC HEALTH SUPPLEMENT

Unique Probiotic Formulation

Herbal Fat-Burning Supplement

Consider the Role of MICROBIOME PLUS+ in your daily health regime today!

- Holistic approach to promote metabolic health
- Unique formulation of three scientifically-proven probiotics that reduce inflammation and oxidative stress
- Works in combination with *Triphala* and *Guggulu* to accelerate assimilation of fat and cholesterol

WWW.PROVIVAPHARMA.COM • 1-514-661-0987

MICROBIOME PLUS+™
ADVANCED OBESITY

Proviva Pharma
The healthy living company.

A MORE COMPLETE METABOLIC HEALTH SUPPLEMENT

Unique Probiotic Formulation

Herbal Fat-Burning Supplement

WHAT IS MICROBIOME PLUS+?

Microbiome Plus+™ is an innovative new line of products that provide more complete dietary support for gastrointestinal and whole body health. All Microbiome Plus+ products and their components have been verified by doctors and optimized to treat specific physiological ailments.

Microbiome Plus+ supplements use professional grade and quality ingredients:

- Full recommended daily dose
- Sourced from nature and allergen free
- Bioavailable formats
- From renewable and sustainable sources
- Developed by doctors

WHAT IS MICROBIOME PLUS+ OBESITY?

Microbiome Plus+ Obesity is a more complete metabolic health dietary supplement that naturally heals the gut microbiota to support a lean phenotype while actively increasing the internal assimilation of fat and elimination of cholesterol.

Probiotic Formulation:

- *L. fermentum* PV6910
- *L. plantarum* PV2398
- *B. infantis* PV8712
- *B. bifidum* PV7761

Supplement:

- Triphala Guggulu

WHY RECOMMEND MICROBIOME PLUS OBESITY?

Gastrointestinal health is critical for maintaining whole-body wellbeing. Imbalances in the gut microbiota living synergistically in the human gastrointestinal tract have been linked to many age-related chronic diseases including diarrhea, constipation, diabetes, obesity, metabolic syndrome, mood disorders, inflammation, allergies, irritable bowel syndrome, colon cancer, neurodegeneration and many more.

Many studies have shown that reinstating gastrointestinal homeostasis with dietary modifications, including probiotic and prebiotics, can prevent, reduce and/or alleviate symptoms of obesity by increasing the efficiency of fat assimilation and natural elimination of cholesterol. This is vital for whole-body health and longevity as obesity is linked to a host of diseases including cancer, neurodegeneration, diabetes and cardiovascular disease.

MICROBIOME PLUS OBESITY, combines gut-healing actions of probiotics with an active assimilator of fat and cholesterol derived from the ancient medicine of India: Ayurveda. The gut microbiota has been shown to be intimately linked with obesity and it is essential to regulate gastrointestinal health to control fat and nutrient assimilation from foods. Further, to aid those already suffering from the disease, Triphala Guggulu is added to enhance the breakdown of toxins, fats and to cleanse the liver and blood.

MICROBIOME PLUS+™
ADVANCED OBESITY

Proviva Pharma
The healthy living company.

THE SCIENCE

Microbiome Plus+™ is an innovative new line of products that provide a more complete dietary support for gastrointestinal and whole body health. All Microbiome Plus+ products and their components have been verified by doctors and optimized to treat specific physiological ailments.

Microbiome Plus+ supplements use professional grade and quality ingredients:

- Full recommended daily dose
- Sourced from nature and allergen free
- Bioavailable formats
- From renewable and sustainable sources
- Developed by doctors
- Produced and conceived in Canada

THE FACTS

- Characterization of such a complex poly-herbal formulation is difficult though one group successfully characterized the potency of Triphala-guggulu using gallic acid for triphala, piperine for *P. longum* and guggulsterones for guggulu: the main active ingredients in each of the main constituents of Triphala Guggulu (Muguli et al., 2015)
- In a clinical study, Triphala Guggulu was found to reduce several physiological and mental disturbances in patients suffering from hyperlipidemia including enhanced weight loss, reduced body fat percentage, reduced, laziness, lack of enthusiasm, joint pain, fatigue with some effects on abdominal fat levels. Further, there was a significant reduction in circulating cholesterol, apolipoprotein and circulating triglycerides (Swapnil et al., 2013)

