The Impact of magma13 on Sleep Quality and Biometrics: A Multi-Modal Analysis

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ABSTRACT:

This study investigated the effects of the magma13 on sleep quality using both subjective and objective measures. Twenty healthy adult volunteers participated in a 5-week study consisting of a 2-week baseline period, a 2-week utilization period using the magma13 LifeBion, and a 1-week post-utilization period. Sleep metrics were collected using the Biostrap Kairos wristband, alongside sleep quality surveys.

Results showed significant improvements in both self-reported and biometric measures of sleep quality during the magma13 utilization period. Participants self-reported a reduction in "terrible" sleep quality and pain and discomfort ratings, as well as an increase in overall sleep satisfaction. Biometric data revealed an increase in deep sleep duration and a decrease in awake time. Notably, the recovery score increased substantially following sleep, and nighttime heart rate variability (HRV) improved.

The utilization also positively impacted daytime functioning, with participants reporting clearer heads upon waking and decreased difficulty getting out of bed. These subjective improvements were supported by decreased daytime heart rate and increased daytime HRV.

Most improvements were maintained, or only slightly decreased, in the post- utilization period, suggesting potential positive lasting effects of sleep with the magma13 LifeBion. This study provides evidence for the efficacy of magma13 in improving both perceived and measured aspects of sleep quality, with particularly strong effects on recovery and autonomic nervous system function as indicated by HRV. Further research with larger sample sizes is warranted to confirm these promising results.

Keywords: Sleep quality, biometrics, heart rate variability, recovery, sleep, magma13, LifeBion

1. INTRODUCTION

Sleep is a fundamental biological process that plays a crucial role in physical health, cognitive function, and overall well-being (Buysse, 2014). In recent years, the importance of sleep quality, beyond mere quantity, has gained increasing attention in both scientific research and public health discussion. Poor sleep quality has been associated with a wide range of negative health outcomes, including increased risk of cardiovascular disease, metabolic disorders, impaired immune function, and mental health issues (Irwin, 2015; Knutson, 2010).

Despite the growing awareness of sleep's importance, many individuals struggle to achieve consistent, high-quality sleep. Modern lifestyles, characterized by high stress levels, irregular schedules, and excessive exposure to artificial light and radiations, often contribute to disrupted sleep patterns and reduced sleep quality (Kecklund & Axelsson, 2016). This has led to an increase in interest in solutions and products designed to enhance sleep quality.

Existing sleep solutions range from pharmaceutical interventions to behavioral therapies and environmental modifications (Morin et al., 2015). While these approaches have shown varying degrees of success, there remains a need for non-invasive, user-friendly solutions that can effectively improve sleep quality without significant lifestyle changes or potential side effects (Irish et al., 2015).

The magma13 LifeBion is a novel sleep application designed to address this need. It aims to enhance sleep quality through the creation of a coherent sleep environment through enhanced natural ambient energy, with the aim of promoting restorative sleep and cellular regeneration. While the functional theoretical basis for magma13's efficacy, the stem and somatic cell magma13 research to date, and numerous subjective reports of sleep improvement are promising, empirical evidence of its impact on sleep quality and associated physiological measures is limited.

This pilot study aims to evaluate the effects of the magma13 on both subjective and objective measures of sleep quality. By combining self-reported sleep assessments with biometric data collected through wearable technology, we seek to provide an analysis of the magma13's potential benefits. This approach aligns with recent recommendations in sleep research to integrate multiple assessment methods for a more holistic understanding of sleep quality (Ibáñez et al., 2018). Specifically, this study investigates changes in sleep duration, sleep stages, heart rate variability, and subjective sleep quality during and after a two-week utilization period with the magma13 LifeBion.

The primary objectives of this study are:

1. To assess the impact of the magma13 on self-reported sleep quality and daytime functioning.
2. To quantify changes in objective sleep metrics, including sleep duration, efficiency, and stages, associated with magma13 LifeBion use.
3. To examine the effects of magma13 on physiological indicators of sleep quality and recovery, particularly heart rate variability.
4. To explore any potential carry-over effects following the cessation of magma13 LifeBion use.

