

Vitamin C titration

Lucia López Clavain

14-12-2020

Group E3

Omiria Euvripidou, Balázs Honfi, Euan Brown, Shelley McCall, Kieran Moorani-Smith and Lucia López

Aims

The aim of this analysis was to determine whether soya's milk and semi-skimmed cows' milk contain different levels of vitamin C.

Risk assessment for laboratory work

Overview

- Task: LSC101 - Calcium and vitamin C evaluation
- Purpose of work: to conduct a calcium and vitamin C experiment to compare animal plant milk
- Location of work: online virtual learning
- Who will be affected: cleaners, security and other Estates staff, visitors, contractors, students and researchers who may visit in the laboratory, and the person or people undertaking the work described here.
- Mandatory PPE: laboratory coat, safety glasses and gloves.
- Emergency contact: security (Extension 8008), Dr Scott Cameron (8530)
- Author: Euan Brown, Omiria Euvripidou, Balázs Honfi, Shelley McCall, Kieran Moorani-Smith and Lucia López.
- Date: 17/11/2020

Assessment

Hazard. Control Measures to reduce hazard. Level of risk.

Glassware: minimise risk of breakage by using glassware as instructed. Any breakages should be cleaned up by staff, and disposed of in broken glassware bin. Low

Chemicals: ensure proper PPE is worn at all times during experiments. Safety glasses should be worn at all times during these experiments, yourself and others may be working with the chemicals which could pose a danger. Disposal of all chemicals should be understood and followed.

Everyone should read this risk assessment and COSHH forms and clarify anything they do not understand before beginning work and signing the H&S declaration sheet.

No eating or drinking in the lab, and proper care taken to remove obstacles (chairs, bags etc...) and used equipment and chemicals when finished with. Anyone with allergies to nuts or milk should make the lecturer aware - and not sources will be removed from the experiment of the whole group. Low.

COSHH Form

Overview

LSC101 PBL Milk Analysis Labs

Online virtual learning

Cleaners, security and other Estates staff, visitors, contractors, students and researchers who may visit in the laboratory and the people using the chemicals might be harmed.

Emergency contact: security (8008) or Dr Scott Cameron / Dr. Sean Brown (8530)

Author: Ewan Brown, Omidia Euripidou, Balázs Hófi, Kieran Morani-Smith, Shelley McCall, Lucia López.

Date: 17-11-2020

Hazardous substances

Vitamin C

Substance. Form. Hazards. Quantity. Additional PPE. Level of risk

- 1% ~~starch~~ starch solution: liquid, no hazards. Safety goggles, 10ml.
- Iodine solution: liquid, eye irritant, 100ml, safety goggles and nitrile gloves. Low.
- Milk: liquid, irritant if ingested in lactose intolerance, nut allergies will be avoided by choice of non-nut milks. Safety goggles. very low. 100ml.

Calcium

EDTA: liquid, harmful if swallowed and inhaled. Causes serious eye irritation. May cause damage to organs through prolonged or repeated exposure. 100ml. Safety goggles and nitrile gloves. Low.

Patton-Reeder indicator: liquid, respiratory tract irritation and skin and eye irritation. 10ml. Safety goggles and nitrile gloves. Low.

0.1M and 2M NaOH: liquid, skin irritant and causes eye damage. 10mls, safety goggles and nitrile gloves. Low.

8M NaOH: liquid, skin irritant and causes eye damage, 10mls safety goggles and nitrile gloves. ~~low~~ Medium

2M HCl: liquid, corrosive to metals, skin corrosion. Specific target organ toxicity - single exposure to respiratory system, 100ml, safety goggles and nitrile gloves. Low.

All the substances's area of work is open bench.

Precautions

Use equipment properly, making sure it is clean and calibrated.

Do not overfill pipettes

Avoid ingestion of substances

Method. Vitamin C

25 mL vitamin C of standard solution was added to 125 mL Erlenmeyer flask

10 drops of 1% starch solution was added. The burette was rinsed with a small volume of the iodine solution.

The initial volume was recorded. The solution then was titrated for 20 seconds until it changed color.

The final volume of iodine solution was recorded. The titration was repeated until the results were 0.1 mL.

25 mL of juice sample was added to a 125 mL Erlenmeyer flask.

Iodine solution was titrated until the color lasted for more than 20 seconds.

Titration was repeated until three measurements agreed with 0.1 mL.

