

Association between the Use of Cosmetic and Breast Cancer: A Case Study

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OBJECTIVE

- The main objective of this work is to prove that use of cosmetics (Antiperspirants, Underarm cream) plays an important role for the cause of Breast Cancer in humans.
- The incidence of breast cancer, which is one of the leading causes of cancer deaths in women has increased over the past decades. Some of the factors associated with etiology of breast cancer include genetic predisposition, long term hormonal replacement therapy, and possibly modern lifestyle.
- Studies have shown that continuous use of cosmetics (antiperspirants, underarm creams) maybe linked to breast cancer development.
- Aluminum-based compounds are the active ingredients in antiperspirants. They block the sweat glands to keep sweat from getting to the skin's surface. Research has suggested that these aluminum compounds may be absorbed by the skin and cause changes in estrogen receptors of breast cells.
- In this research, some female breast cancer patients were asked about history of the usage of antiperspirants and underarm creams pre- or post-diagnosis. Two out of the subjects, 23-year old and 29-year old confirmed the use of these substances. The former added that none of her relatives have breast cancer, and that she is a tv-anchor, therefore there was a long term exposure to cosmetics)
- In conclusion, the use of these cosmetics may contribute to the rising incidence of breast cancer in young females and there is a need for creation of awareness on safe usage of this products due to their potential carcinogenic effect.

BACKGROUND

- According to the American Society of Cancer (ASC) Breast cancer accounts for 25% of the new cancer.
- The advancement in the technology has lead to the early detection of cancer either invasively or non-invasively but focus on the root cause for the cancer has comparatively reduced.

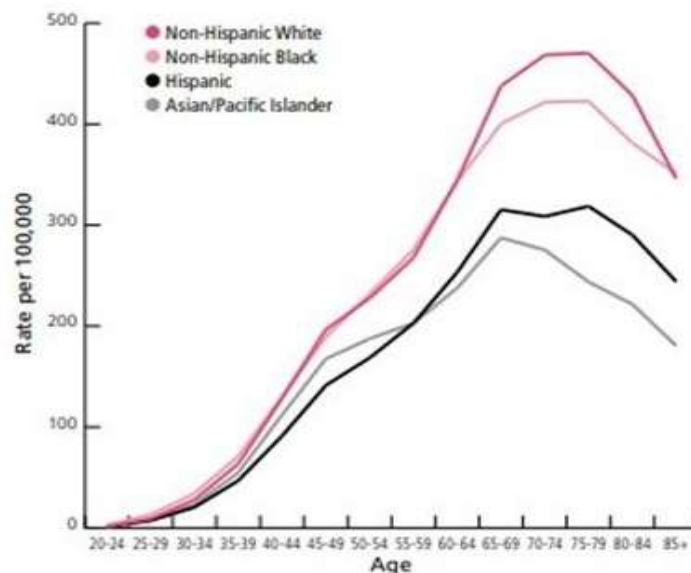


Fig 1: Age specific Female Breast cancer incidence, 2010-2014, US

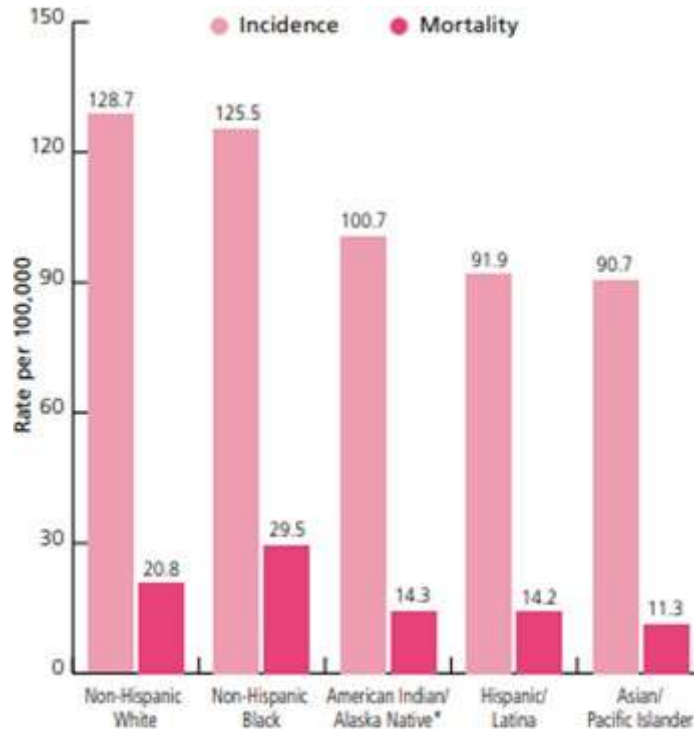


Fig 2: Breast Cancer Incidence with Mortality, 2012-2014,US

INTRODUCTION

According to the World Health Organization (WHO) :

Cancer is one of the leading causes of morbidity and mortality worldwide, with approximately 14million new cases in 2021.

The number of new cases is expected to rise by about 70% over the next 2 decades. Approximately 70% of deaths from cancer occur in low- and middle-income countries.

SURVEY OF 2015 (WHO):

SL.NO	CANCER	NO.OF DEATHS
1.	Lung	1.69 million
2.	Liver	788000
3.	Colorectal	774000
4.	Stomach	754000
5.	Breast	571000

Survey of 2018:



Fig 3: Depicts the most common cancers expected to occur in men and women in 2018. Prostate, lung and bronchus and colorectal cancers account for 42% of all cases in men, with prostate cancer alone accounting for almost 1 in 5 new diagnoses. For women, the 3 most common cancers are breast, lung, and colorectum. Breast cancer alone accounts for 30% all new cancer diagnoses in women.

SL.NO	CANCER	% OF DEATH
1.	Lung & Bronchus	25-26%
2.	Breast	14%
3.	Colon & rectum	7-8%
4.	Prostrate	9%
5.	Pancreas	7%
6.	Leukemia	4%
7.	Liver & intra hepatic bile duct	6-3%
8.	Ovary	5%
9.	Non-Hodgkin lymphoma	3-4%
10.	Esophagus	4%

These are the common cancer irrespective of the gender. And the percentage of death is according to the 2018 survey. The % of death indicates the necessary and the urge for its early detection and its treatment to reduce the mortality rate.

BREAST CANCER:

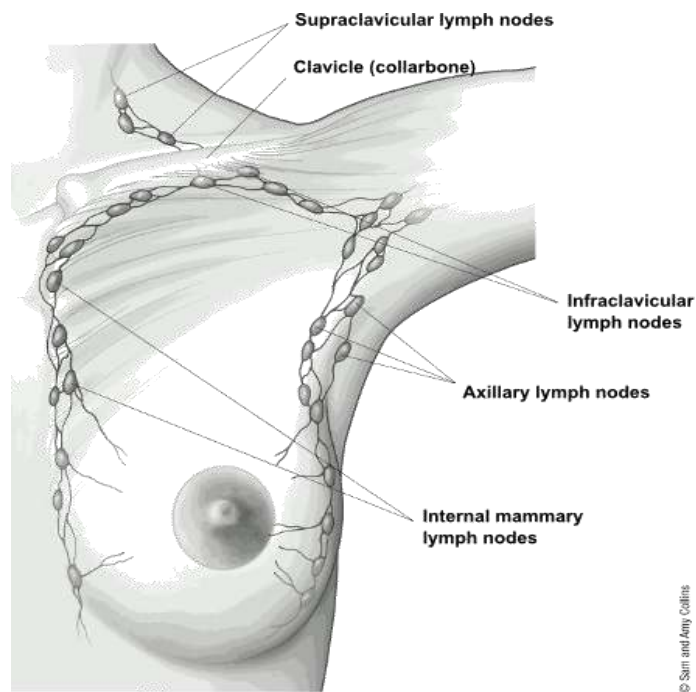
Breast cancer starts when cells in the breast begin to grow out of control.

These cells usually form a tumor that can often be seen on an x-ray or felt as a lump.

The tumor is malignant (cancer) if the cells can grow into (invade) surrounding tissues or spread (metastasize) to distant areas of the body.

Breast cancers begin in the ducts that carry milk to the nipple (ductal cancers). Some start in the glands that make breast milk (lobular cancers). These be the most common breast cancer.

A small number of cancers start in other tissues in the breast. These cancers are called sarcomas and lymphomas and are not really thought of as breast cancers.



Lymph nodes in relation to the breast

SPREADING OF BREAST CANCER:

Breast cancer can spread when the cancer cells get into the blood or lymph system and are carried to other parts of the body.

Lymph node: The lymph system is a network of lymph (or lymphatic) vessels found throughout the body that connects lymph nodes (small bean-shaped collections of immune system cells). The clear fluid inside the lymph vessels, called lymph, contains tissue by-products and waste material, as well as immune system cells. The lymph vessels carry lymph fluid away from the breast. In the case of breast cancer, cancer cells can enter those lymph vessels and start to grow in lymph nodes.

Lymph vessels in that drain into breast are as follow:

- Lymph nodes under the arm (axillary nodes)

- Lymph nodes around the collar bone (supraclavicular [above the collar bone] and infraclavicular [below the collar bone] lymph nodes)
- Lymph nodes inside the chest near the breast bone (internal mammary lymph nodes).

MECHANISM OF AL BASED ANTIPERSPIRANT SALTS

The AL salts in the antiperspirant when they are exposed the following mechanism occurs:

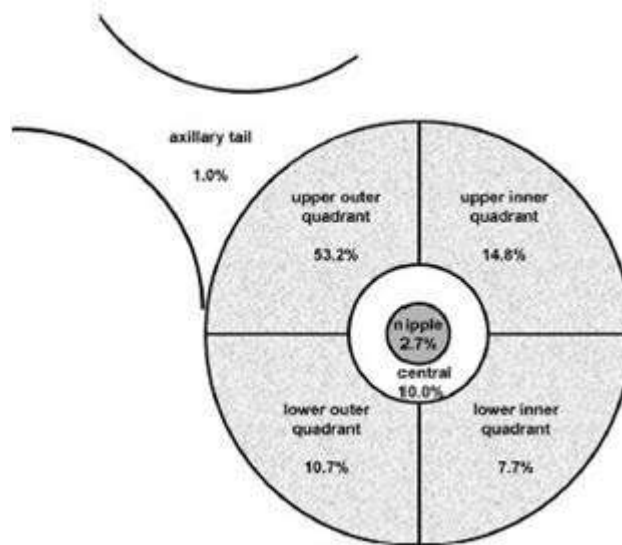
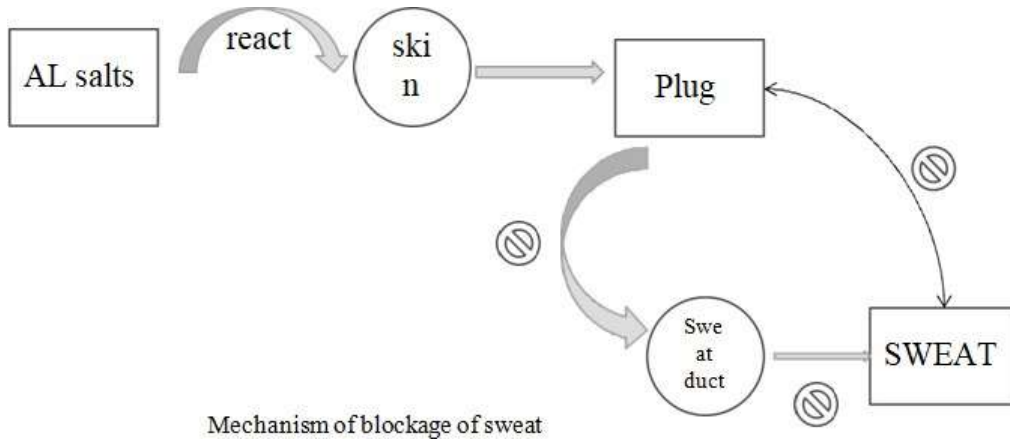


Fig 5: Seven regions of human breast –Cancer incident-European population.

Exposure to Antiperspirants

Long terms exposure to low dose can cause build up of Al in tissues such as breast.

In vitro studies by (Pineau et al.,(2012) showed the uptake of Al into human cells when using antiperspirants, during shaving)

Al Measurement in Human Breast

Al in the human breast cells are more when compared to the human blood (Darbre PD et al., (2013).

Al was measured at higher levels in samples from breast cancer patients than from women who did not have cancer at the time of sampling.

Al levels were higher from breast cystic fluid even.