By addressing these objectives, this study aims to contribute to the growing body of knowledge on non-pharmacological sleep solutions and provide initial evidence for the efficacy of magma13 in improving sleep quality. The findings from this pilot study may inform future larger-scale investigations and potentially offer a new tool for individuals seeking to optimize their sleep and overall wellbeing.

2. METHODS

2.1 Study Design

This study employed a within-subjects design consisting of three phases: a 2-week baseline period, a 2-week utilization period, and a 1-week post-utilization period. This design allowed for comparison of sleep metrics before, during, and after the use of the LifeBion device.

2.2 Participants

Twenty healthy adult volunteers (n = 20) between the ages of 25 and 67 years were recruited through invitations within a clinical practice. Participants were screened to ensure they could complete the 5-week study in full and had no conflicting medical treatments or complications that might interfere with the sleep study. The final sample consisted of 15 females (75%) and 5 males (25%). Sample size was determined based on similar pilot studies in sleep research.

2.3 Materials

magma13 LifeBion: The LifeBion is a sleep technology device that utilizes magma13, a proprietary technology developed by SOLS Switzerland, which consists of two 72-cell panels containing specially formulated magma13. This device is designed to create a coherent sleep environment by potentially influencing the sleeper's exposure to natural ambient energy mediated by magma13, with the aim of promoting restorative sleep and cellular regeneration.

Biostrap Kairos Wristband: This wearable device was used to collect objective sleep and biometric data throughout the study period. Wrist-worn actigraphy has been validated for sleep assessment in numerous studies (Smith et al., 2018).

Sleep Quality Survey: A comprehensive survey assessing various aspects of sleep quality and daytime functioning was administered pre- and post-utilization of the magma13 LifeBion. The survey was adapted from validated sleep quality measures.

Daily Sleep Diary: Participants completed a brief daily questionnaire to assess subjective sleep quality and note any relevant observations, following recommendations for sleep diary research (Carney et al., 2012).

2.4 Procedures

Baseline Period (2 weeks): Participants were instructed on setting up and syncing their Biostrap Kairos wristband data. They wore the wristband continuously for two weeks to establish baseline sleep metrics. Participants completed the initial Sleep Quality Survey and began the daily sleep diary.

Utilization Period (2 weeks): Participants continued wearing the Kairos wristband while also using the magma13 LifeBion sleep mat during sleep. They were instructed on optimal placement and usage of the magma13 LifeBion and completed the Sleep Quality Survey again at the end of this period.

Post-Utilization Period (1 week): Participants removed the magma13 LifeBion but continued wearing the Kairos wristband for one additional week.

This multi-phase design is consistent with recommended practices for evaluating sleep interventions (Buysse et al., 2006).

2.5 Measures

Objective Measures: The following data were collected via the Biostrap Kairos wristband:

1. Sleep Duration and Stages (light sleep and deep sleep)
2. Sleep Efficiency
3. Awakenings and Disturbances
4. Heart Rate (resting, average, minimum, maximum)
5. Heart Rate Variability (HRV)
6. Respiratory Rate
7. Recovery Score

These measures are consistent with recommended parameters for sleep and circadian rhythm research (Ancoli-Israel et al., 2015).

2.6 Subjective Measures:

1. Sleep Quality Survey: Assessed overall sleep quality, perceived sleep disturbances, and daytime functioning on a 5-point Likert scale.
2. Daily Sleep Diary: Included ratings of sleep quality and open-ended comments about sleep experiences.

The combination of objective and subjective measures aligns with best practices in sleep research (Ibáñez et al., 2018).

2.7 Data Analysis

Quantitative data from the Biostrap Kairos and Sleep Quality Surveys were analyzed by calculating and comparing values for various sleep and physiological parameters across baseline, utilization, and post-utilization periods. The analysis focused on changes in measurement pillars, including percentage changes across these periods.

2.8 Ethical Considerations

While formal IRB approval was not sought due to the low-risk nature of the intervention and the commercial intent of the data, all participants were provided written informed consent before participating. They were informed of their right to withdraw from the study at any time without penalty. All data were anonymized to protect participant confidentiality, adhering to standard practices in human subject research (Resnik, 2018).