TRIPHALA GUGGULU

Triphala Guggulu has been used for 3000 years in India to combat obesity, high cholesterol and metabolic distress. Triphala is a herbal amalgamation of three fruits: *amalaki*, *haritaki* and *bibhitaki* and is commonly used alone as a regulator of gastrointestinal ailments including diarrhea/constipation, bloating, heaviness and indigestion. Guggulu is a purified extract of the bark of the medicinal plant *Commiphora wightii*. Together, Triphala and Guggulu complement and synergistically increase the effects of both potent formulations. Benefits of this potent herbal concoction include, but are not limited to:

- Remove toxins from the body
- Support weight management
- Maintains healthy cholesterol levels
- Maintains digestion and absorption

TRIPHALA

Gastrointestinal Health

- Anti-diarrheal effects in castor-oil induced distress (Birada et al., 2007)
- Twice daily doses of 2.5 g of Triphala for 1 month in patients improved significantly the amount, frequency and consistency of stools while reducing flatulence (Mukherjee et al., 2006)
- Anti-bacterial effects against *E. faecalis* (Shakouie er al., 2014), E.coli and S. aureus (Biradar et al., 2008)

Metabolic Effects

- Reduce cholesterol-induced atherosclerosis in rabbits (Thakur et al., 1988)
- In high-fat diet induced obesity mice, Triphala reduced body weight, improved lipid profiles, lowered total serum cholesterol, increased oral glucose tolerance and reversed pathological changed in liver tissue (Gurjar et al., 2012)
- Triphala reduced serum glucose in both normal and alloxan-induced diabetic rats (Sabu et al., 2002)

TRIPHALA Continued

Immune Boosting Effects

- Healthy immune system (Naik et al., 2005)
- Triphala reduced arthritic scores in Freund's adjuvant-induced arthritis in rats including oxidant and inflammatory marks (Kalaiselvan et al., 2015)
- Amla has one of the highest concentrations of vitamin C contributing to its immune potentiating activities (Scartezzini et al., 2006)
- In a Phase I clinical trial, Triphala tablets (3X daily) was immunostimulatory (Phetkate et al., 2012)
- In an acetominophen-induced toxicity model in mice, Triphala reduced proinflammatory cytokines and lipid peroxidases, restored levels of free glutathione and antioxidant enzymes (SOD, CAT, GPx, GPx, GST) and decreased the level of hepatic damage as observed though lowr levels of alkaline phosphatase, alanine aminotransferase and aspartate aminotransferase and histopathological observations (Rasol et al., 2007)

Anti-cancer effects

- Reduced proliferation and induces apoptosis in human colorectal cancer stem cells via suppressing c-Myc/Cyclin D1 and Elevation of Bax/Bcl-2 ratio (Vadde et al., 2015)
- Pre-clinical studie shave shown Triphala to possess antineoplastic effects on MCF-7 and human breast cancer cells (Kaur et al., 2005; Sandhya et al., 2006; Sandhya et al., 2006), prostate cancer cells (Shi et al., 2008), and many more
- Mechanistically, Triphala induced apoptsis and increased intracellular ROS through the p53 pathway (Sandhya et al., 2006, Shi et al., 2008)

Anti-oxidant Effects

- Several studies indicate that Triphala scavenges free radicals in several biological and non biological contexts (Jagetia et al., 2004; Vani et al., 1997)
- Triphala oral administration normalized bromobenzene-induced oxidation, reduction in anti-oxidant proteins (SOD, GPx, CAR, etc.) and increase in lipid peroxidation (Baskaran et al., 2015)

GUGGULU

Based on the ancient texts of India, Guggulu has been used for obesity, osteoarthritis, rheumatoid arthritis, gout, facial paralysis, sciatica, constipation, haemorrhoids, liver disorders, inflammation, cyst, cervical lymphadenitis, coronary thrombosis, anaemia, diabetes, urinary calculus, increased frequency and turbidity of urine, and skin diseases (Dev et al., 1987, Anurekha et al., 2006)

Constituents

- The prevalence of Guggulu has stimulted several investigations to the active constituents of Guggulu. Guggulu contains many phytochemicals including mono-terpenoids, sesquiterpenoids, diterpenoids, triterpenoids, steroids (esp. guggulsterols), flavonoids, guggultetrols, lignans and amino acids (Sarup et al., 2015)