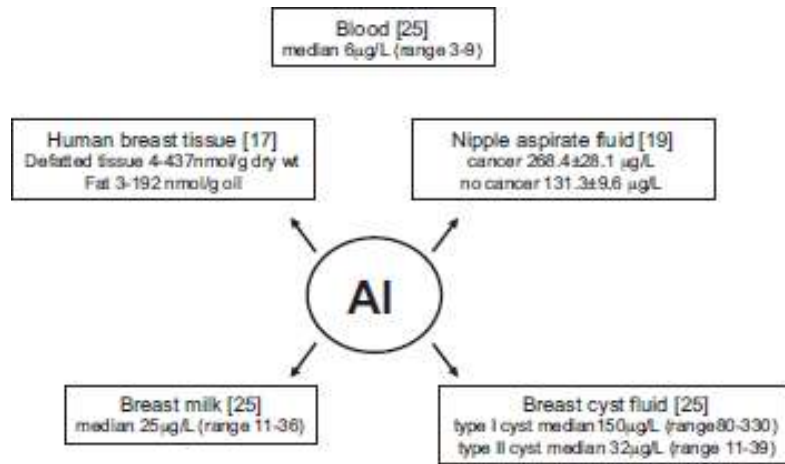


FIG 6: Al in human breast tissue

Al In Cyst Formation

Gross cystic fibrosis – common Benign disorder of breast.

There is a high chance of cyst formation due to the long term usage of antiperspirants as a result of absorption of Al in breast tissue.

Zirconium and Aluminium zirconium are mainly associated.

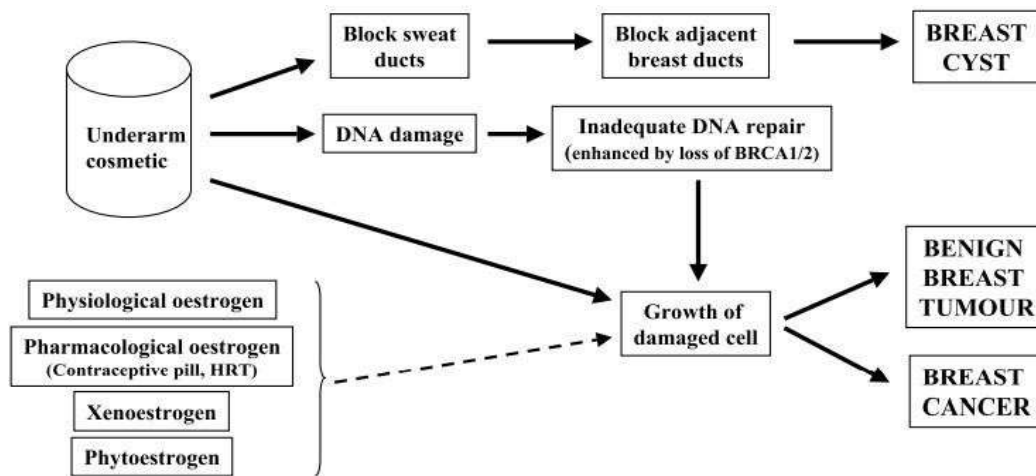


Fig 7: Ways by which underarm cosmetics may cause BC- Schematic Representation

AL – Hallmark of Cancer To Develop In The Breast CE

Hallmark describes about the alteration to gene expression and signaling path.

This leads to the molecular and cellular alteration observed in cancer cell.

Al is a metalloestrogen and oestrogen is a risk factor for breast cancer known to influence multiple hallmarks.

Exposure to Al cause genomic instability in human breast epithelial cells.

It is been reported that genomic instability in human breast is more in outer region than in inner regions of breast.

Local exposure to genotoxic chemicals in outer regions of the breast have been suspected as a major cause.

Antiperspirants are being used in this region and this result to the greater or higher amount of Al in outer breast tissue. The fundamental hallmark of breast cancer cell is that they undergo sustained proliferation.

It was found that Al to increase growth of MCF10A human breast epithelial cells.

Al is one of several metal ions, which have now been shown capable of binding to oestrogen receptors .

Inorganic xenoestrogens have been termed metalloestrogens.