3. RESULTS

3.1 Sleep Quality Survey Findings

3.1.1 Overall Sleep Quality and Satisfaction

Analysis of the Sleep Quality Survey revealed significant improvements in participants' subjective sleep experiences. The percentage of participants reporting "terrible" overall sleep quality decreased from 26% at baseline to 0% post-utilization. Overall sleep satisfaction increased, with "poor" ratings decreasing from 21% to 5%. The distribution of sleep quality ratings shows a trend toward normalization after the intervention, with responses concentrating around higher ratings. (Buysse, 1989). These sleep quality improvements additionally align with findings with sleep interventions designed to improve recovery and athletic performance (Bonnar et al., 2015).

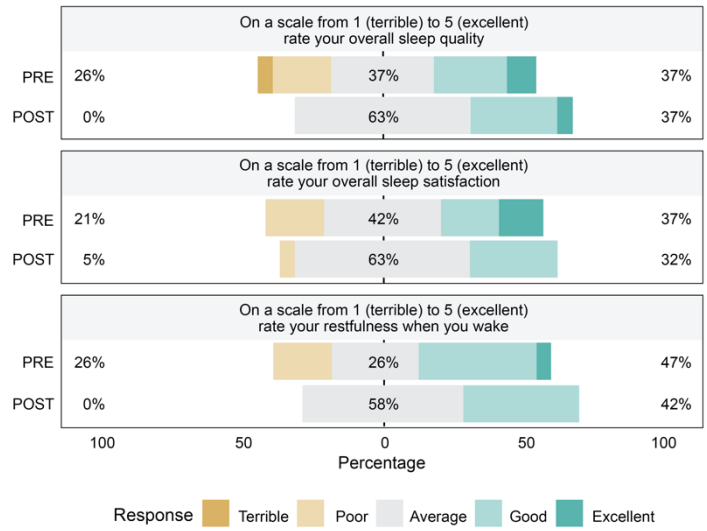

Figure 1: Graph of pre- and post- rating scale of overall sleep quality, overall sleep satisfaction, and restfulness.

3.1.2 Sleep Disturbances

Participants reported fewer sleep disturbances during the intervention period. Notably, difficulty getting back to sleep after waking in the middle of the night reduced by 10%, as well as self-reported decreases in perceived movements during sleep and periodic waking during the night. These reductions in sleep disturbances are consistent with improvements seen in some non-pharmacological behavioral change sleep solutions (Black et al., 2015).

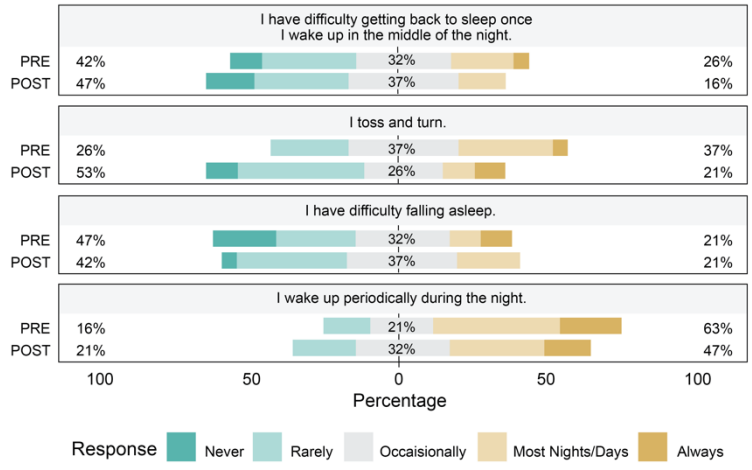

Figure 2: Graph of pre- and post- rating scale of overall sleep disturbances.

3.1.3 Daytime Functioning

Improvements in sleep quality translated to enhanced daytime functioning. Participants reporting, they "never" feel vigorous after sleep decreased from 42% to 32%, and 11% more participants reported having a clear head after sleep, suggesting improved cognitive function upon waking

(Wilckens et al., 2018). Additionally, participants reported waking up with physical discomfort (e.g., back pain, joint pain) reduced by 27%.