Hypolipidemic activity

- In 1966, one study meticulously demonstrated that guggulu protected rabbits fed a high cholesterol diet (hydrogenated vegetable oil) from high serum cholesterol levels, body weight gain and cholesterol-induced atherosclerosis (Satyavati et al., 1988)

GUGGULU *continued*

Hyperlipdedmia Con't

- An acetate extract of Guggulu rears a solution rich in Z-guggulsterones and E-guggul-sterones, which are purported to be the compounds responsible for the hypolipidemic activity of guggulu (Morais et al., 2007)
- There have been many clinical studies outling the effectiveness of both Z-guggulsterones and E-guggulsterones on hypolipidemic activity in individuals (Nityanand et al., 1989; Verma & Bordia, 1988)
- In animal studies, guggulu fed in associated with a high-fat diet led to significant reductions in serum cholesterol and triglyceride levels and that guggulu partially reversed the atherosclerosis in the aorta that was induced by the high-fat diet (Baldwa 1981)
- The mechanism of Guggulu's action can be partially attributed to the decrease in hepatic steroid release which ultimately increases the catabolism of plasma LDL cholesterol. Also, the guggulsterones E and Z may increase hepatic binding sites for LDL cholesterol thus increasing hepatic binding sites for LDL cholesterol and consequent clearance. Finally, the guggulsterones are highly effcacious antagonists of the farnesoid X receptor, a nuclear receptor that is activated by bile acids thus allowing increased cholesterol catabolism and excretion from the body (Wu et al., 2002; Urizar et al., 2002)

Anti-inflammatory Activity

- There have been many studies indicating the anti-inflammatory activity of Guggulu (Chaudary, 2012; Khanna et al., 2007; Karan et al., 2012)
- There have been several indications for the efficacy of Guggulu in standard osteoarthris models in both animal and clinical trials (Singh et al., 2003)

Thyroid Stimulatory Activity

- Administration of guggulu to the female mice enhanced the triiodothyonine (T3) concentration and T3/T4 ratio (Panda & Kar 1999).
- *Z*-Guggulsterone was shown to be responsible for the thyroid stimulatory action of guggulu increasing all thyroid function parameters, namely, uptake of iodine by the thyroid, enzymes involved in the synthesis of thyroid hormones, and tissue oxygen uptake, thus suggesting thyroid stimulatory action (Tripathi et al., 1984).

Antioxidant Activity

- The antioxidant activity helped prevent the oxidation of cholesterol and subsequent hardening of the arteries, reduced the stickiness of platelets and lowered the risk of coronary artery disease (Mester et al., 1979)
- Guggulu also enhanced the production of thyroxin and triiodothronine – hormones that increase the metabolism of carbohydrates and protein synthesis and help in lowering the lipid activity (Panda et al., 1999)
- Guggulsterone can prevent the lipid peroxdiation of LDL cholesterol, possibly through its metal chelating capacity (Chander et al., 2002)

MICROBIOME PLUS+™
ADVANCED OBESITY

Proviva Pharma
The healthy living company.

PROBIOTIC FORMULATION

Probiotic	CFU/capsule
L. fermentum PV6910	1.0 x 10^9
L. plantarum PV2398	1.0 x 10^9
B. Infantis PV8312	1.0 x 10^9
B. bifidum PV7761	1.0 x 10^9

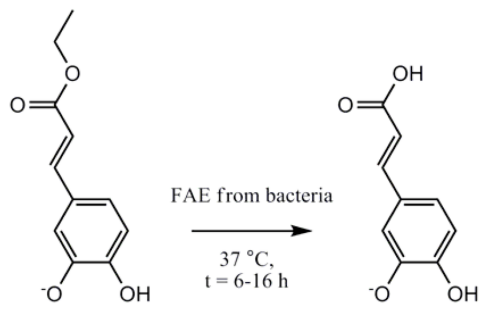
Probiotics are defined by the The Food and Agriculture Organization (FAO) of the United Nations and the WHO as "live microorganisms which, when administered in adequate amounts, confer a health benefit on the host". The administration of probiotics not only promote the growth of the administered bacterial species, but also creates a gastrointestinal microenvironment permissive to the growth of other beneficial bacterial species and non-favourable to the growth of pathogenic species. In the present formulation, the use of several species of aerobic *Lactobacillus* and anaerobic *Bifidobacteria* allows rapid development of a universally homeostatic system with complementary biological effects as outlined below.

