Introduction:
Calcium and vitamin D are underconsumed “nutrients of concern” in the American diet for all age groups (Dietary Guidelines Advisory Committee, 2015). Active calcium absorption occurs in the presence of vitamin D in the small intestine. Calcium and phosphorus from hydroxyapatite crystals to strengthen bones (Khaizi et al., 2008). Both calcium and vitamin D have been identified by The Dietary Guidelines for Americans 2015-2020 as nutrients of public health concern whole low intakes are associated with osteoporosis and other health consequences (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015). Calcium and vitamin D are featured nutrients on new, updated Nutrition Facts panel required on manufactured foods.

Methods:
We investigated the doses of calcium and vitamin D3 in commercial dietary supplements using the Dietary Supplement Label Database (DSDL) https://dldat.nlm.nih.gov. The DSDL is an online educational and research tool of The National Institutes of Health (NIH) developed jointly by The Office of Dietary Supplements and The National Library of Medicine. It is used by students, academics, and other professionals to access the nutrient contents of over 80,000 products sold in the U.S. Each dietary supplement listing includes full label-derived information from dietary supplement products marketed in the U.S. We accessed the database to search all calcium chews and calcium gummy dietary supplements between October 2018 and November 2019.

We first searched "supplements that contained calcium" yielded thousands of results, so we limited our search to only "calcium chews" and "calcium gummies." This search yielded hundreds of calcium-containing chews and gummies. We then eliminated supplements that didn’t contain "calcium" in the name of the supplement, for example, multivitamin mineral supplements that contained calcium were eliminated, and we retained only "calcium" or "calcium with vitamin D supplements." After combining like products, for example, different flavors of the same calcium chew and different sized containers of the same calcium chew, we had a total of 13 calcium chews and 17 calcium-containing gummies.

From this information, we developed our DSDL spreadsheet that contained information as follows:
- product name
- date that the product was entered into the database
- form, that is, a gummy or chew
- dose (how many gummies or how many chews were recommended as a dose)
- manufacturer
- calcium content in mg and vitamin D content in mcg or International Units (IU) (whichever value was given for the product). We then converted IU to mcg so that we could uniformly compare all vitamin D contents in the same unit of measure (mcg).

Presumably, at the time we collected the information, all products were available for commercial sale in the U.S.

Analysis:
We began by analyzing the recommended calcium doses in the 29 calcium supplements. The mean amount of calcium in the supplement doses was 422.56 mg for the gummies and 530.7 mg for the chews. A Levene’s Test was run and equality of variances between the two groups was supported. Figure 2 shows the analysis for the calcium content of calcium gummies vs. calcium chews. Because Levene’s Test yielded a significance of 0.986, we can assume equality of variance between the groups. However, the significance level for a two-tailed difference of means is 0.093. Thus, a statistically significant difference between the means cannot be concluded without an allowance of 8.3% error. Traditionally an alpha level (the present amount of error allowed) is 5%. If an individual takes the recommended doses for the sampled calcium supplements, there is not a significant difference in calcium content between gummies and chews.

Following this analysis, we compared the calcium content in the calcium chews, which sometimes varied from the recommended label doses. The chews averaged 436.5385 mg per unit while the gummies provided 202.4510 mg of calcium per unit. The difference between these sets of data appears much more pronounced than the labeled dosage comparison. In Figure 3, it is shown that the significance value for the t-test was reported 0.001. It can be stated with nearly full certainty that there is a statistically significant difference between calcium amounts in individual gummy and chew supplements.

Conclusion:
We analyzed 30 supplements, 17 gummies and 13 chews, for calcium content and for vitamin D content. Using independent sample t-tests, we found a demonstrable difference in calcium content between individual gummies and chews. When analyzing vitamin D content per individual gummy or chew, the data suggested that there was a difference in vitamin D content, but it did not quite meet the standard 0.05 level of significance.

There was no statistically significant difference between calcium or vitamin D content when accounting for the full recommended dosage. There is more calcium and vitamin D in a single chew than in a single gummy, however, if one takes the recommended dosage of calcium gummy or chew, there is no significant difference between calcium or vitamin D intake.

Future Research and Delimitations:
If this study were repeated, access to a higher number of calcium supplements would increase the sample size necessary to improve validity and potentially show a greater statistical difference between gummies and chews.

References:

