EFFECTS of GUM CHEWING on ESPORTS PLAYERS
Technical Report
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Brett E. Shelton
Boise State University

Short Description: Previous studies have indicated a link between chewing gum and reducing stress due to the physiological release of certain hormones. Additionally, at least one recent study has indicated heightened anxiety and stress related to competitive esports play. The study's goals were to examine the relationships between chewing gum and playing esports, with a focus toward anxiety reduction and gaming performance. Results include statistically significant results post treatment with regard to reduced anxiety and player perceptions of increased performance and confidence in their skills. Age, gender and gamer level were not contributing factors.

Keywords: gaming, gamification & simulation, performance support & improvement, esports

Abstract:
Previous studies have indicated a link between chewing gum and reducing stress by way of the physiological release of certain hormones (Sasaki-Otomaru, 2011). In parallel, at least one recent study has indicated heightened anxiety and stress related to competitive esports play (LeNorgant et. al, 2018). Here, we present the results that examined relationships between chewing gum and playing esports, with specific attention to which characteristics of players may be influenced by chewing and the results on anxiety reduction and gaming performance. Because strong links have been established between learning and STEM-related outcomes for esports activities, a better understanding of how secondary activity (such as gum chewing) helps provide insight into performance support and improvement (Anderson et. al, 2018).

Original Research Questions:
1. What effect does chewing gum during esport gaming have on self-reported stress?
2. What effect does chewing gum during esport gaming have on confidence, and perceptions of performance?
3. Through exploratory analysis, what other findings may hold potential for further research and analysis? For example, are there gender differences between self-reported outcomes? Does the type or flavor of gum have any effects? Is there a difference between casual gamers and more serious gamers? Etc.

Data Collection

Participants for the study included recruiting 41 individuals with instructions to chew gum for a week that closely mimicked the research framework from Sasaki-Otomaru's 2011 study. Each participant, local to the area of Boise, ID, USA was provided with gum and instructions for participating along with an electronic letter of consent describing procedures and protocols of the study. The study was approved through the Institutional Review Board of Boise State University prior to any recruitment.

Participants began by completing a pre- and post- web-based survey set up to collect information on state- and trait-based levels of anxiety, as well as to establish a baseline for their current esports performance, enjoyment and confidence, and their regular chewing gum habits. Participants were provided with gum of a predetermined type and flavor. An oft-used instrument for determining anxiety levels, the STAI (State and Trait Anxiety Inventory) was the primary tool for comparing pre- and post-gum chewing anxiety levels (Spielberger, 1977). After one week of chewing at least 2 pieces of gum per day, they again responded to stress and self-efficacy questions. At the conclusion of the data gathering, participants received a gift card for $30. See the appendix for a copy of the pre- and post- questionnaire.

Analysis and Results

During initial investigation and discussions with the research team, the research question 1 was modified to: "What effect does chewing gum during esport gaming have on state-based anxiety?" because of the relationship to the original Sasaki-Otomaru study which used the STAI inventory as its basis. Research question 1 was addressed by compiling the state-based anxiety scores before and after the gum treatment, visualized via boxplot, analyzed using a paired t-test for normally distributed data for statistical significance, then by calculating an effect size. , The comparison of means for state anxiety scores, pre vs. post, revealed a mean anxiety score of 38.39 pre-test, and 35.17 post-test. This improvement, or reduction in state-based stress levels, was statistically significant with a moderate effect size, $t(40) = 2.82$, $p = .007$, $d = 0.44$.

Similarly, research question 2 was slightly modified based on more thorough discussion with the research team to: "What effect does chewing gum have on esports players' perceptions of performance, enjoyment and confidence?" Question 2 was analyzed through paired t-tests appropriate for normally distributed data and was calculated based on a self-reported rating from 1 to 10, with a rating of 10 being the highest. The pre vs. post performance measure revealed a significant increase with a moderate effect size, $t(40) = -2.37$, $p = .023$, $d = -0.37$. The enjoyment measure, while on average increased during the treatment week, was not statistically significant at .05 although it did have a moderate-to-small effect size, $t(40) = -1.78$, $p = .082$, $d = -0.28$. Similar to the performance measure, the self-reported confidence measure resulted in a significant increase with moderate effect size, $t(40) = -3.18$, $p = .003$, $d = -0.50$.

Research question 3 was introduced to see if any other demographic or theoretically important factors may have influenced the performance outcome after the gum treatment. It is noted that ending factors for enjoyment and confidence were influential with the performance outcome, unsurprisingly. A linear regression model was run on other categorical factors collected as demographic information. Only a single factor emerged as contributing to the model, that of "Future Likelihood to Chew." Factors that included gender, age, player skill level, and previous chewing habits did not emerge as significant. Refer to the R Studio output appendix, "Gum Study Analysis," for additional detail.

Interpretation

The result of question 1 is that there was a difference in anxiety levels pre- and post- treatment of gum chewing. One interpretation of the result is that chewing (more) gum reduced the anxiety levels of esports players.

The results regarding question 2 are that there was a difference in the players' perceptions for performance and confidence pre- and post- treatment of gum chewing. One interpretation of the result is that chewing (more) gum increased their performance and confidence while playing esports.

Further exploratory analysis addressed by question 3 revealed some interesting results that have potential for additional analysis. For example, all of the participants reported an increase in their daily chewing of gum over the treatment week, and none of the participants reported a negative effect on their perceived performance based on that increase. Only four participants reported having any more than a few technical or access issues during the week. Qualitatively, the effect sizes for increases in performance, enjoyment, and confidence are all worth consideration, especially in the realm of education research.

It is important to consider that factors of age, gender, and player skill level did not factor as contributing to increased performance after chewing the gum. One interpretation of this result is that regardless of age, gender, or ability, chewing gum may help increase performance for esports.

Some factors that could be potentially valuable to consider such as gum flavor, amount of gum chewed, and chewing duration, have yet to be explored. There also exist several possible limitations to consider, as a Hawthorne effect may have occurred (participants knew they were given chewing gum and being asked about their anxiety and performance). An increase in gaming performance could naturally have occurred at some level, given that the more esports are played, improving at those esports may naturally occur. While self-efficacy is a viable measure for one's performance, of which confidence, enjoyment, and self-assessment of skill are components, a more accountable increase in performance would be to measure statistics of the esports games played. Similarly, data collection of brain activity may be another way to measure stress, enjoyment, confidence and performance. Other mediating factors that could influence outcomes should also be considered.

The results of this study will further the general body of knowledge in understanding how chewing gum may impact psychological factors of competition. Specifically, it will help illuminate how alternative passive activity such as gum chewing may enhance focus, time-on-task activities, and state-based anxiety. It is our hope that with this work that we might foster further collaborations and investigations on how to better inform the perceived beneficial elements of various parallel activities with our collegiate esports players, and learning activity in general. The participants may also gain helpful insight into their stress levels and activities as a result.

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