L. fermentum PV6910

L. fermentum PV6910 is a human-derived aerobic bacterium with several active properties. Like other *Lactobacillus* species, *L. fermentum* has a good pH and bile-acid tolerance making it a practical probiotic species. Various species of *L. fermentum* have been shown to have immune-modulating, anti-aging, anti-oxidant and metabolic effects, though the specific characteristics of *L. fermentum* PV6910 will be outline below:

General Characteristics

- *L. fermentum* PV6910 has a potent intrinsic ferulic acid esterase (FAE) activity, producing large quantities of the phytochemical ferulic acid (Tomaro-Duchesneau et al., 2012)
- Traditionally, plants and herbs containing high levels of FA have been used in Chinese medicine for its potent inhibition of ROS generation and anti-inflammatory properties.
- In modern medicine, FA is recognized as a potent ROS scavenger with therapeutic potential in various chronic diseases including neurodegeneration, cancer, accelerated cell aging, obesity and diabetes (Hu et al., 2011)
- Potent antioxidant activity can be explained by its phenolic nucleus and unsaturated side chain which allow for the formation of a resonance-stabilized phenoxy radical since the unpaired electron may be present on the oxygen but also delocalized across the FA molecule (Srinivasan et al., 2007)
- Ferulic acid regulates oxidative stress through the regulation of peroxiredoxins and thioredoxins, key elements that provide neuro-protection and are correlated with aging (Patenaude et al., 2005)



Ethyl ferulate — Ferulic acid

- Ferulic acid also inhibits apoptosis through the upregulation of CRMP2 via the Akt/GSK3beta pathway (Gim et al., 2013)
- FA has been shown to regulate blood glucose levels by modulating insulin secretion, by promoting pancreatic beta-cell survival, and by reducing inflammatory markers linked to antioxidant activity (Adisakwattana et al., 2008)
- *L. fermentum* PV6910 has significant *in vitro* and *in vivo* cholesterol assimilation activity possible through affecting epithelial-cell surface hydrophobicity and cellular cholesterol uptake mechanisms (Tomaro-Duchesneau et al., 2014)
- In an *in vivo* study using a rat model of metabolic syndrome (ZDF rats), *L. fermentum* PV6910 reduced fasting insulin levels and insulin resistance, serum triglyceride levels, serum low-density lipoprotein cholesterol levels and the atherogenic and atherosclerosis indices (Tomaro-Duchesneau et al., 2014)

L. plantarum PV2398

L. plantarum species occupies a broad range of phenotypic properties due to its diverse range of environmental niches (Siezen et al., 2011). It is a facultative heterofermentative organism whose variety of species are able to ferment a diverse range of carbohydrates. In general, *L. plantarum* has a high acid tolerance making it an important component to food and health industries (Luxananil et al., 2008). As a probiotic, *L. plantarum* is superior at adapting to the host's colonic environment's metabolic capacity by expressing exopolysaccharide and proteinaceous cell-surface compounds (Marco et al., 2010). Of all the *L. plantarum* species, *L. plantarum* PV2398 is one of the most versatile and dynamic species with several prominent biological effects as detailed below:

Pharmacokinetics

- *L. plantarum* PV2398 has favourable pharmacokinetics in the body with a high survivability upto the ileum and through to the fecal matter (Vea et al., 2000)
- How? *L. plantarum* PV2398 has increased proton transport by F_0F_1-ATPase to retain proper intracellular pH and increased expression of the chaperone genes *dnaK, groEL, clpB and clpE, hsp1, hsp2, hsp3*
- Keen digester of a variety of plant-derived phenolics due to its intrinsic tannase, *p*-coumaric acid decarboxylase and benzyl alcohol dehydrogenase (Rodriguez et al., 2009)
- *L. plantarum* PV2398 has 4 bile-salt hydrolases to improves its integrity and anti-oxidant production in the colon compartments (van der Nieuboer er al., 2016)
- *L. plantarum* PV2398 also has some ferulic acid esterase activity for the liberation of methyl ferulate from plant lignins (Jimenez et al., 2013)
- *L. plantarum* PV2398 has a developed secretome, meaning it secretes several proteins mediating functional processes including bacteriocins (Bodaszewska-Lubas 2012), pSIP, mucus adhesion factors, mannose-specific adhesion molecules (Minic et al., 2015)

