Influence of Liposomes on Glutathione Absorption

February 2020

1. Study Objective

To evaluate the absorption of a liposomal glutathione supplement (liposomal) compared to a non-liposomal glutathione supplement (standard) after seven days of administration.

2. Methods

The current study was a two-group, randomized controlled trial of the effect of liposomal versus standard glutathione supplementation on plasma reduced glutathione levels (GSH) after daily supplementation for seven days. Participants and laboratory staff were blinded to the study arm.

2.1. Participants

Twenty metabolically healthy participants enrolled in the study. They were randomly and evenly assigned to either the liposomal or standard supplementation group. Participants exclusion criteria included:

- Age <20 and >50 years
- Any diagnosis of chronic condition(s)
- BMI outside of the normal category range (18.5-24.9kg/m^2)
- Presence of acute illness
- Use of drugs or dietary supplements on a frequent and/or mandatory basis

2.2. Active Substance

a. **Liposomal Product:**
Purazell Liposomal Reduced Glutathione (*12.5mL/500mg)*
Company:
Roh Vegan am Limit / Patrick Strobach
Sandstrasse 104
40789 Monheim am Rhein

b.

c. **Standard Product:**
Solgar Reduced L-Glutathione *2 tablets/500mg*
Manufactured by:
Solgar Inc.
Leonia, New Jersey, USA

2.3. Dosage and Blood Collection

An oral dose of 500mg of liposomal or standard glutathione supplement was administered in the morning at the testing center every day for seven days. Plasma was collected at baseline, before administration on day three and after administration on day seven. Participants were fasted for each blood draw. Plasma was then measured for GSH using Liquid Chromatography and Mass Spectrometry (LC/MS-MS) techniques at the laboratories of Surya Research Clinics.

2.4. Statistics

Between group and within group analyses were conducted to determine significant changes in plasma GSH levels. A two-way ANOVA with Tukey's comparison of means was performed to determine the difference between groups in mean GSH levels at baseline, day three, and day seven. A one-way repeated measures ANOVA with Tukey's pairwise comparisons was used to determine the within group changes in plasma GSH levels from baseline to day seven in both the liposomal and the standard group.

3. Results

All enrolled participants completed the study. Participants were in their late twenties, predominately male and had a healthy BMI and blood pressure. Participant anthropometric data is presented in *Table 1.* The mean plasma GSH levels before supplementation, on day three, and on day seven are presented in *Table 2.* A graphical representation of this data is available in *Figure 1.* Overall, the plasma GSH levels rose over the course of seven days in the liposomal group with little change observed in the standard group.

A two-way ANOVA was conducted that examined the effect of supplement type (treatment) and time of blood draw on plasma GSH levels. There was a statistically significant interaction between the treatment and time of blood draw on the plasma GSH levels, F (2,53) =19.01, p=0.000, R^2=73.27%. Simple main effects analysis showed that the liposomal group had significantly higher levels of plasma GSH levels at day three (p=0.003) and day seven (p=0,000) when compared to the standard group. There were no significant differences between groups at baseline (p=0.970). The results from the comparisons of means test are presented in *Table 3.*

A one-way repeated measures ANOVA was conducted to examine the effects of time on supplementation within both the liposomal and standard groups. There was a statistically significant effect of time on plasma GSH levels in the liposomal group F (2,26) =23.88, p=0.000, R2=64.75%. Post hoc tests revealed a significant increase in plasma GSH levels from baseline at day three (p=0.045) and day seven (p=0.000). Plasma GSH levels also increased significantly from day three to day seven (p=0.001) in the liposomal group. These results are presented in *Table 4.* There were no significant increases over time in the standard group (F (2,27) =0.02, p= 0.981, R^2 =0.14%). These results are presented in *Table 5.*

Table 1. Participant Anthropometrics

	Liposomal[ab]	Standard[ab]
Age (years)	27.30 (6.30)	28.2 (6.80)
Females (%)	40.00	30.00
BMI (kg/m^2)	21.10 (2.00)	21.4 (1.80)
Systolic BP (mm Hg)	122.20 (15.10)	120.8 (9.20)
Diastolic BP (mm Hg)	77.20 (8.50)	77.3 (6.10)

[a] Mean (SD)
[b] n=10

Table 2. Mean Plasma GSH Level After Supplementation

Time Point	Liposomal[ab]	Standard[ab]
Baseline	2.93 (0.29)	2.55 (0.71)
Day 3	4.56 (0.85)	2.58 (0.73)
Day 7	7.21 (2.21)	2.61 (0.59)

[a] Unit µmol/L
[b] Mean (SD)

Figure 1. Mean Plasma GSH Levels over Seven Days after Daily Supplementation with a Standard or Liposomal Formulation

