Published Studies on the Efficacy of MSM (methylsulfonylmethane)

Skin Studies

Skin Studies-Human	Study Title	Study Summary
Anthonavage, M. et al. 2015 Natural Medicine Journal OptiMSM® Study using OptiMSM™	Effects of Oral Supplementation With Methylsulfonylmethane on Skin Health and Wrinkle Reduction	Two-part study. Part one was a pre-clinical evaluation of gene expression in a 3D skin model. Results supported the design of clinical portion. Part two was a double-blind placebo controlled design. 20 healthy females randomized to take 3g OptiMSM® per day or placebo for 16 weeks. Significant improvements in skin appearance and condition were found in the treatment group when evaluated by expert grading, instrumental analysis, and participant self-assessment.

Exercise Recovery Studies

Exercise Recovery Studies-Human	Study Title	Study Summary
Peel S. et al. 2015 Presented at American Society for Biomechanics Conference Aug, 2015 Published abstract and poster presentation OptiMSM® Study using OptiMSM™	The Effects of MSM Supplementation on Knee Kinetics during Running, Muscle Strength, and Muscle Soreness following Eccentric Exercise-Induced Quadriceps Damage	Double-blind, placebo controlled study. 40 healthy resistance-trained men; 3 g/day for 28 days before eccentric knee exercise. Testing occurred before exercise (Baseline) then at 0hr, 24hrs, 48hrs and 72 hrs post exercise. @ 72 hrs Maximum Isometric Force (MIF) normal in MSM group but still 8% below BL for Placebo. Absolute change in muscle soreness during passive knee flexion was smaller in MSM group. Some findings of this study suggest individuals may be able to return to regular training more quickly following knee extensor damage with OptiMSM® supplementation.
Withee. et al. 2015 Journal of the International Society of Sports Nutrition Published abstract and poster presentation OptiMSM® Study using OptiMSM™	Effects of MSM on exercise-induced muscle and joint pain: a pilot study	Double-blind, placebo controlled study design. 22 healthy adults randomly assigned to take either 3g of OptiMSM® per day or placebo for 21 days before running a half marathon. MSM attenuated post-exercise induced muscle and joint pain at clinically significant levels compared to placebo. Statistically significance was not reached possibly due to small sample size
Kalman D. et al. 2013 FASEB J, 2013, 27:1076.7 Published abstract and poster presentation OptiMSM® Study using OptiMSM™	A Randomized Double Blind Placebo Controlled Evaluation of MSM for Exercise Induced Discomfort/Pain	Double-blind, placebo controlled study. 24 healthy adult males randomly assigned to receive either treatment or placebo for 14 days. Intervention of 3 grams of OptiMSM® per day for the 14 day period resulted in significantly lower (1.55 + 0.82 vs. 3.75 + 2.58 p=0.012) pain/discomfort 2 hours following a leg extension exercise to muscle failure when compared to the placebo group.
Nakhostin-Roohi B. 2013 Iranian J of Pharma Research 2013, 12(4): 845-853	Effect of Single Dose Administration of Methylsulfonylmethane on Oxidative Stress Following Acute Exhaustive Exercise	16 subjects randomly assigned to receive either 100mg/kg BW (6g for a 60kg person) MSM in water or placebo (just water) were subjected to treadmill running until exhaustion. Protein Carbonyls were lower at 2, and 24 hrs post exercise. Plasma TAC was higher at 24 hrs after exercise. Serum levels of bilirubin and uric acid were significantly lower immediately after exercise in the MSM group. Results suggest a single oral dose of MSM lowers exercise induced oxidative stress in healthy untrained men, but is not adequate to significantly affect reduced glutathione levels.

