The effect of vitamin C on tooth growth in Guinea Pigs

Statistical Analysis Team

Main Questions

1. Does Orange Juice have significant impact than Vitamin C on the tooth growth?
2. Does the dose level (0.5, 1, 2 mg/day) significantly affect tooth growth?
3. Is there an interaction between delivery method and dose?

Data description

The ToothGrowth dataset examines the effect of Vitamin C supplementation on tooth growth in guinea pigs, measuring odontoblast length (cells responsible for tooth growth) under different dosage levels and delivery methods.

- Sample size: 60 guinea pigs
- Supplement: 2 supplement types (VC vs OJ)
- Dose: 3 dosage levels (0.5, 1.0, 2.0 mg/day)
- Length: Odontoblast length (indirect measure of tooth growth)

OVERALL TOOTH LENGTH STATISTICS

statistic	count	mean	std	min	max
tooth length	60	18.813	7.65	4.2	33.9

Interpretation

Interpretation:

- Mean (18.813): The average tooth length across all observations is approximately 18.81 units
- Standard Deviation (7.65): Relatively high variability indicates tooth lengths are quite spread out around the mean
- Range (4.2 to 33.9): Substantial difference between shortest and longest teeth (29.7 unit spread)

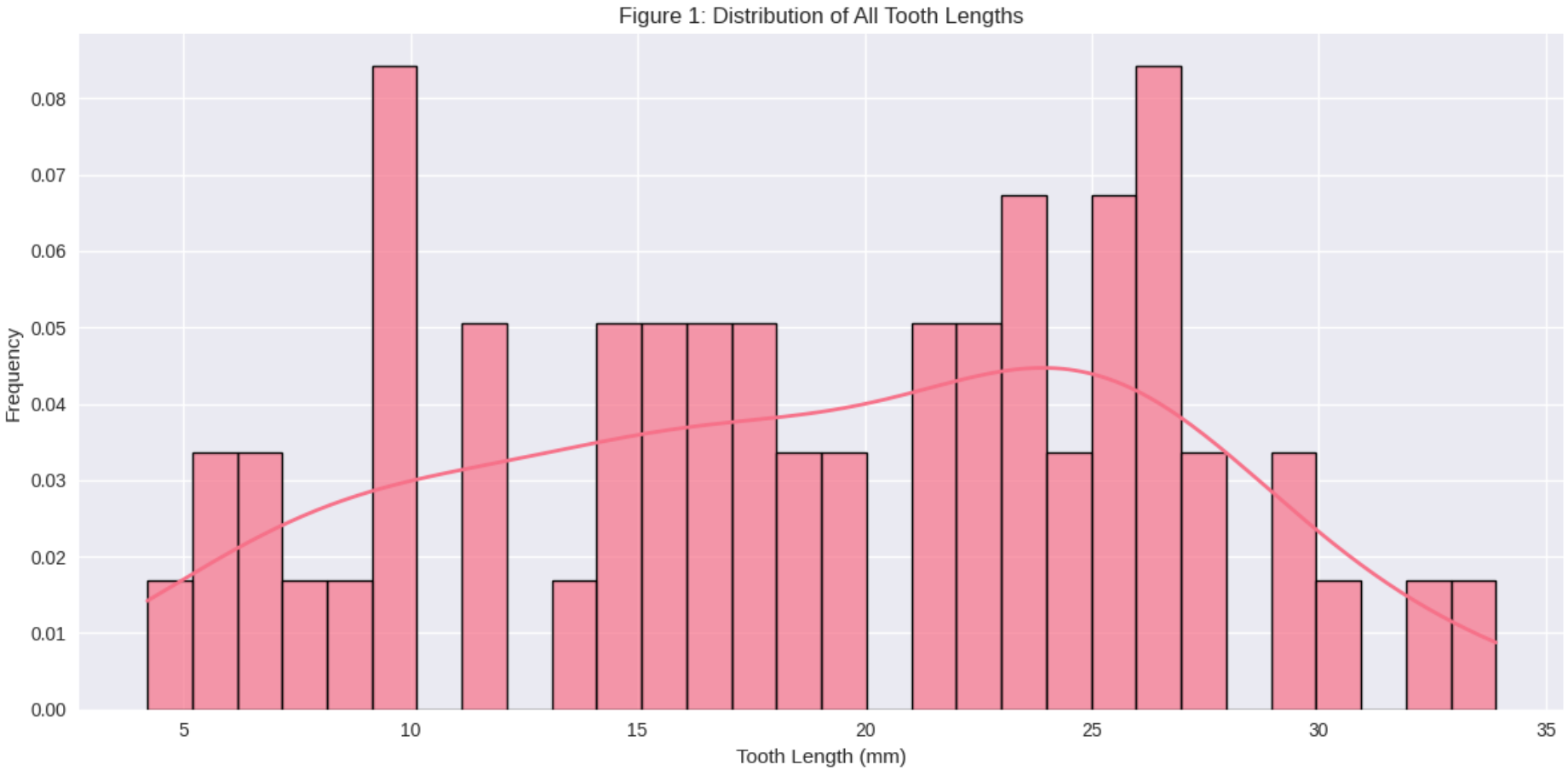
STATISTICS BY SUPPLEMENT TYPE

supp	count	mean	std	min	max	median
OJ	30	20.663333	6.605561	8.2	30.9	22.7
VC	30	16.963333	8.266029	4.2	33.9	16.5