Calculations

Vitamin C semi-skimmed cow milk values (mL)

1 \rightarrow 1.3 2 \rightarrow 0.8 3 \rightarrow 1.6 4 \rightarrow 1.7 5 \rightarrow 1.7

(L) 1 \rightarrow 0.0013 2 \rightarrow 0.0008 3 \rightarrow 0.0016 4 \rightarrow 0.0017 5 \rightarrow 0.0017

Vitamin C solution average in 250 g = 17.1 mL = 0.017 L

Vitamin C soy milk values (mL)

1 \rightarrow 0.7 2 \rightarrow 1.5 3 \rightarrow 1.3 4 \rightarrow 1.3 5 \rightarrow 1.5

(L) 1 \rightarrow 0.0007 2 \rightarrow 0.0015 3 \rightarrow 0.0013 4 \rightarrow 0.0013 5 \rightarrow 0.0015

Semi-skimmed milk

Soy milk

$$\frac{0.0171}{0.250} = \frac{0.0013}{x}$$

$$x = \frac{0.250 \cdot 0.0013}{0.0171} = 0.0019 \text{ g/L}$$

$$\frac{0.0171}{0.250} = \frac{0.0007}{x}$$

$$x = \frac{0.250 \cdot 0.0007}{0.0171} = 0.0102 \text{ g/L}$$

$$\frac{0.0171}{0.250} = \frac{0.0008}{x}$$

$$x = \frac{0.250 \cdot 0.0008}{0.0171} = 0.0117 \text{ M}$$

$$\frac{0.0171}{0.250} = \frac{0.0015}{x}$$

$$x = \frac{0.250 \cdot 0.0015}{0.0171} = 0.0219 \text{ M}$$

$$\frac{0.0171}{0.250} = \frac{0.0016}{x}$$

$$x = \frac{0.250 \cdot 0.0016}{0.0171} = 0.0234 \text{ g/L}$$

$$\frac{0.0171}{0.250} = \frac{0.0013}{x}$$

$$x = \frac{0.250 \cdot 0.0013}{0.0171} = 0.0019 \text{ g/L}$$

$$\frac{0.0171}{0.250} = \frac{0.0013}{x}$$

$$x = \frac{0.250 \cdot 0.0013}{0.0171} = 0.0019 \text{ g/L}$$

Data analysis

The aim of this analysis was to determine whether soya's milk and cows' milk contain different levels of vitamin C.

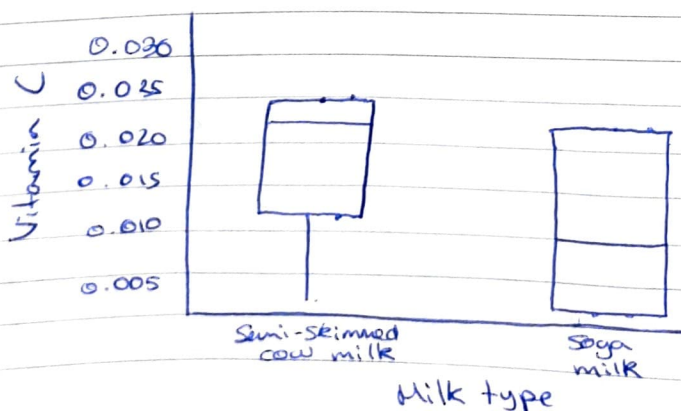
On average, semi-skimmed milk has higher values of vitamin C concentration. The two values of the mean are very similar, but they have a small difference of 0.0057.

The median of cows' milk is 0.023 and soya's milk 0.0102, they are not in the centre of the box. (Figure 1)

There are some outliers in semi-skimmed cow milk (0.0002) as indicated in the box plot, which ~~are~~ ^{is} far away from the boxes. This means that the data might not be normally distributed. (Figure 1)

The box plot also show us the results ~~are not~~ ^{might not be} normally distributed because in soya milk the box are almost symmetrical (the bar is cutted in the middle) but for the cow milk is not the same. (Figure 1)

Dispite this, p values of both kinds of milks are above 0.05, meaning that our data is normally distributed. From shepiro-wilk test $p(\text{semi-skimmed}) = 0.121$ and $p(\text{soya milk}) = 0.112$



An independent samples t-test will be used to test for a relevant difference between the levels of vitamin C in cows and soya. The ~~hypothesis~~ hypothesis is null because we can observe in the Q-Q plot that for both kinds of milk the plots are linear, so the data is normally distributed.

The level of vitamin C in semi-skimmed cow milk and soya's milk is significantly different ($t(8) = 0.397$; $p = 0.005$). On average cows milk contains 0.00640 mg/L 95% CI ($-0.00903, 0.0205$) more ~~than~~ than soya milk. The data are distributed according to a Shapiro Wilks test ($W(10) = 0.887$; $p = 0.393$) and the normal Q-Q plot is linear suggesting a normal distribution (Appendix A). This satisfied the assumption of the t-test and the result is valid.

Discussion

Semi-skimmed cow milk contains more vitamin C than soya milk in this experiment. However, only a small sample size was tested. Also the levels of vitamin C may vary between each breed of animal, seasons and diet so further studies are required to cover this limitations.

Limitations and Solutions

The experiment could not be done in the laboratory because of covid-19. We were not able to test it in a bigger scale to gain more precision in the results. Also, the quality of equipment ~~we~~ could have affected the accuracy of the results.

The solutions could have been using social distance in the laboratory for the group work. A bigger variety of data and to ~~check~~ check equipment performance before the experiment.

Final discussion

We expected for cow milk to have more vitamin C than soya milk. The experiment has confirmed this hypothesis.