- Through the secretion of autoinducing peptides, there is are keen quorum-sensing and cross-feeding effects to promote a healthy gut environment (Sturme et al., 2005)
- *L. plantarum* PV2398 also secretes plantaricin A which triggers transcription of immune proteins (Rojo-Bezares et al., 2008) and has antimicrobial activity (Diep et al., 2009).
- In particular, *L. plantarum* PV2398's alanine-rich lipoteichoic acid moieties proves to be potently anti-inflammatory (Grangette er al., 2005)
- Indeed, it promotes secretion of anti-inflammatory cytokines by PBMCs and increases the number of regulatory dendritic cells and regulatory T cells in the spleen (Dong et al., 2012)
- *L. plantarum* PV2398 shown to increase the secretion of T cells, proportion of CD69+ on lymphocytes, NK cells and increased the production of IL-1, IL-6, IL-10 and TNFalpha and MIP1alpha (Dong et al., 2012)
- Secretion of bacteriocins inhibit the growth of pathogenic species including *Streptococcus* spp.
- *L. plantarum* PV2398 has enhanced efficiency for dealing with oxidative stress, especially in the production of the anti-oxidant thioredoxin (Serrano et al., 2007)
- Through its predicted 223 extracellular proteins, *L. plantarum* PV2398 can enhance intestinal cell wall integrity through TLR-2 activation and tight junction formation (Karczewski er al., 2010)
- Finally, in a human trials, after only 6h of exposure to *L. plantarum* PV2398, there was an upregulation of lipid and fatty-acid metabolic genes in addition to anti-oxidant molecules (Troost et al., 2008)

B. longum spp. infantis PV5553

Bifidobacteria spp. are a class of anaerobic bacteria… *B. longum spp. Infantis* PV5553 is an anaerobic bacteria derived from the infant's intestine that is prominently present in early life though levels are quickly lost in adolescence. *B. Infantis* thrives on human milk oligosacchrides and is highly beneficial at fighting off infections and invasion of pathogenic species in the gut. *B. infantis* significantly breaks down lactic acid thus modulating the pH of the intestines and controlling the growth of pathogenic species.

Gastrointestinal considerations

- *B. infantis* strains are experts at digesting long-chained complex carbohydrates and promoting cross-feeding growth of other health-promoting species in the gut.
- *B. infantis* sequenced to date contain a 43-kb gene cluster (HMO cluster I) that encodes a variety of oligosaccharide transport proteins and glycosyl hydrolases; this gene cluster is not found in other bifidobacterial species[53]
- *B. infantis* produces an endo-β-*N*-acetylglucosaminidase that is able to cleave the *N*-glycans associated with human glycoproteins like lactoferrin, IgA, and IgG[54]
- B. infantis strains have been shown to lower symptoms of irritable bowel syndrome in women, specifically the inflammatory and indigestion discomfort[55]

Immunity considerations

- *B. infantis* species have potent effects on the immune system.
- *B. infantis* produce exogenous substances that promote maturation of the immature innate immune response which attenuating IL-8 and IL-6 response to inflammatory stimuli, which explains the mechanism where *B. infantis* protects infants against necrotizing enterocolitis, an intestinal inflammatory disease[56]
- In normal BALB/c mice, a high dosage of *B. infantis* increased the number of T regulatory and Th17 cells and increased cytokine transcription in immunoregulatory cells. Further, such pretreatment for 3 weeks before the induction of colitis decreased inflammatory cell infiltration and restored the intestinal epithelium[57]
- *B. infantis* also decreases intestinal permeability increased stabilization of the tight junction proteins claudin 4 and occludin, and decreased the incidence of NEC[58]
- Finally, in F344 rats after 38 days of treatment, *B. infantis* has a significant decrease in Enterobacteriaceae compared to controls and reduced fecal and serum endotoxin levels[59]

B. bifidum PV7761

B. bifidum PV7761 is an anaerobic species derived from infant feces. In general, *B. bifidum* species are commonly used in yogurts and probiotic supplements due to their known effectiveness for supporting digestive health and the immune response. *B. bifidum* actually attached to the epithelial lining of the intestine and increases the integrity of the intestinal barrier thus prevents the infiltration of toxins, germs and unhealthy bacteria.