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Barmaki, S. et al. 2012 J. Sports Med Phys Fitness 2012;52:170-4	Effect of MSM Supplementation on Exercise-induced Muscle Damage and Total Antioxidant Capacity	Double-blind, placebo controlled study. 18 subjects; treatment = 50mg/kg BW/day MSM for 10 days before a 14 km run. CK and Bilirubin was significantly reduced in MSM group vs. placebo. TAC significantly increased. MSM decreased muscle damage via antioxidant capacity.
Kalman D. et al. 2012 J. of Int. Society of Sports Nut. 2012, 9:46 OptiMSM® Study using OptiMSM™	Influence of MSM on Markers of Exercise Recovery and Performance and Total Antioxidant Capacity	8 subjects were randomly assigned either 1.5 or 3.0g of OptiMSM® per day for 30 days. Leg extension exercise to exhaustion. TEAC increased in a dose-dependant manner. Fatigue and homocysteine decreased in dose-dependant manner. MSM may favorably influence selected markers of exercise recovery, especially at 3g/day.
Nakhostin-Roohi et al.2011 Journal of Pharmacy and Pharmacology 2011, 63:1290-1294	Effect of Chronic Supplementation with MSM on Oxidative Stress Following Acute Exercise in Untrained Healthy Men	Double-blind, placebo controlled study. 18 subjects; treatment = 50mg/kg BW/day MSM for 10 days before a 14 km run. Serum MDA, PC, GSSG, GSH, and GSH/GSSG ratio were evaluated. MDA, PC, GSSG were significantly reduced in treatment group vs. placebo and GSH and ratio were increased. MSM decreased oxidative stress following acute exercise.

Exercise Studies-Animal	Study Title	Study Summary
Marañón et al. 2006 Acta Veterinaria Scandinavica 2008; 50:45 doi:10.1186/1751-0147-50-45	The Effect of MSM Supplementation on Biomarkers of Oxidative Stress in Sport Horses Following Jumping Exercise	24 jumping horses divided into 3 groups; control, MSM@ 8 mg/kg BW and combo of 8mg/kg MSM and Vit C 5mg/kg. Blood samples collected before and after exercise.NO, CO, Lipid Hydroperoxides, and Antioxidant enzymes, glutathione peroxidase,glutathione transferase and glutathione reductase measured. Exercise induced significant increase in lipid peroxidation, NO, and CO. Reduced glutathione, and antioxidant enzyme activity was decreased. MSM significantly ameliorated all of these exercise-related changes and the combo of MSM/Vit C potentiated this effect with some of the parameters close to pre-exercise levels.

Joint Support Studies

Joint Support Studies-Human	Study Title	Study Summary
Pagonis et al. 2014 Int Journal of Orthopaedics 2014 June 23 1(1): 19-24 ISSN2311-5106	The Effect of Methylsulfonylmethane on Osteoarthritic Large Joints and Mobility	Double-blind, placebo controlled study. 100 subjects took MSM 3g twice daily for 26 wks. Statistically significant improvement for MSM group in all WOMAC and SF-36 quality of life scores. No adverse effects reported.
Debbi et al. 2011 BMC Comp and Alt Med 2011, 11:50	Efficacy of Methylsulfonylmethane Supplementation on Osteoarthritis of the Knee: A Randomized Controlled Study	Double-blind, 49 subjects, 12 week treatment with 1.125 g of MSM 3X daily. Significant improvement seen in pain and physical function. WOMAC, VAS, KSKS, ALF scales utilized.
Kim et al. 2006 OsteoArthritis and Cartilage 2006, 14:286-294 OptiMSM® Study using OptiMSM™	Efficacy of MSM in Osteoarthritis Pain of the Knee: A Pilot Clinical Trial	Double-blind, placebo controlled study. 50 subjects MSM 3g twice daily for 12 wks. Significant reduction for MSM group in WOMAC pain, Urine MDA and Plasma Homocysteine. SF-36 scores indicated improvement in basic performing activities in the treatment group.

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Joint Support Studies-Human	Study Title	Study Summary
Usha and Naidu. 2004 Clin Drug Invest 2004, 24:6 353-363	Randomized, Double-Blind, Parallel, Placebo-Controlled Study of Oral Glucosamine, Methylsulfonylmethane and their Combination in Osteoarthritis	118 patients randomized to receive placebo, 500mg Glu+ 500mg of MSM or combo of 500 mg Glu+500mg MSM for 12 wks. Glu, MSM and their combination produced analgesic and anti-inflammatory effect. VAS, Lesquene index and consumption of rescue meds measured.