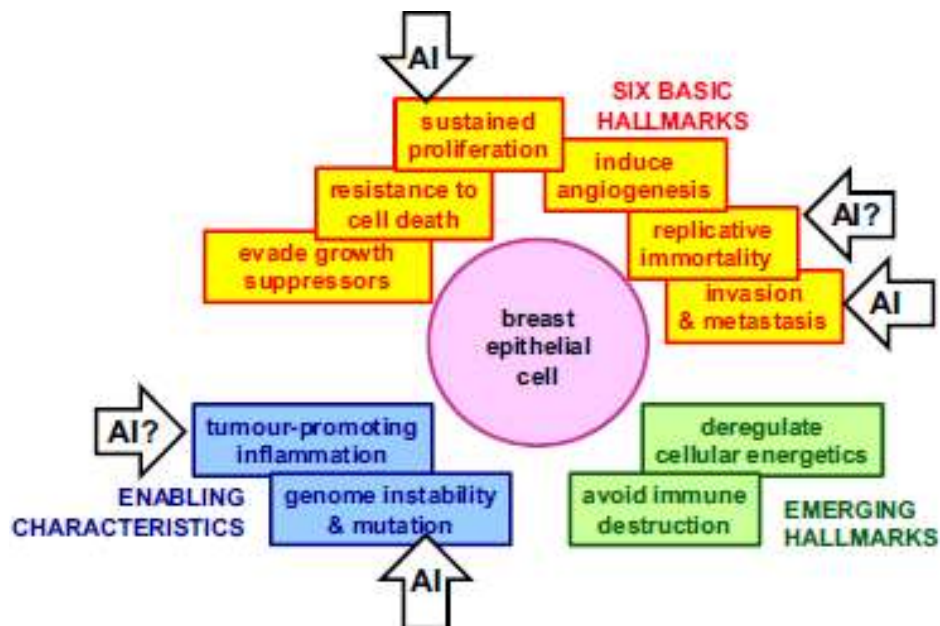


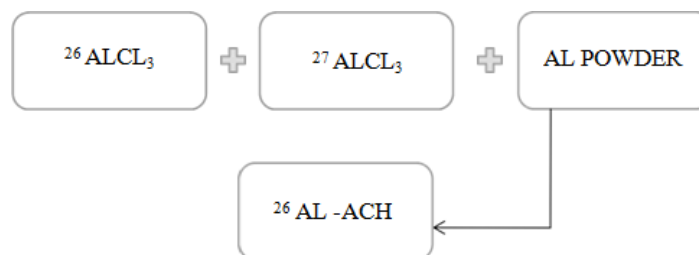
Fig 8: Hallmark of cancer influenced by Al in breast

Cell Al Absorbtion in the Human- A Study

In this study the Al absorption was estimated using the AMS (Accelerator Mass Spectroscopy) and Al isotope.

Particularly Aluminium-26-labeled aluminium chlorohydrate (ACH) was used.

PREPARATION OF ALUMINIUM-26 LABELLED ACH (ALUMINIUM CHOLOROHYDRATE):



The prepared ACH was applied on 2 volunteers (women's) and also on men's.

The subjects were not allowed to use any deodorants or antiperspirants for about 21 days.

2 days before the application of ACH the subjects were asked to use electric razors.

Then prepared ACH was applied on the skin and bandage was wrapped around that region after the application of ACH was dried.

The tape-stripping results provided that indicate that in the male subject at least 48% (in 6 days) and in the female subject at least 31% (in 4 days) of the applied aluminium was recovered from the skin surface.

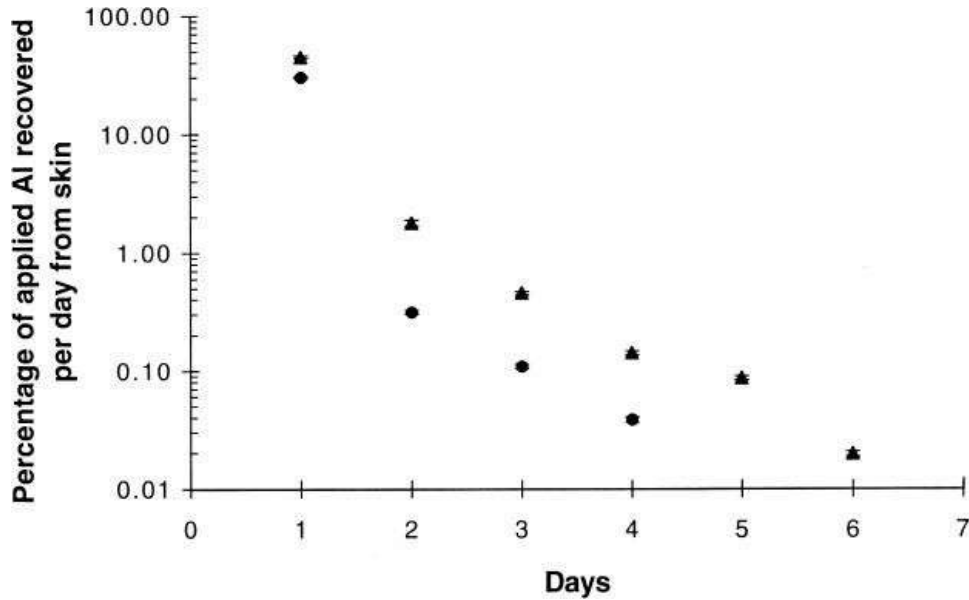


Fig 9: Amount of Al recovered from the skin surface.

The blood samples from the patients were also obtained.

It indicated that there was a considerable amount of Al presence in the blood, 6 hours after the application of the ACH.

It was also observed that the presence of the ACH in the blood stayed for a longer period of about 15 days.

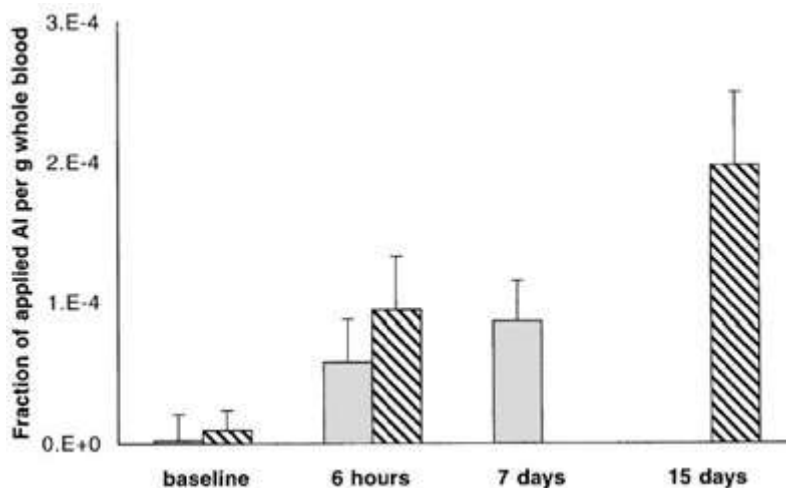


Fig 8: Concentration of Al in Blood.

Table 1: The amount of Al being absorbed and excreted

	Aluminium applied	Aluminium recovered from skin	Aluminium eliminated in urine	*Aluminium absorbed through skin
Male subject	13.3 mg	6.3 mg	1.1 µg	2.6 µg
Female subject	12.4 mg	3.8 mg	1.9 µg	4.5 µg
Average	12.9 mg	5.1 mg	1.5 µg	3.6 µg

From the table it can be inferred that one day application of underarm doesn't cause much of aluminum burden in the body. But Continuous use can have severe impact.

CONCLUSION

- After waxing or using Shaving cream the pores in the body is open and this procedure even leads to cuts and wounds in the skin.
- As a result these pores pave a pathway for the entrance of Al into the body.
- The age specification for antiperspirants or deodorants are not specified by all the companies and the usage of these products by the children's before adolescence is increasing.
- The Breast cells are susceptible to carcinogenic property before puberty.
- Thus it is important to create awareness for the safe usage of these products before puberty.

REFERENCES

- [1]. <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/breast-cancer-facts-and-figures/breast-cancer-facts-and-figures-2017-2018.pdf>
- [2]. Darbre, P.D., 2016. Aluminium and the human breast. *Morphologie*, 100(329), pp.65-74.
- [3]. Darbre, P.D., Mannello, F. and Exley, C., 2013. Aluminium and breast cancer: Sources of exposure, tissue measurements and mechanisms of toxicological actions on breast biology. *Journal of inorganic biochemistry*, 128, pp.257-261.
- [4]. Flarend, R., Bin, T., Elmore, D. and Hem, S.L., 2001. A preliminary study of the dermal absorption of aluminium from antiperspirants using aluminium-26. *Food and chemical toxicology*, 39(2), pp.163-168.
- [5]. Pineau, A., Guillard, O., Fauconneau, B., Favreau, F., Marty, M.H., Gaudin, A., Vincent, C.M., Marraud, A. and Marty, J.P., 2012. In vitro study of percutaneous absorption of aluminum from antiperspirants through human skin in the Franz™ diffusion cell. *Journal of inorganic biochemistry*, 110, pp.21-26.