At Bergstrom Nutrition we believe in advancing science to optimize health. The following research was sponsored in the interest of furthering the understanding of the efficacy, safety and mechanisms of action of MSM.

**Efficacy of methylsulfonylmethane (MSM) in osteoarthritis pain of the knee: a pilot clinical trial**
Kim LS, Axelrod LJ, Howard P, Buratovich N, Waters RF

Research summary:
A randomized, double-blind, placebo-controlled clinical trial to evaluate the effects of distilled MSM on mild to moderate osteoarthritis of the knee. Participants were randomized to receive 3,000 mg twice daily of either placebo or OptiMSM® for twelve weeks. Patients were evaluated using the Western Ontario and McMaster University Osteoarthritis Index visual analog scale (WOMAC), as well as for several secondary endpoints, adverse events, and clinical laboratory markers. Compared to placebo, those taking MSM experienced statistically significant reductions in pain and in difficulty performing activities of daily living. Statistically significant reductions in serum homocysteine (a risk factor for cardiovascular disease) and urinary malondialdehyde (a marker of oxidative stress) were also observed. There were no significant adverse events in the study.


**Anti-inflammatory effect of methylsulfonylmethane (MSM) in mice**
Hasegawa T, Ueno S, Kumamoto S

Research summary:
Researchers investigated three aspects of the anti-inflammatory activity of OptiMSM®: skin damage caused by ultraviolet (UV) light exposure, skin inflammation, and itching. Mice were used in the experiments: UV-irradiated hairless mice for skin damage, ovalbuminimmunized mice for inflammatory skin reaction, and mice injected under the skin with histamine for scratching behavior.

Results: 1) OptiMSM® suppressed the skin inflammation caused by UV radiation. Animals treated with MSM also had improved weight gain, and no rise in sialic violet (a marker of inflammation) compared to untreated animals. 2) Mice that consumed a 2.5% OptiMSM® solution beginning one week prior to the ovalbumin treatment tended to suppress the immediate-phase swelling reaction. 3) Scratching behavior was considerably less in mice that drank the 2.5% OptiMSM® solution starting one week prior to the histamine injections.

Conclusion: Although much remains to be discovered about how MSM fights inflammation, this study confirms that MSM is an anti-inflammatory agent, and that it mitigates abnormal immune reactions that trigger inflammation.


**Suppressive effect of methylsulfonylmethane (MSM) on type II collagen-induced arthritis in DBA/1J mice**
Hasegawa T, Ueno S, Kumamoto S, Yoshikai Y

Research summary:
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.


**Preventive effect of methylsulfonylmethane (MSM) at the induction stage of mammary carcinogenesis induced by DMBA in female SD rats**
Wang M-Y, Anderson G, Nowicki D.

Research summary:
The cancer preventive effect of OptiMSM® at the initiation stage of multiple stage chemical carcinogenesis was investigated in rats. A breast cancer animal model was employed, using dimethylbenzanthracene (DMBA) to induce carcinogenesis in female Sprague-Dawley (SD) rats. Animals receiving only DMBA developed a variety of tumors, including carcinoma in-situ in 25%. No animal treated with DMBA + MSM developed any tumor, either benign or malignant, indicating a protective effect of OptiMSM® on the development of mammary carcinoma at the initiation stage.

Research Summary:
The cancer preventive effect of OptiMSM® and Tahitian Noni Juice (TNJ) at the initiation stage of multiple stage chemical carcinogenesis was investigated in rats. As above, DMBA was utilized to induce mammary carcinogenesis in female Sprague-Dawley (SD) rats. Animals receiving only DMBA developed a variety of tumors, including carcinoma in-situ. Animals receiving either OptiMSM®, TNJ, or the combination developed no tumors. The authors state, “A synergistic cancer preventive effect was observed in the combination group.”


**Pharmacokinetics and Distribution of Methylsulfonylmethane (as OptiMSM) following Oral Administration to Rats**
Magnuson B, Appleton J, Ames G

Research summary:
The objective of this study was to evaluate the pharmacokinetic profile and distribution of radiolabeled MSM in rats. The results of this study suggest that OptiMSM is rapidly absorbed, well distributed, and completely excreted from the body.

Status: Published, *J. Agric Food Chem* 2007: 55, 1033-1038

**Oral Developmental Toxicity Study of Methylsulfonylmethane (as OptiMSM) in Rats**
Magnuson B, Appleton J, Ryan B, Matulka R

Research summary:
The objective of the study was to determine the developmental toxicity potential of MSM when administered orally to pregnant rats during the period of major organogenesis and histogenesis. Four groups of female rats were administered various dosages of MSM via gavage. No evidence of maternal toxicity, and no significant differences in litter viability, litter size, or litter body weight were detected. Fetal evaluations failed to show any biologically significant increase in the incidence of anomalies in the MSM treated groups, and no malformations were seen in any of the fetuses. No evidence of fetal mortality, alterations to growth, or structural alterations were observed in the fetuses of dams administered 50–1000 mg/kg/day. Therefore, under the conditions of this study, the no-observed-adverse-effect level (NOAEL) for maternal and developmental toxicity was 1000 mg/kg/day.


**A Multi-Centered, Open Label Trial on the Safety and Efficacy of Methylsulfonylmethane in the Treatment of Seasonal Allergic Rhinitis**
Barrager E, Veltmann JR, Schauss AG, Schiller RN

Research summary:
Fifty participants completed the study. They consumed 2,600 mg of MSM orally per day or 30 days. Clinical respiratory symptoms and energy levels were evaluated by a Seasonal Allergy Symptom Questionnaire at the beginning of the study and again on days-7, 14, 21 and 30. Immune and inflammatory reactions were also determined by laboratory tests. After one week, the frequency of upper respiratory signs and symptoms (e.g., runny nose, watery and itchy eyes, nasal obstruction, paroxysmal sneezing) were significantly improved compared to initial levels. At the three-week mark, participants also had significant improvements in lower respiratory symptoms (e.g., coughing, shortness of breath and other lung or chest symptoms). All respiratory improvements were maintained through the 30-day visit. Energy levels increased significantly by day-14, an increase that continued through day-30. Minimal side effects were associated with use of MSM.


**Ocular and dermal irritation assays for OptiMSM® brand of methylsulfonylmethane**
Flora Research Laboratories, Grants Pass, OR; August 1999

Research Summary:
Ocular and Dermal Irritancy results are classified as a Minimal Irritant. Actual scores from the Irritation Draize Equivalent (IDE) and Human Irritancy Equivalent (HIE) were found to be the lowest scores that can be achieved by any compound.

Status: Data on file.