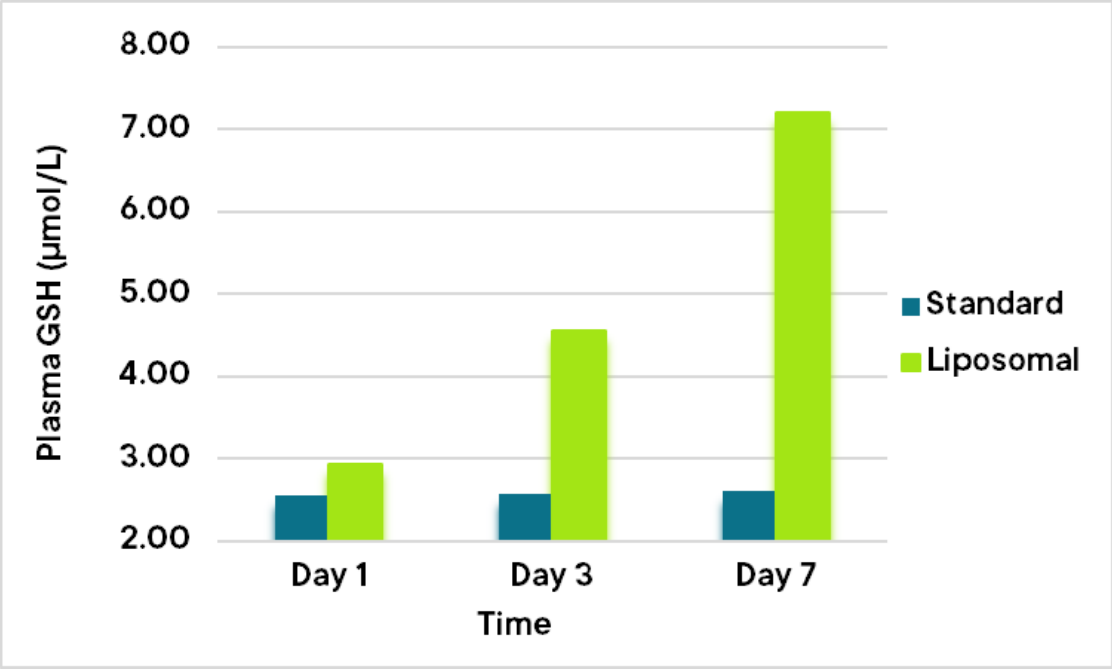

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Table 3. Between-Group Comparison of Mean Plasma GSH Levels[a]

Time Point	Standard[bcd]	Liposomal[bcd]	Difference of Means[c]	95% Confidence Interval	T-Value	P-Value
Baseline	2.55 (0.23)	2.93 (0.09)	-0.38 (0.49)	-1.82, 1.06	-0.78	0.970
Day 3	2.58 (0.23)	4.56 (0.28)	-1.98 (0.50)	-3.46, -0.49	-3.94	0.003*
Day 7	2.61 (0.19)	7.21 (0.70)	-4.60 (0.49)	-6.04, -3.16	-9.42	0.000*

[a] Data analyzed using two-way ANOVA with Tukey Comparison of Means
[b] n=10
[c] Mean (SE)
[d] Unit µmol/L
* P-Value <0.05 is statistically significant

Table 4. Change in Plasma GSH Levels Over Time in Liposomal Group[ab]

Time Point	Difference of Means[c]	95% Confidence Interval	T-Value	P-Value
Baseline - Day 3	1.63 (0.64)	0.032, 3.22	2.53	0.045*
Day 3 - Day 7	2.65 (0.64)	1.06, 4.25	4.14	0.001*
Baseline - Day 7	4.28 (0.63)	2.73, 5.83	6.85	0.000*

[a] Analyzed using Tukey's pairwise comparisons
[b] n=10
[c] Mean (SE)
* P-Value <0.05 is statistically significant

Table 5. Change in Plasma GSH Levels Over Time in Standard Group[ab]

Time Point	Difference of Means[c]	95% Confidence Interval	T-Value	P-Value
Baseline - Day 3	0.03 (0.08)	-0.16, 0.22	0.40	0.916
Day 3 - Day 7	0.03 (0.75)	-0.16, 0.22	0.40	0.916
Baseline - Day 7	0.06 (0.75)	-0.13, 0.25	0.80	0.709

[a] Analyzed using Tukey's pairwise comparisons
[b] n=10
[c] Mean (SE)
* P-Value <0.05 is statistically significant

4. Conclusion

The liposomal glutathione supplement significantly raised plasma GSH levels at after seven days of administration when compared to a standard glutathione supplement. The standard supplement was unable to significantly increase these plasma GSH levels. This suggests that daily supplementation with liposomal GSH results in higher absorption and sustained plasma levels of GSH when compared to a standard GSH supplement. Limitations of the study include a small sample size, a short supplementation period, and a lack of plasma measurements at each day of supplementation. Future studies should assess glutathione supplementation in a larger sample size over a longer period of time.

Acknowledgements

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