ESTIMATION OF AMOUNT OF CALCIUM PRESENT IN VARIOUS MILK POWDER SAMPLES BY COMPLEXOMETRIC METHOD

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Abstract: *Calcium is an essential component in the production of enzymes and hormones that regulates digestion, energy and fat metabolism in the human body. Besides this, calcium is responsible for the construction, formation and maintainance of bone and teeth. This function helps reduce the occurrence of osteoporosis. A lot of food sources contribute as sources of calcium such as grains, nuts and seeds, seafood as well as milk products and vegetables. Thus in order to determine the amount of calcium a human body requires for consumption it is very essential to know the calcium content present in the given food. Milk powder serves as an alternate source of milk and calcium content. Therefore it is important to know the amount of calcium present in the given food item. The main aim of this paper is to calculate the amount of calcium present in three different milk powder samples by using complexometric method. The maximum calcium content present was found to be 11.2% sample **1**. This method is most commonly used for the determination of calcium present in the various samples as well as to determine the purity of the drinking water.*

Keywords: *calcium, milk powder, osteoporosis, complexometric method*

1.0 Introduction- Calcium is known to be one of the most important elements present in the earth's crust. Calcium present in the human body makes up for about 1-2% of the total body weight. It is considered to be a very important element in our diet because of its essential structural component present in bones, teeth and soft tissues. Besides these, calcium along with potassium it is vital in the functioning of the human body's metabolic processes such as to regulate the permeability and electrical properties of cell walls, which in turn are used to control muscle and nerve functions, glandular secretions and most importantly serves in blood clotting. Moreover, calcium is very essential to maintain three important regulations in the body such as PTH, Vitamin D and calcitonin. Low levels of calcium in the body leads to hypocalcemia, thereby causing the gastro-intestinal tract to increase calcium absorption from foods, whereas, in some instances it causes the kidneys to excrete more phosphorus, which indirectly raises calcium levels in the body. Vit-D plays an important role in maintaining bone health. Insufficient intake of Vit- D, which is mainly found in milk can cause severe health problems in both children as well as adults. These are known to cause severe bone deformities. It is well known that calcitonin (a hormone) released by the thyroid, PTH and other thyroid inner most glands lowers blood levels by promoting the deposition of calcium into the bones. The amount of calcium required by a human being every day is mentioned in the table given below.

Age of a child/adult	Amount of calcium required by the body (mg)
Birth-6 mths	210
6-12 mths	270
1-3yrs	500
4-8	800

9-18	1000
19-50	~1300
50 yrs & above	1300

Table 1: Amount of calcium required by a person each day

2.0 Need & Scope of work

Deficiency of calcium content causes a number of health problems such as bone fractures, bone pain or tenderness, loss of height over a period of time. Other diseases related to calcium deficiency are allergies, diarrhea, sinusitis, cold and flu, diabetes, ear infections, asthma, constipation, chronic fatigue, headaches, acnes, obesity, arthritis, anemia, gastrointestinal bleeding, arteriosclerosis and osteoporosis which is a type of bone disease. Osteoporosis typically takes place during old age. Women over 50 years are generally more susceptible to men. Many factors are known to influence calcium absorption in the body. For instance, lifestyle, exercise, dietary intake and pH balance of the gastrointestinal intact. There has to be an effective calcium absorption in the human body. *ie.* a person must remain healthy. This absorption generally takes place in the stomach. If the stomach produces either little or more acid, calcium remains insoluble and cannot be ionized which is very much required for it to be assimilated into the intestines. Proper levels of acid is needed so as to carry about a normal digestive process. If the acid level is not properly maintained it may cause serious loss of available calcium absorption into the body. Some of the key factors that affect calcium absorption leading to reduced stomach acid are poor diet, *ie* over-cooked food which causes poor intestinal health problems such as Crohn's disease. On the other hand mineral imbalance are also responsible for reduced stomach acid thereby affecting calcium absorption in the body.

3.0 Materials and Methods

Here in this work, the amount of calcium in milk powder samples were carried out by complexometric method. This method is not only cost effective but also one of the most reliable method with least time period involved in obtaining the result. The main aim of this paper was to calculate the percentage of calcium content present in various commercial milk powder samples.