Joint Support Studies-Animal	Study Title	Study Summary
Ezaki et al. 2012 J Bone Miner Metab. 2013 Jan;31(1):16-25. doi: 10.1007/s00774-012-0378-9. Epub 2012 Aug 10.	Assessment of Safety and Efficacy of MSM on Bone and Knee Joints in OA Animal Model	This study evaluated cartilage formation in growing rats and cartilage degradation in mice, both are acceptable Human OA models at recommended human dosage of 0.6g/kg BW/day and at 10x & 100X. Intake of MSM for 4 wks did not affect cartilage formation in rat's knee joints. MSM Intake for 13 weeks decreased degeneration of the cartilage on knee joint surface of the mice. 100X dosage significantly decreased organ wt. compared to control.
Hasegawa T, Ueno S, Kumamoto S, Yoshikai Y 2004 Jpn Pharmacol Ther 2004;32(7):421-7. OptiMSM® Study using OptiMSM™	Suppressive effect of methylsulfonylmethane (MSM) on type II collagen-induced arthritis in DBA/1J mice	Oral administration of OptiMSM® modified immune responses in DBA/1J mice. Arthritic deformation and swelling induced by type II collagen injections (an animal model of rheumatoid arthritis) were significantly diminished in mice drinking MSM compared to controls. Abnormal white blood cell proliferation in lymph nodes was also reduced in mice drinking MSM.
Muravyev et al. 1991 Patol Fiziol Eksp Ter 1991, 2:37–39	Effect of DMSO and MSM on a Destructive Process in the Joints of Mice with Spontaneous Arthritis	Oral administration of DMSO or its main metabolite MSM lessened the destructive changes in joints of 36 Mrl/Mn/lnr female mice.
Moore et al. 1985 Proceedings of Fed of American Soc. Of Exp Bio 1985, 530: Abstract 692	Diminished Inflammatory Joint Disease in MRL/lpr Mice Ingesting DMSO or MSM	A 3% solution of either DMSO or MSM was administered in drinking water, ad libitum for 3 months. Inflammatory reaction of synovial tissue was found in 95% of control, 82% of DMSO and 71% of MSM. Pannus formation was significantly reduced in MSM vs. placebo.

Oxidative Damage Protection Studies

Additional Oxidative Damage Protection Studies-Animal	Study Title	Study Summary
Amirshahrokhi, K. et al. 2013 Inflammation. 2013 Oct;36(5):1111-21. doi: 10.1007/s10753-013-9645-8.	Effect of MSM on Paraquat-Induced Acute Lung and Liver Injury in Mice	Mice treated with 500mg/kg/day i.p. for 5 days histological and biochemical examination of lung and liver tissue. Results showed a significant reduction in liver and lung tissue damage and a significant reduction in tissue levels of MDA, MPO and TNF-α. MSM significantly increased the levels of SOD, CAT and GSH. Findings suggest MSM attenuates PQ-induced pulmonary and hepatic oxidative injury.