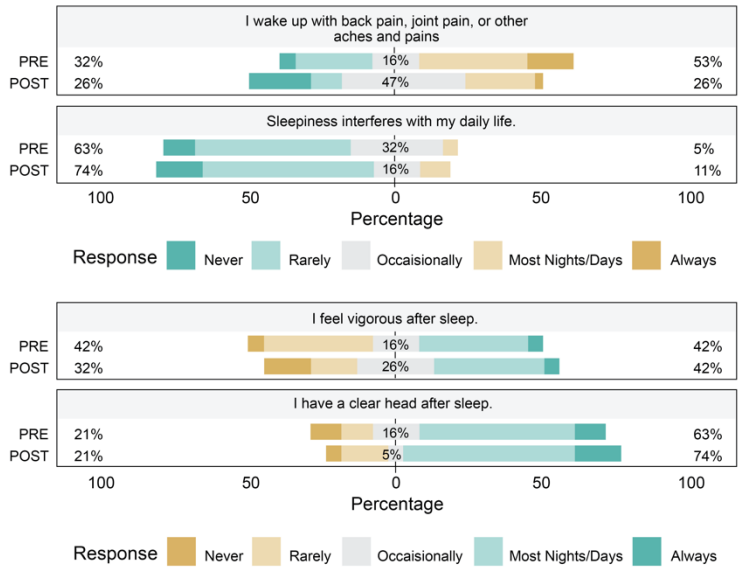

Figure 3: Graph of pre- and post- rating scale of daytime functioning changes.

3.2 Biometric Data Results

3.2.1 Sleep Duration and Stages

Analysis of the Biostrap Kairos data showed small but noticeable changes in sleep architecture:

- Total time in bed decreased from 464.18 minutes (baseline) to 461.10 minutes (intervention)
- Deep sleep increased from 183.33 minutes to 184.97 minutes
- Light sleep decreased from 231.31 minutes to 229.71 minutes
- Awake time decreased from 46.99 minutes to 44.33 minutes

The trend towards increased deep sleep and decreased awake time is noteworthy, as these parameters are associated with better sleep quality (Åkerstedt et al., 2019).

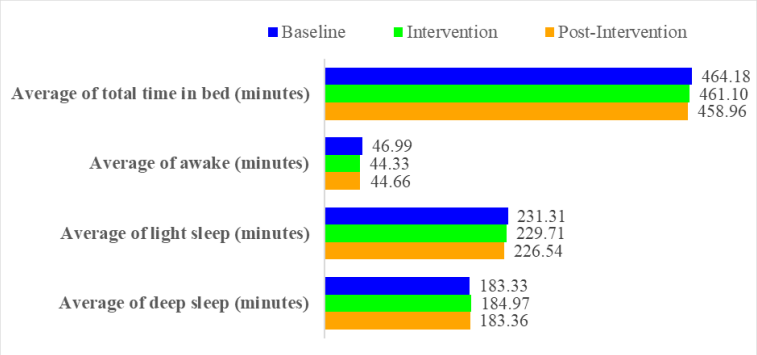

Figure 4: Graph of average total time in bed, awake time, light sleep, and deep sleep-in minutes change from baseline to post-intervention.

3.2.2 Sleep Efficiency and Quality

Sleep efficiency remained stable, changing from 94.29% (baseline) to 94.11% (intervention). However, other indicators of sleep quality showed improvement:

- Sleep score increased from 83.09 to 83.81
- Recovery score significantly increased from 44.44 to 62.37
- Average waking/arousal count decreased from 3.90 to 3.67

The substantial improvement in recovery score is particularly notable, as it suggests enhanced restorative properties of sleep during the intervention period (Peake et al., 2018)

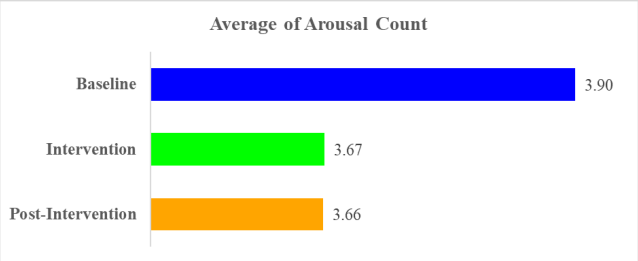

Figure 5: Graph of average arousal/waking count from baseline to post-intervention.