Immunity considerations

- The adherence of *B. bifidum* PV7761 to the intestinal cell wall was shown to be influences by the consumption of oligosacchrides (Altamimi et al., 2016)

Gastrointestinal considerations

- *B. bifidum* PV7761 significantly improved the gastrointestinal microflora ecosystem in BALC/c mice by increasing the amount of probiotics (*Lactobacillus intestinalis* and *Lactobacillus crispatus*) and by reducing unwanted bacterial populations (*Enterobacter, Escherichia coli*) (Wang et al., 2016)

Anti-oxidant considerations

- In BALB/c mice, *B. bifidum* PV7761 enhanced the rodent's free radical scavenging activity and microflora reducing power indicating beneficial effects and the anti-oxidant capacity (Medina et al., 2007)

References

Adisakwattana S, Moonsan P, Yibchok-Anun S. Insulin-releasing properties of a series of cinnamic acid derivatives in vitro and in vivo. J. Agric. Food Chem. 2008;56:7838–44.

Altamimi M, Abdelhay O, Rastall RA. Effect of oligosaccharides on the adhesion of gut bacteria to human HT-29 cells. Anaerobe. 2016;39:136–42.

B. B. Singh, L. C. Mishra, S. P. Vinjamury, N. Aquilina, V. J. Singh, and N. Shepard, "The effectiveness of Commiphora mukul for osteoarthritis of the knee: an outcomes study," Alternative Therapies in Health and Medicine, vol. 9, no. 3, pp. 74–79, 2003

Bodaszewska-Lubas M, Brzychczy-Wloch M, Gosiewski T, Heczko PB. Antibacterial activity of selected standard strains of lactic acid bacteria producing bacteriocins--pilot study. Postepy Hig Med Dosw (Online). 2012;66:787–94.

D. Khanna, G. Sethi, K. S. Ahn et al., "Natural products as a gold mine for arthritis treatment," Current Opinion in Pharmacology, vol. 7, no. 3, pp. 344–351, 2007.

Diep DB, Straume D, Kjos M, Torres C, Nes IF. An overview of the mosaic bacteriocin pln loci from Lactobacillus plantarum. Peptides. 2009;30:1562–74.

Dong H, Rowland I, Yaqoob P. Comparative effects of six probiotic strains on immune function in vitro. Br J Nutr. 2012;108:459–70.

G. Chaudhary, "Pharmacological properties of Commiphora wightii Arn. Bhandari—an overview," International Journal of Pharmacy and Pharmaceutical Sciences, vol. 4, no. 3, pp. 73–75, 2012

G. V. Satyavati, "Gum guggul (Commiphora mukul)—the success story of an ancient insight leading to a modern discovery," Indian Journal of Medical Research, vol. 87, no. 4, pp. 327–335, 1988

Gim S-A, Sung J-H, Shah F-A, Kim M-O, Koh P-O. Ferulic acid regulates the AKT/GSK-3β/CRMP-2 signaling pathway in a middle cerebral artery occlusion animal model. Lab Anim Res. 2013;29:63.

Grangette C, Nutten S, Palumbo E, Morath S, Hermann C, Dewulf J, et al. Enhanced antiinflammatory capacity of a Lactobacillus plantarum mutant synthesizing modified teichoic acids. Proc. Natl. Acad. Sci. U.S.A. 2005;102:10321–6.

Hu C-T, Wu J-R, Cheng C-C, Wang S, Wang H-T, Lee M-C, et al. Reactive oxygen species-mediated PKC and integrin signaling promotes tumor progression of human hepatoma HepG2. Clin Exp Metastasis. 2011;28:851–63.

J. Anurekha and V. B. Gupta, "Chemistry and pharmacological profile of guggulu—a review," Indian Journal of Traditional Knowledge, vol. 5, pp. 478–483, 2006.

J. Wu, C. Xia, J. Meier, S. Li, X. Hu, and D. S. Lala, "The hypolipidemic natural product guggulsterone acts as an antagonist of the bile acid receptor," Molecular Endocrinology, vol. 16, no. 7, pp. 1590–1597, 2002.