Interpretation

Interpretation: Orange juice produces **longer teeth on average** (20.66 mm vs 16.96 mm) – a relevant difference of 3.70 mm.

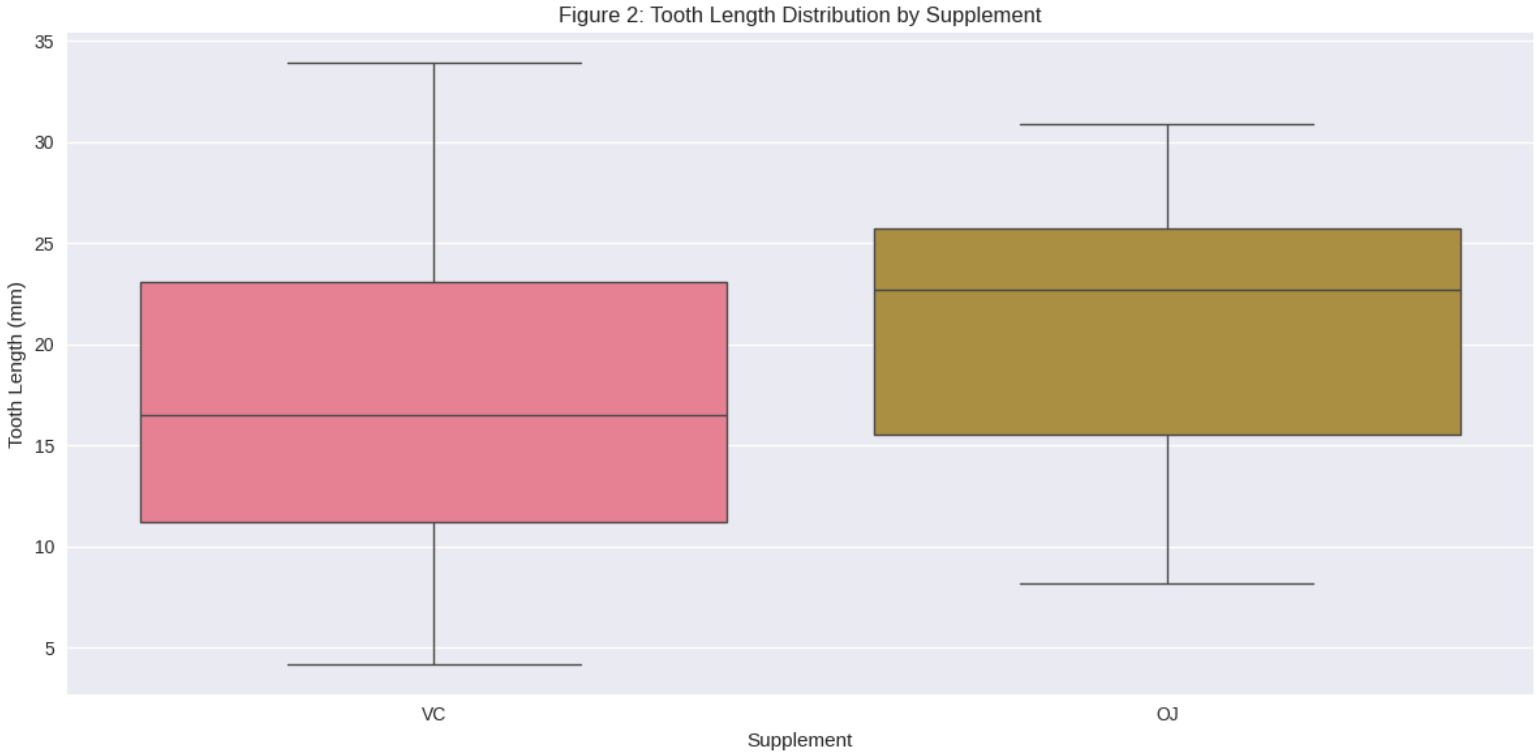
Histogram of Length



Interpretation

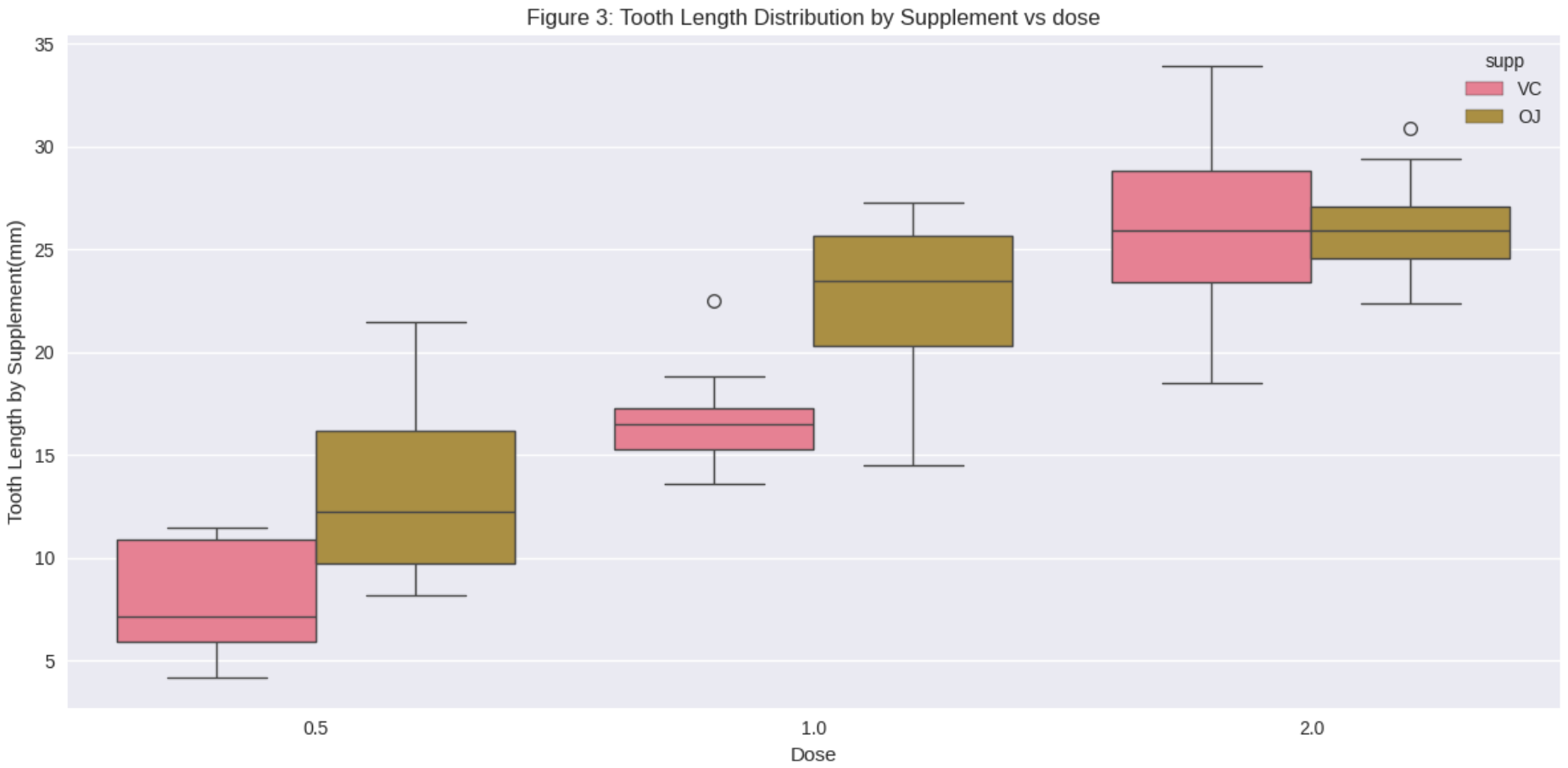
Values are highly spread out. But visually, we cannot compare to any known distribution.

Boxplot of Tooth Length by Supplement



- Box positions shift upward systematically with increasing dose
- At 0.5 mg and 1.0 mg, OJ boxes are positioned higher than VC boxes
- At 2.0 mg, OJ and VC boxes overlap completely
- VC groups show slightly more variability (longer whiskers)

