Serum MSM Concentrations Following One Month of MSM Treatment in Healthy Men

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Abstract

Introduction: Methylsulfonylmethane (MSM) is a commonly used dietary supplement for the alleviation of joint and muscle pain. It is known primarily for its anti-inflammatory and antioxidant properties. While it is believed to have excellent bioavailability, little is known about its serum concentrations following chronic ingestion.

Methods: 20 healthy men were supplemented with 3 grams of MSM daily for four weeks. Blood was collected at baseline and after two and four weeks of supplementation. Serum was analyzed for MSM concentration using Nuclear Magnetic Resonance (NMR) spectroscopy.

Results: All baseline samples but one (0.028 mM) was below the limit of quantification for the NMR assay (0.002 mM). Serum MSM values increased across time (p<0.0001) to a mean (± SD) of 1.68 ± 0.60 mM at week 2 and 1.91 ± 0.81 mM at week 4. Values at week 2 and week 4 were greater than at baseline (p<0.05), but not different from one another (p>0.05). A total of 13 of the 20 men demonstrated higher serum MSM values at week 4 as compared to week 2. And eight of these men demonstrated an increase at week 4 of at least 25% above what was observed at week 2.

Conclusions: Serum MSM concentrations increase following oral MSM supplementation, in somewhat of a time-dependent manner in selected subjects. The pattern of increase varies somewhat from subject to subject, although all individuals experience an increase of approximately 1-3 mM after 2-4 weeks of supplementation.

Keywords: Blood; Dietary supplements; Methylsulfonylmethane

Introduction

Methylsulfonylmethane (MSM) is a naturally occurring compound that is composed of sulfur, oxygen, and methyl groups [1]. It is found in small quantities in a variety of foods, [2] such as milk, fruits and vegetables (e.g. tomatoes, corn), coffee, and tea. While being a very stable compound, MSM does sublime and may be removed during the processing and/or preparation of foods. An early MSM researcher, Robert Herschler, suggested this may lead to lower than optimum amounts of MSM in the average diet. As a result, supplementation with MSM has grown in popularity in recent years for its health-enhancing properties. For example, multiple health-related benefits have been reported in association with MSM use, primarily related to its anti-oxidative and anti-inflammatory activity [3], which may be specific to both skeletal muscles during exercise recovery and reductions in joint pain during normal ambulation.

MSM is Generally Recognized as Safe (GRAS) as determined by a panel of experts and the United States Food and Drug Administration-Center for Food Safety and Applied Nutrition has issued a letter of no questions [4]. Human clinical trials have commonly included dosages of MSM between 1.5 [3] and 6 [6,7] grams daily, for periods of several weeks to months with no major adverse events reported from the MSM treatment. Anecdotally, benefits are often obtained within just a few days following the initiation of supplementation, suggesting that serum concentrations may be elevated rapidly following intake. While MSM is believed to have excellent bioavailability [8] and a single 3 gram dosage has been shown to increase serum MSM concentrations to approximately 0.15 - 0.20 mM just 90 minutes after ingestion, [9] little is known about its serum concentrations following chronic ingestion. Specifically, there are currently no data detailing the change in plasma MSM concentrations following chronic supplementation with this ingredient; something of interest to both investigators studying MSM and formulators who use MSM within dietary supplements for its health-enhancing properties. Hence, the purpose of the present study was to determine the impact of daily MSM supplementation over the course of a four week period on serum MSM concentrations in healthy men. It was our objective through this study to provide a base data set for potential future dose and time ranging studies that may assist in optimizing the suggested dosing of MSM, in particular as its popularity continues to grow.

Materials and Methods

Subjects

A total of 20 men were assigned to consume three grams of MSM daily for a period of four weeks. It should be noted that an additional 20 men were assigned to consume an identical-appearing placebo for the same period of time. Assignment was performed in a randomized, double-blind manner. The characteristics of subjects assigned to MSM are presented in Table 1.

Men were recruited to participate via informal word of mouth conversations, email communications, and recruitment flyers posted on campus. All subject recruitment was performed under the direction of Dr. Richard J. Bloomer, et al., Clin Pharmacol Biopharm 2015, 4:1

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Subjects reported to the lab following an overnight fast and performed by Bruker BioSpin Corp (Billerica, MA). The body mass of subjects was also weakly/moderately and negatively correlated to serum MSM concentrations (r=0.12; p=0.45). Pairwise correlations using subjects’ capsule compliance (both total and 2 week) indicated significant but weak/moderate correlations as follows: total capsule compliance over the four week period (r=0.40; p=0.01); capsule compliance at each two week period (r=0.32; p=0.04). That said, 13 of the 20 men demonstrated higher serum MSM values at week 4 as compared to week 2 (Figure 1). 4 were not different from one another (p>0.05). That said, 13 of the 20 men demonstrated higher serum MSM values at week 4 as compared to week 2 (Figure 1).