Jimenez N, Curiel JA, Reveron I, las Rivas De B, Munoz R. Uncovering the Lactobacillus plantarum WCFS1 gallate decarboxylase involved in tannin degradation. Applied and Environmental Microbiology. 2013;79:4253–63.

Karczewski J, Troost FJ, Konings I, Dekker J, Kleerebezem M, Brummer R-JM, et al. Regulation of human epithelial tight junction proteins by Lactobacillus plantarum in vivo and protective effects on the epithelial barrier. AJP: Gastrointestinal and Liver Physiology. 2010;298:G851–9.

L. Mester, M. Mester, and S. Nityanand, "Inhibition of platelet aggregation by 'guggulu' steroids," Planta Medica, vol. 37, no. 4, pp. 367–369, 1979.

Luxananil P, Promchai R, Wanasen S, Kamdee S, Thepkasikul P, Plengvidhya V, et al. Monitoring Lactobacillus plantarum BCC 9546 starter culture during fermentation of Nham, a traditional Thai pork sausage. Int J Food Microbiol. 2009;129:312–5.

M. Karan, P. Sarup, V. Suneja, and K. Vasisht, "Effect of traditional ayurvedic purification processes (sodhanvidhi) of guggulu on carrageenan-induced paw oedema in rats," Journal of Pharmaceutical and Biomedical Sciences, vol. 21, no. 5, pp. 1–5, 2012.

Marco ML, de Vries MC, Wels M, Molenaar D, Mangell P, Ahrne S, et al. Convergence in probiotic Lactobacillus gut-adaptive responses in humans and mice. ISME J. 2010;4:1481–4.

Medina M, Izquierdo E, Ennahar S, Sanz Y. Differential immunomodulatory properties of Bifidobacterium logum strains: relevance to probiotic selection and clinical applications. Clin Exp Immunol. 2007;150:531–8.

Minic R, Gavrovic-Jankulovic M, Petrusic V, Zivkovic I, Eijsink VGH, Dimitrijevic L, et al. Effects of orally applied Fes p1-displaying L. plantarum WCFS1 on Fes p1 induced allergy in mice. J Biotechnol. 2015;199:23–8.

Muguli G, Vadaparthi PRR, Ramesh B, Gowda V, Paramesh R, Jadhav AN, et al. A novel high-performance liquid chromatography-electron spray ionization-mass spectrometry method for simultaneous determination of guggulsterones, piperine and gallic acid in Triphala guggulu. Pharmacogn Mag. 2015;11:S66–72.

N. L. Urizar, A. B. Liverman, D. T. Dodds et al., "A natural product that lowers cholesterol as an antagonist ligand for FXR," Science, vol. 296, no. 5573, pp. 1703–1706, 2002.

References

Patenaude A, Murthy MRV, Mirault M-E. Emerging roles of thioredoxin cycle enzymes in the central nervous system. Cell. Mol. Life Sci. 2005;62:1063–80.

R. Chander, A. K. Khanna, and R. Pratap, "Antioxidant activity of guggulsterone, the active principle of guggulipid from Commiphora mukul," Journal of Medicinal and Aromatic Plant Sciences, vol. 24, pp. 371–375, 2002

Rodriguez H, Curiel JA, Landete JM, las Rivas De B, Lopez de Felipe F, Gomez-Cordoves C, et al. Food phenolics and lactic acid bacteria. Int J Food Microbiol. 2009;132:79–90.

Rojo-Bezares B, Saenz Y, Navarro L, Jimenez-Diaz R, Zarazaga M, Ruiz-Larrea F, et al. Characterization of a new organization of the plantaricin locus in the inducible bacteriocin-producing Lactobacillus plantarum J23 of grape must origin. Arch Microbiol. 2008;189:491–9.

S. Dev, "A modern look at an age old ayurvedic drug guggulu," Science Age, vol. 5, pp. 13–18, 1987.

S. K. Verma and A. Bordia, "Effect of Commiphora mukul (gum guggulu) in patients of hyperlipidemia with special reference to HDL-cholesterol," Indian Journal of Medical Research, vol. 87, no. 4, pp. 356–360, 1988.

S. M. de Morais, V. A. Facundo, L. M. Bertini et al., "Chemical composition and larvicidal activity of essential oils from piper species," Biochemical Systematics and Ecology, vol. 35, no. 10, pp. 670–675, 2007.

S. Nityanand, J. S. Srivastava, and O. P. Asthana, "Clinical trials with gugulipid—a new hypolipidaemic agent," The Journal of the Association of Physicians of India, vol. 37, no. 5, pp. 323–328, 1989.

S. Panda and A. Kar, "Gugulu (Commiphora mukul) induces triiodothyronine production: possible involvement of lipid peroxidation," Life Sciences, vol. 65, no. 12, pp. 137–141, 1999

Sarup P, Bala S, Kamboj S. Pharmacology and Phytochemistry of Oleo-Gum Resin of Commiphora wightii (Guggulu). Scientifica (Cairo). 2015;2015:138039.

Serrano LM, Molenaar D, Wels M, Teusink B, Bron PA, de Vos WM, et al. Thioredoxin reductase is a key factor in the oxidative stress response of Lactobacillus plantarum WCFS1. Microb Cell Fact. 2007;6:29.

Siezen RJ, van Hylckama Vlieg JET. Genomic diversity and versatility of Lactobacillus plantarum, a natural metabolic engineer. Microb Cell Fact. 2011;10 Suppl 1:S3.

Srinivasan M, Sudheer AR, Menon VP. Ferulic Acid: therapeutic potential through its antioxidant property. J Clin Biochem Nutr. 2007;40:92–100.

Sturme MHJ, Nakayama J, Molenaar D, Murakami Y, Kunugi R, Fujii T, et al. An agr-like two-component regulatory system in Lactobacillus plantarum is involved in production of a novel cyclic peptide and regulation of adherence. Journal of Bacteriology. 2005;187:5224–35.

Tomaro-Duchesneau C, Jones ML, Shah D, Jain P, Saha S, Prakash S. Cholesterol assimilation by Lactobacillus probiotic bacteria: an in vitro investigation. Biomed Res Int. 2014;2014:380316.

Tomaro-Duchesneau C, Saha S, Malhotra M, Coussa-Charley M, Kahouli I, Jones ML, et al. Probiotic Ferulic Acid Esterase Active Lactobacillus fermentum NCIMB 5221 APA Microcapsules for Oral Delivery: Preparation and in Vitro Characterization. Pharmaceuticals (Basel). 2012;5:236–48.

Tomaro-Duchesneau C, Saha S, Malhotra M, Jones ML, Labbe A, Rodes L, et al. Effect of orally administered L. fermentum NCIMB 5221 on markers of metabolic syndrome: an in vivo analysis using ZDF rats. Appl Microbiol Biotechnol. 2014;98:115–26.

Troost FJ, van Baarlen P, Lindsey P, Kodde A, de Vos WM, Kleerebezem M, et al. Identification of the transcriptional response of human intestinal mucosa to Lactobacillus plantarum WCFS1 in vivo. BMC Genomics. 2008;9:374.

V. Baldwa, V. Bhasin, P. Ranka, and K. Mathur, "Effects of Commiphora mukul (guggulu) in experimentally induced hyperlipemia and atherosclerosis,"The Journal of the Association of Physicians of India, vol. 29, no. 1, pp. 13–17, 1981.

van den Nieuwboer M, van Hemert S, Claassen E, de Vos WM. Lactobacillus plantarum WCFS1 and its host interaction: a dozen years after the genome. Microb Biotechnol. 2016.

Vesa T, Pochart P, Marteau P. Pharmacokinetics of Lactobacillus plantarum NCIMB 8826, Lactobacillus fermentum KLD, and Lactococcus lactis MG 1363 in the human gastrointestinal tract. Aliment Pharmacol Ther. 2000;14:823–8.

Wang B-G, Xu H-B, Xu F, Zeng Z-L, Wei H. Efficacy of oral Bifidobacterium bifidum ATCC 29521 on microflora and antioxidant in mice. Can J Microbiol. 2016;62:249–62.

Y. B. Tripathi, O. P. Malhotra, and S. N. Tripathi, "Thyroid stimulating action of Z-guggulsterone obtained from Commiphora mukul," Planta Medica, vol. 50, no. 1, pp. 78–80, 1984.