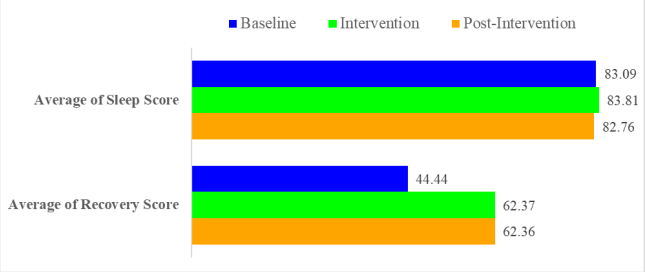

Figure 6: Graph of average sleep score and recovery score from baseline to post-intervention.

3.2.3 Heart Rate and Heart Rate Variability (HRV)

Significant changes were observed in both daytime and nighttime heart rate and HRV measures:

- Daytime heart rate decreased from 68.85 bpm to 67.66 bpm
- Daytime HRV increased from 35.74 ms to 38.47 ms
- Nighttime average heart rate decreased from 64.06 bpm to 63.13 bpm
- Nighttime average HRV significantly increased from 33.37 ms to 36.41 ms

These changes in HRV are particularly important, as increased HRV is associated with better sleep quality, improved recover especially related to athletics and overall health (Shaffer & Ginsberg, 2017).

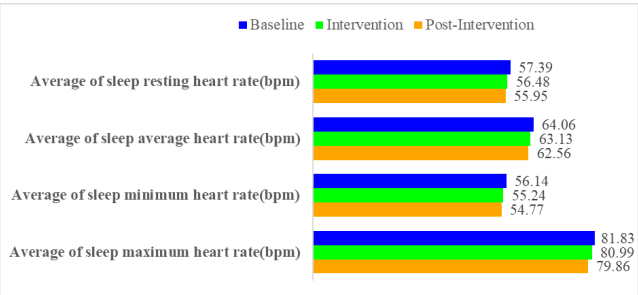

Figure 7: Graph of average sleep resting heart rate, sleep average heart rate, sleep minimum heart rate, and sleep maximum heart rate (bpm) change from baseline to post-intervention.

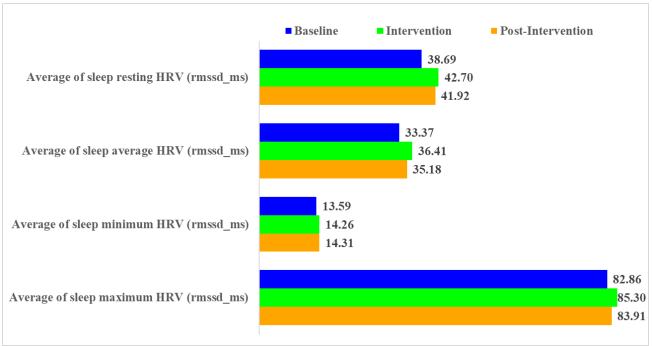

Figure 8: Graph of average sleep resting HRV, sleep average HRV, sleep minimum HRV, and sleep maximum HRV (rmssd_ms) change from baseline to post-intervention

3.2.4 Respiratory Rate

A slight decrease in daytime respiratory rate was observed, from 15.36 to 15.28 breaths per minute.

3.2.5 Post-Intervention Effects

Most improvements observed during the intervention period were maintained, or only slightly decreased, in the post-intervention period. Notably, the recovery score remained stable at 62.36 in the post-intervention period, suggesting potential lasting effects of the magma13 intervention.

4. DISCUSSION

This study investigated the effects of the magma13 on sleep quality using both subjective and objective measures. The results suggest that the magma13 LifeBion intervention led to significant improvements in several aspects of sleep quality and associated physiological parameters.

One of the most striking findings was the substantial improvement in participants' subjective sleep experiences. The complete elimination of "terrible" sleep quality ratings and the significant increase in

overall sleep satisfaction suggest that the magma13 LifeBion intervention had a meaningful impact on participants' perception of their sleep. This aligns with research showing that even small improvements in sleep quality can lead to noticeable overall enhancements in subjective well-being (Pilcher et al., 1997).