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Additional Oxidative Damage Protection Studies-Animal	Study Title	Study Summary
Bohlooli et al. 2013 Iran J. of Basic Med Sci, 2013, 16:896-900	Effect of Methylsulfonylmethane Pretreatment on Acetaminophen Induced Hepatotoxicity in Rats	The study evaluated effect of pretreatment of MSM on acetaminophen-induced liver injury in rats. Dosage of MSM pre-treatment = 100 mg/kg BW for one week. On day 7 rats received acetaminophen @ 850mg/kg to induce liver injury. Blood serum levels of AST and ALT measured 24 hrs post dose. Tissue samples of liver were evaluated for MDA, GSH, SOD and MPO activity. Results show acetaminophen caused a negative impact on all measured biological indices and pre-treatment with MSM significantly attenuated this negative impact.
Kamel et al. 2013 Arch. Pharm. Res. 2013, doi:10.1007/s12272-013-0110-x	Hepatoprotective Effect of MSM Against Carbon Tetrachloride-Induced Liver Injury in Rats	Pre-treatment with MSM (400mg/kg) before a single dose of CCl4 (2ml/kg, i.p.) inhibited serum ALT and AST activities, decreased liver MDA, TNF-α, IL-6 and Bax/Bcl2 ratio compare to CCl4 group. MSM raised SOD and CAT activity as well as CYP2E1 level in liver tissues. MSM protects liver from CCl4 injury possibly through its antioxidant, anti-inflammatory and anti-apoptotic properties.
Mohammadi et al. 2012 Adv in Pharma Sci 2012, doi:10.1155/2012/507278	Protective Effects of MSM on Hemodynamics and Oxidative Stress in Monocrotaline-Induced Pulmonary Hypertensive Rats	MSM administered to rats at 100, 200, and 400 mg/kg/day for 10 days before a single dose of 60 mg/kg, IP, MCT. Blood samples analyzed for CAT, SOD, GPx, GSH and MDA. MSM treatment showed potential protective antioxidant effects by a significant increase in antioxidant enzyme activity and associated reducing agents.
Amirshahrokhi, K. et al. 2011 Tox and App Pharm 2011, doi 10.1016/j.taap.2011.03.017	Effect of MSM on Experimental Colitis in the Rat	Colitis induced by intra-colonic instillation of 1 ml of 5% acetic acid. Rats treated with MSM at 400mg/kg/day orally for 4 days. Colon evaluated histologically and biochemically. Micro and macroscopic colonic damage was decreased. MDA, MPO, and IL-1 were significantly decreased while GSH levels increased. MSM may have a protective effect in experimental ulcerative colitis.
DeSilvestro et al. 2008 FASEB J, 2008, 22:445.8 Published abstract and poster presentation OptiMSM® Study using OptiMSM™	MSM intake in Mice Produces Elevated Liver Glutathione and Partially Protects against CCl4 -Induced Liver Damage	MSM administration (5 weeks, 80 mg/100 ml drinking water) produced a statistically significant increase in liver GSH (mean increase of 78%). A similar effect was not seen in lung or skeletal muscle. Also, MSM partially inhibited liver injury after injection of CCl4, which induces liver oxidative stress.

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Allergy/Immune Studies

Allergy/Immune Studies	Study Title	Study Summary
Godwin, S. et al. 2015 Journal of the International Society of Sports Nutrition Published abstract and poster presentation OptiMSM® Study using OptiMSM™	MSM enhances LPS-induced inflammatory response after exercise.	Supplementation of MSM blunted the increase in systemic levels of inflammatory cytokines (IL-6 & IL-1B) immediately after exercise. However, Ex vivo incubation of blood from various time points with LPS caused a dramatic increase in inflammatory cytokines after exercise only in the group treated with MSM. Also, a 2-3 fold increase in IL-10 was seen only in the MSM group after LPS stimulation despite lower IL-10 levels before exercise.
Hasegawa T, Ueno S, Kumamoto S 2005 Jpn Pharmacol Ther 2005;33(12):1217–1223 OptiMSM® Study using OptiMSM™	Anti-inflammatory effect of methylsulfonylmethane (MSM) in mice	3 aspects of anti-inflammatory effects of OptiMSM evaluated: 1) Skin damage by UV, 2) Skin inflammation by ovalbumin injection and 3) Itching from histamine. Results: 1) OptiMSM suppressed skin inflammation from UV light. 2) Mice that consumed 2.5% OptiMSM in solution suppressed immediate-phase swelling reaction. 3) Scratching behavior was considerably less in mice following ingestion of 2.5% MSM solution for 1 week before histamine injections. Conclusion: Study confirms MSM is an anti-inflammatory agent, and it mitigates abnormal immune reactions that trigger inflammation.
Barrager E, Veltmann JR, Schauss AG, Schiller RN 2002 J Altern Complement Med 2002; 8:167–73. OptiMSM® Study using OptiMSM™	A Multi-Centered, Open Label Trial on the Safety and Efficacy of Methylsulfonylmethane in the Treatment of Seasonal Allergic Rhinitis	50 person study consumed 2600mg/day MSM orally for 30 days. Clinical respiratory symptoms and energy levels evaluated by questionnaire at the beginning and @ days 7, 14, 21, and 30. Immune and inflammatory reactions were also determined by lab tests. After 1 week, frequency of upper respiratory symptoms were significantly improved. At 3 weeks, participants also had significant improvements in lower respiratory symptoms. All respiratory improvements were maintained through day 30. Energy levels improved significantly by day 14, and were maintained through day 30. Minimal side effects reported during trial.

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