



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Kate E. Jackson	Project Number J2113
Project Title Sustainable Play: Comparing the Safety of Renewable Alternatives to Commercial Playground Surface Materials	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project goal was to test if alternative renewable surface materials can perform as well as commercial materials in preventing playground head injuries. After researching the topic and choosing 4 renewable and 4 commercial materials, I hypothesized the effectiveness of each in preventing head injuries. Overall, I predicted that no alternative material would perform better than the best commercial material (rubber mulch).</p> <p>Methods/Materials I selected 8 surface materials to test (rubber mulch, wood chips, sand, pea gravel, cherry pits, pistachio shells, coconut chips, and straw). I dropped an 8 lb (3.6 kg) plastic skull containing an accelerometer from three heights [6 ft (1.8 m), 9 ft (2.7 m), 12 ft (3.7 m)] onto three thicknesses of surface material [3 in (7.6 cm), 6 in (15.2 cm), 9 in (22.8 cm)]. In total, I performed 216 experiments with three tests per combination. I recorded my results on an oscilloscope and transferred them onto my computer for analysis. I evaluated my results in peak g-force (deceleration of the skull) and HIC (head injury criteria). HIC is a way to access brain injury that takes into account the duration of the deceleration.</p> <p>Results The safety of the materials varied greatly depending on thickness and drop height. At 9 inches thick, the thickness the Consumer Product Safety Commission recommends, I was able to identify the best and worst materials. The top three materials were pistachio shells, cherry pits, and rubber mulch, and the bottom three materials were straw, coconut chips, and pea gravel.</p> <p>Conclusions/Discussion After comparing my results at 9 inches to my hypothesis, I concluded that my hypothesis was incorrect. My hypothesis predicted that the commercial rubber mulch material would be safest, with the alternative coconut chip material a close second. In my results, the two safest materials (pistachio shells and cherry pits) were renewable rather than commercial. Another way to analyze my results is to consider the safety of the materials at different thicknesses. For example, rubber mulch was one of the best materials at 9 inches, but at 3 inches it was one of the worst materials. On the other hand, cherry pits were one of the top two materials at all three thicknesses. Therefore, the answer to my project objective is a confirmed yes. Alternative renewable materials exist that perform better than commercial materials when preventing playground head injuries.</p>	
Summary Statement I constructed an experimental setup to drop a plastic skull containing an accelerometer in order to compare the safety of renewable alternatives to commercial surface materials for preventing playground head injuries.	
Help Received My father helped my understand the formula for HIC and assisted my with lifting the 8 pound skull during my experimentation.	