The reduction in reported sleep disturbances, particularly difficulty returning to sleep after nighttime awakenings and decreased physical discomfort upon waking, is noteworthy. These improvements could be attributed to the magam13's potential influence on sleep continuity and depth, which are crucial factors in sleep quality (Ohayon et al., 2017). The reported enhancements in daytime functioning, including increased vigor and mental clarity, further underscore the potential benefits of improved sleep quality on cognitive performance and daily life (Maggio et al., 2013).

From an objective standpoint, the biometric data provided valuable insights into the physiological changes associated with magma13 LifeBion use. While some of the changes in sleep architecture were subtle, the trend towards increased deep sleep and decreased awake time is promising. Deep sleep, in particular, is crucial for physical restoration and has been linked to improved cognitive function and overall health (Tasali et al., 2008).

The significant improvement in recovery scores is especially intriguing. This suggests that the magma13 may enhance the regenerative properties of sleep, potentially through the improvement in sleep quality. The mechanisms behind this improvement warrant further investigation, as enhanced recovery could have far-reaching implications for both physical and mental health (Kellmann et al., 2018).

Perhaps the most compelling objective findings were the changes in heart rate variability (HRV). The significant increases in both daytime and nighttime HRV indicate a potential positive impact on autonomic nervous system function. Higher HRV is generally associated with better cardiovascular health, stress resilience, and overall well-being (Thayer et al., 2012). The observed improvements in HRV suggest that the benefits of the magma13 LifeBion intervention may extend beyond sleep quality to overall physiological regulation.

The maintenance of many improvements during the post-intervention period is encouraging, suggesting that the magma13 may have lasting effects on sleep patterns and physiology. This aligns with research on other sleep interventions that have shown carry-over effects (Morin et al., 2009), however, longer follow-up periods would be necessary to determine the true duration of these effects.

The strong correlations between subjective improvements and objective measures lend credibility to the overall findings. This concordance between perceived sleep quality and physiological changes is not always present in sleep research (Landry et al., 2015), and it strengthens the case for the magma13's effectiveness.

In consideration of these promising results, potential limitations of the study should be noted. The sample size was relatively small, and the study duration was limited. While subjects were instructed not to make general lifestyle changes during the study other than using the LifeBion, there were not controls for levels of stress or other lifestyle experiences, which could affect subjective individual participant responses. A larger, more diverse sample, including populations with specific sleep challenges as compared to this population of healthy individuals with existing positive sleep practices, and a longer intervention period would provide more robust trends of improved sleep. Additionally, the lack of a control group limits our ability to rule out placebo effects or natural improvements over time. Future studies should employ randomized controlled designs to address these limitations.

The specific mechanisms by which the magma13 influences sleep and physiological parameters remain to be elucidated. Further research could explore potential pathways, such as effects on circadian rhythms, brain wave patterns, or neuroendocrine function. Additionally, investigating the impact of the magma13 on specific populations, such as those with diagnosed sleep disorders or chronic health conditions, could provide valuable insights into its therapeutic potential.

5. CONCLUSION

In conclusion, this study provides preliminary evidence for the potential efficacy of the magma13 in improving both subjective and objective measures of sleep quality. The observed improvements in participants' sleep satisfaction, recovery scores, and physiological parameters such as heart rate variability suggest that the magma13 may offer a promising non-pharmacological approach to enhancing sleep quality and overall well-being.

The consistent positive trends across various sleep metrics, including subjective feelings of restfulness and objective measures of sleep, indicate that the magma13 LifeBion could be a valuable tool for those seeking to improve their sleep. Participants reported feeling more refreshed upon waking and experiencing better daytime functioning, which aligns with the device's intended purpose of creating a more coherent sleep environment.

While these initial findings are encouraging, they also point to the need for further research to fully understand the potential physiologic effects of the magma13. The magma13 LifeBion offers a promising option for individuals looking for sleep solutions, particularly those interested in non-invasive, technology-based approaches. As sleep quality continues to be a significant concern for many individuals, innovations like the magma13 LifeBion represent an option for strong improvements in this critical aspect of health and well-being.

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