1. **Materials used:** milk powder samples (everyday, nido nestle, gowardhan), HCl, EDTA solution, buffer, distilled water (DW). All of the materials were used without any further purification.
2. **Experimental procedure**

a) **Preparation of sample solution:** Weigh the given samples (1.5 g) accurately and transfer it to a clean dry silica crucible. Heat under a low flame for 10-15 mins. Transfer the ash into a 250 ml beaker. Wash the powder with conc. HCl and transfer all the washings to the beaker. Then add about 3 ml of conC. HCl. Evaporate the sample till it is dried completely. Repeat with about 5 ml of conc. HCl on a low flame. Add about 50 ml of DW. Heat the sample. Cool and then filter. Collect the filtrate

and washings in a 100 ml standard measuring flask (SMF). Dilute upto the mark with DW.

b) **Estimation of calcium:** Pipette out 10 ml of stock solution. Neutralize with 0.1N NaOH. Add about 10 ml DW and 5 ml of buffer solution and a pinch of EBT indicator. Titrate the solution against 0.02M EDTA. End point is from wine red to steel blue.

4.0 Results and discussion

Sample 1-Everyday Milk Powder

Solution in the burette: 0.02M EDTA solution

Solution in the flask: 10 ml of the diluted solution + 10 ml DW + 5 ml buffer solution

Indicator: EBT

End point: Wine red to steel blue

Observation table

Observation number	Initial reading (ml)	Final reading (ml)	Constant burette reading (ml)
1	0	2.1	2.1
2	0	2.1	2.1
3	0	2.1	2.1

Sample 2- Nido Nestle Milk Powder

Solution in the burette: 0.02M EDTA solution

Solution in the flask: 10 ml of the diluted solution + 10 ml DW + 5 ml buffer solution

Indicator: EBT

End point: Wine red to steel blue

Observation table

Observation number	Initial reading (ml)	Final reading (ml)	Constant burette reading (ml)
1	0	1.8	1.8
2	0	1.8	1.8
3	0	1.8	1.8

Sample 3- Gowardhan Milk Powder

Solution in the burette: 0.02M EDTA solution

Solution in the flask: 10 ml of the diluted solution + 10 ml DW + 5 ml buffer solution

Indicator: EBT

End point: Wine red to steel blue

Observation table

Observation number	Initial reading (ml)	Final reading (ml)	Constant burette reading (ml)
1	0	1.6	1.6
2	0	1.6	1.6
3	0	1.6	1.6

Calculations

a) **Sample 1**

Amount of calcium^{+2} present in the sample

1000 ml of 1M EDTA = 40.08g of Ca^{+2}

2.1 ml of 0.02M EDTA = **x**

Therefore x = 2.1 x 0.02 x 40.08/1000
= 0.0016833
10 ml of stock solution (y) = 0.0016833g of Ca^{+2}
Therefore 100 ml of stock solution = 10 y
= 10 x 0.0016833
= 0.016833
Amount of calcium^{+2} present in the sample = 0.16 83mg
% of calcium present in the milk powder sample = weight of calcium/weight of milk powder x 100
0.16/1.5 x 100 = 11.2 %
Therefore % of calcium present in the milk powder sample = 10.66 %

b) **Sample 2**

Amount of calcium^{+2} present in the sample

1000 ml of 1M EDTA = 40.08g of Ca^{+2}

1.8 ml of 0.02M EDTA = **x**

Therefore x = 1.8 x 0.02 x 40.08/1000
= 0.00144288
10 ml of stock solution (y) = 0.00144288 of Ca^{+2}
Therefore 100 ml of stock solution = 10 y
= 10 x 0.00144288
= 0.001442

Amount of calcium^{+2} present in the sample = 0.144288 mg

% of calcium present in the milk powder sample = weight of calcium/weight of milk powder x 100
0.144288/1.5 x 100 = 9.6 %
Therefore % of calcium present in the milk powder sample = 9.6 %

c) Sample 3

Amount of calcium^{+2} present in the sample

1000 ml of 1M EDTA = 40.08g of Ca^{+2}

1.6 ml of 0.02M EDTA = **x**

Therefore x = 1.6 x 0.02 x 40.08/1000
= 0.00128
10 ml of stock solution (y) = 0.00128 g of Ca^{+2}
Therefore 100 ml of stock solution = 10 y
= 10 x 0.00128
Amount of calcium^{+2} present in the sample = 0.128 mg
% of calcium present in the milk powder sample = weight of calcium/weight of milk powder x 100
0.128/1.5 x 100 = 8.55 %
Therefore % of calcium present in the milk powder sample = 8.55 %

5.0 Conclusion: Calcium content in different milk powder samples were determined by using complexometric method. From the results, it was observed that sample **1** had a higher concentration of calcium content present in the milk powder as compared to the other two samples. The advantages of this method is that they are low cost in nature and can be used effectively with accurate readings. It can thus be concluded that commercially available milk powders are safe for human consumption as they contain and provide the necessary amount of calcium needed.

6.0 References

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