Boxplot of Tooth Length by Supplement and Dose



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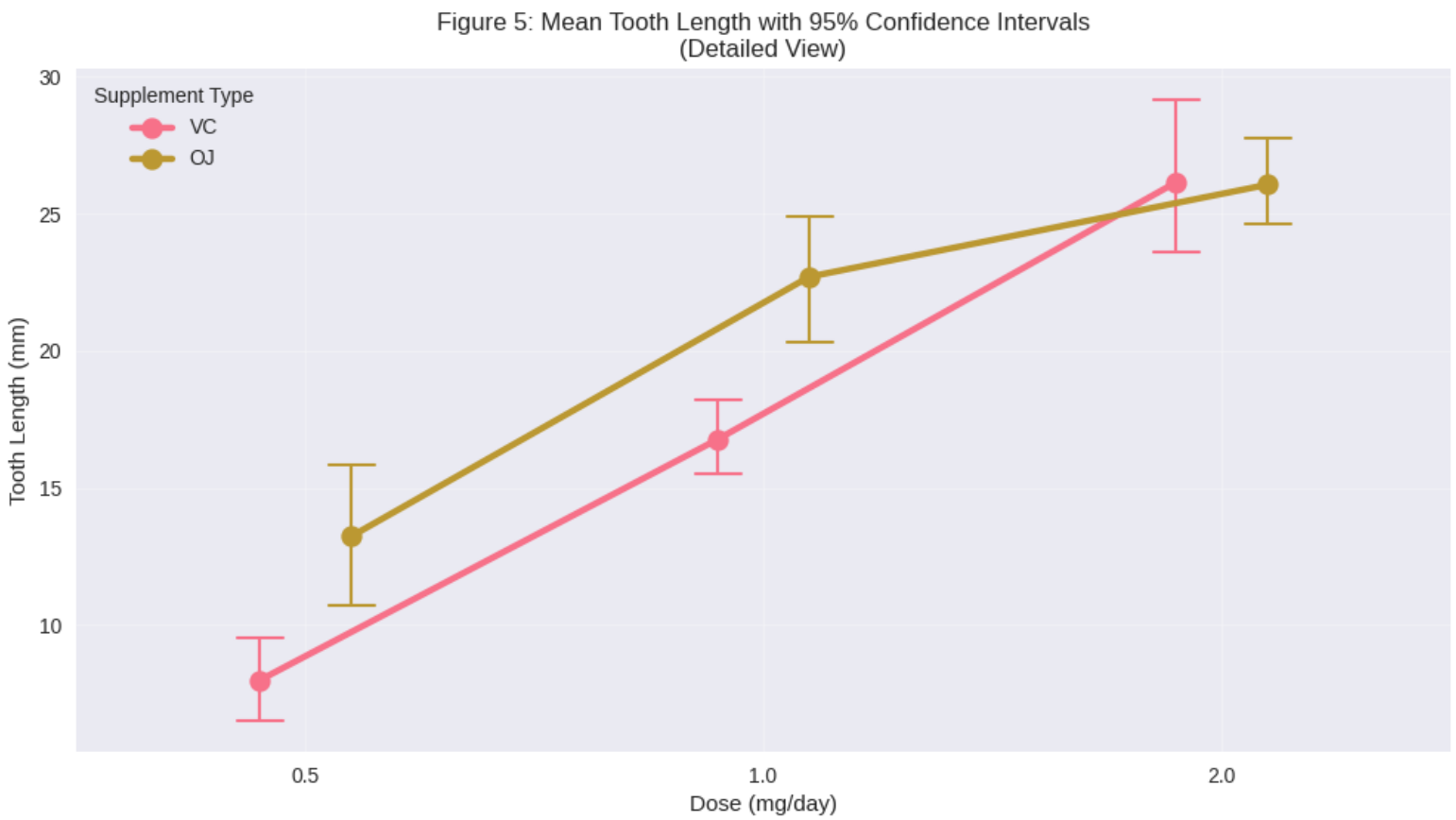

- Non-overlapping CIs: at 0.5 mg and 1.0 mg indicate statistically significant differences
- Overlapping CIs: at 2.0 mg indicate no significant difference

STATISTICAL TESTS

T-test for supplement comparison

$$t(58) = 1.9153, \ p = 0.0604$$

Interpretation

Since $p > 0.05$, we fail to reject that there is a difference between Orange Juice and Vitamin C in tooth growth. We observe that $p = 0.0604$ is close to 0.05. Therefore, it requires further investigation (for evidence).

STATISTICAL TESTS

T-tests at each dose level:

Comparison	t-statistic	p-value	Significance
0.5 mg: OJ vs VC	$t(18) = 3.1697$	0.0052	Reject
1.0 mg: OJ vs VC	$t(18) = 4.0328$	0.0008	Reject
2.0 mg: OJ vs VC	$t(18) = -0.0461$	0.9638	Fail to Reject

Interpretation

1. Low-dose (0.5 mg): Orange juice is significantly better
2. Medium-dose (1.0 mg): Orange juice is significantly better
3. High-dose (2.0 mg): Both methods are equally effective

Final Conclusions

- Orange Juice is generally MORE effective than pure Vitamin C, except at the highest dose where they are equally effective.
- The advantage of orange juice is most pronounced at lower supplementation levels.

Thank you for your attention!

Questions?