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Discussion/Conclusion

The main findings of the present study are as follows: 1. MSM is not detectible in serum samples of healthy men using NMR unless they

![Table 1: Characteristics of 20 men supplemented with MSM for 4 weeks.](image-url)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>25.1 ± 7.2</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>176.5 ± 6.4</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>84.6 ± 6.9</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.2 ± 2.1</td>
</tr>
<tr>
<td>Heart rate (bpm)</td>
<td>65.9 ± 7.9</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>119.2 ± 7.7</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>78.2 ± 7.4</td>
</tr>
<tr>
<td>Years anaerobic exercise training</td>
<td>7.1 ± 7.4</td>
</tr>
<tr>
<td>Hours per week anaerobic exercise</td>
<td>4.7 ± 2.1</td>
</tr>
<tr>
<td>Years aerobic exercise training</td>
<td>7.2 ± 8.0</td>
</tr>
<tr>
<td>Hours per week aerobic exercise</td>
<td>2.3 ± 1.6</td>
</tr>
<tr>
<td>4-week capsule compliance (%)</td>
<td>96.6 ± 4.6</td>
</tr>
</tbody>
</table>

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As has been suggested for many dietary supplements, we hypothesized that the body mass of individuals may have impacted the overall serum MSM concentrations. A cursory review of the data presented in Figure 1 suggests this to some extent. For example, of the 20 subjects receiving MSM, those who experienced the highest serum MSM concentrations at week 4 had a body mass of: 78 kg, 81 kg, 92 kg, 77 kg, and 79 kg. That said, other subjects with a relatively low body mass (e.g. 75 kg, 82 kg) did not exhibit very high serum MSM levels. A correlation analysis indicated that body mass was weakly/moderately and negatively correlated to serum MSM (r=−0.34; p=0.03), indicating that the body mass of subjects does impact the serum MSM concentrations to some extent following supplementation. Aside from body mass, it is likely that metabolic factors involved in the uptake, distribution, and storage of MSM in humans also contribute to serum MSM concentrations. This is supported by the somewhat inconsistent findings for serum MSM concentrations across our subject pool, which are supplemented with a daily dosage of the nutrient, corroborating existing data indicating that circulating MSM levels in human plasma are between 0 mM and 0.025 mM [10]; 2) Daily supplementation with MSM at a dosage of 3 grams reliably increases serum MSM concentrations (all subjects experience an increase in serum MSM concentrations between approximately 1-3 mM); 3) serum MSM increases in somewhat of a time-dependent manner following chronic supplementation with MSM (as demonstrated in 13 of the 20 men); and 4) body mass is weakly/moderately and negatively related to serum MSM concentrations, as serum values increased to a slightly greater extent in individuals with lower body mass.

As can be seen in Figure 1, serum MSM values increased in all 20 subjects who received MSM supplementation. While the total accumulation varied from one subject to the next, it was generally consistent and within a fairly narrow range of 1-3 mM. In 13 of the 20 men, values were higher at week 4 as compared to week 2. This increase was 25% or more for eight of the men (as shown in Figure 1). Prior work has shown that a single 3 gram dosage of MSM results in a serum MSM concentration of approximately 0.15 - 0.20 mM just 90 minutes after ingestion [9]. It is possible that daily ingestion of MSM leads to an accumulation that can be detected in serum in significant quantities in the days following the initiation of supplementation.

In conclusion, we report for the first time that chronic treatment with MSM results in a reliable increase in serum MSM concentrations, in the range of 1-3 mM following 2-4 weeks of supplementation. The increase in serum MSM appears to be somewhat time-dependent, with the majority of subjects experiencing a continued rise following the initial two-week treatment period. Future studies may seek to determine if serum MSM values continue to rise with longer-term supplementation, to determine the time course of decline in serum MSM concentrations following cessation of MSM use, to determine the influence of different MSM dosing patterns on serum accumulation, and to determine if the pattern of increase is the same for both men and women.
Acknowledgments

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Authors’ contributions

RJB was responsible for the study design, statistical analyses, and manuscript preparation. DAM was responsible for management of the study protocol, all data collection, and review of the final manuscript. RLB assisted with the study design and manuscript preparation. All authors read and approved of the final manuscript.

Conflict of Interest Statement

RJB has been a Consultant for and/or Principal Investigator on research studies funded by various dietary supplement and ingredient companies. RLB is the Director of Research and Development and Technical Support for Bergstrom Nutrition. DAM declares no competing interests.

References