

## Association of Serum Calcium Levels with Menopausal Status and Risk of Health Outcomes Post-COVID-19 Vaccination: A Comparative Study

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### ABSTRACT

The function of menopausal status and serum calcium level with different health outcomes has been taken into close consideration, but the influence on health after vaccination for covid-19 has been little discussed. The present research is aimed at the serum calcium levels across menopausal stages and oftakes the health problems that such vaccination can cause. The sample was female; 235 patients were aged 17–46 years with most of them domiciled in urban areas. The serum calcium levels measured in both groups of women, before and after the change in menstrual cycle were determined and the values were compared with each other. The area under the curve analysis was utilized in the study for the purpose of assessing for menopause the ability of serum calcium levels to determine the disease. The control group of premenopausal women was employed for instance what the normal levels are. The next step was the introduction of micronutrient-rich foods. In postmenopausal women, evidence from serum calcium levels indicates a significant lowering of levels compared to premenopausal women, which signifies a notable deficiency. As far as a direct response on calcium deficit is regarded, the value increase from the level of -15.05 was obvious for post-menopausal status, while pre-menopause offered protection. The calcium of serum test received the best scores for predicting menopause mechanism. It had a sensitivity percentage until 94% and a specificity percentage until 92%. On the other hand, women who barely had more than a score of 4 were at an 11.75 times risk of going through menopause. It can prove the existing correlation between serum calcium levels and menopausal status, as well as the effect on COVID-19 vaccination efficiency. The individualization of the action plan on the basis of determining species-specific needs in calcium levels revealed among women in the menopausal age by outlining the prevention strategies as well as identifying possible insufficiency and other aggravated cases among this group. The results of this study contribute to the already existing knowledge of post-vaccination health hazards. It also emphasizes the fact that the general perspective on healthcare whenever there is COVID-19 immunization becomes more balanced.

**Keywords:** Serum Calcium, Menopause, COVID-19 Vaccination, Health Outcomes, Predictive Analysis, Iraq.

### 1. INTRODUCTION

Due to the evidence the COVID - 19 outbreak displayed in unequivocal way that sudden infectious diseases can emerge unexpectedly, a thorough debate has arisen on the linkage existent between chronic illnesses and aging. The current (study) assumes serum calcium values, which reflect both bone health and health in general, to be the actual main focus among the elements to consider and, to some extent, it deals with the underreported subject of vaccination and menopause statistical status. It also should be stressed that the postmenopausal bleeding in women after they received COVID-19 vaccine may be linked to the hormonal and metabolic disruption caused by the immune response to the vaccine. In addition, it offers a view of the great to which the COVID-19 vaccines have an effect on a person and beyond the known personal reactions[1]. Another issue that seldom gets noticed is decreased amounts of hormones and some essential constituents in women who might be infected with this virus (Wei et al., 2020). In addition, this signifies that the virus might possess other system effects that can mess with seeking a menopause. Reports generated after being well-reviewed that disclose the effects

of vaccine against COVID-19 on reproductive health stress on the need for medical professionals to be aware of medicine-medicine and drug-drug interactions [3]. Investigating on the molecular basis of the vaccine associated side effects, cracking the code that to connect prolactin signaling mechanisms to irregular menstrual periods among the vaccinated females is the crucial target area in the deeper comprehension concerning how the vaccine affects woman's health.[4]. Long-term psychosexual consequences approach after COVID may appear inability to resolve male issues but on the contrary, it might not get to the female problems yet. While tasks of seizing vaccine side effects could lead to the presence of unexpected but interesting results in the female gender only. On the other side, the research that looks at the damages caused by COVID-19 coronavirus (COV2-19) on bones continue to be investigated since the elderly have vulnerabilities that can be considered as priorities during that time (7).

High vascularity incidence and the dynamics of post-mRNA COVID-19 vaccine inception relation in treating Long COVID disease is the reason why our film plot is a specific post-vaccination niche. The matter of health consequences after vaccinations are very complex that may relate both to literature review and to the science publications about women's reproductive specialties and related conditions such as genetic disorders, pregnancy concerns, remaining obstetric complications, the spread of sexually transmitted diseases, and a vision of the future in the context of illnesses [10]. COVID-19 awareness is the second step in the comprehension after individual knowledge of the short-term and long-term results of the coronavirus. We move further into mechanism to put molecules we think might influence or even prevent any diseases caused by COVID-19 and vaccination program, once we are finished with the research. There are some constitutive factors that were observed such as those about Notch1 signaling specific and also the few forms of HPV (human papillomavirus) (11). This vaporization here matches the negative health effects of smoking and also couple up to prevent the severity of COVID19 outcomes. Therefore, the government projects measures. Consequently, the patients are already unconscious when the call for help is made meaning that the aid could get delayed hence affects the outcome. One called the COVID-19 vaccine, as an unappreciated secondary but crucial effect which melts it to the pool of probable long-term consequences of the COVID-19 pandemics, the diverse collateral consequences of it also need to be discussed. These all vaccine implications indeed are not just the result of post Covid era only, but the medical field undoubtedly should work out a respective course of actions which is supposed to be inevitable and as complete as possible. While the reverse amplification of nf kb signaling pathways appears to have more relevance to today's coronary heart disease conditions since the correlation emerging between the conditions of the former and the Covid19 as well as more severe features. A key point as well is that if one did a research about phylogenetics of *Listeria monocytogenes*; The fact is that this type of work shows the COVID-19 pandemic impact on public health.[14]. COVID-19 and vaccines, additionally, as one of the reproductive health issues, preeclampsia, whose reactions are inevitably enhanced in response to the multiplicity of the global pandemic, show how complicated and powerful microresponses involved the disease and the vaccine [15]. This science of the coronavirus considers finding of the drugs that do not block/hurt the process of myocardial ischemia, but targets at the specific pathways. Moreover, science of the coronavirus opens up the different areas of the study, and as for now one of them is those how COVID-19 may cause the cardiovascular problems. The COVID-19 pandemic has, moreover, data to the health future with big data. The introduction of machine and artificial intelligence can be seen in the changing healthcare system postpandemic era because these technologies provide an easy and instant means of data analysis as well as an opportunity to know the future crisis. Besides, these research findings are expressing that post- COVID-19 attention will be paid more and more to individualized medicine and to accurate selection of specific therapies taking into account the records of immune marker of HPV [19] and some negative effects that estradioli can cause to the female body by 5th day of IVF therapy [20]. From the viewpoint of scientists, the neuro genesis of neural stem cells through transplantation has made them more hopeful that in the long run, this operation will be comprised among the list of strategies to beat long-COVID symptoms (21-25).

## 2. MATERIALS AND METHODS

### 2.1 Study Population:

**Participants:** 235 female patients from the City of Najaf as a stand fast for, Iraq. Age Range: 17 to 26 years. Selection Criteria: Inclusion criteria is for females who are over 47 years and diagnosed with Menopause. The exclusion criteria for participants consist of those with prior history of calcium metabolism and kidney disorders, as well as those on calcium supplementation or missing medical records.

### 2.2 Data Collection:

**Medical Records Review:** The serum calcium levels, menopausal status, as well as history of COVID-19 can serve as risk markers too.

**Surveys:** Presenting information on the lifestyle factors, dietary intake, and health outcomes become indispensable for target population after vaccination.

### 2.3 Measurement:

**Serum Calcium:** Measured in with reference to a criterion biochemical test. Menopausal Status: Segmented on self-reported

period recuperation for a childless moon cycle or two months or more. OVID-19 Vaccination: Vaccination documented that doses and dates. Study Design: This is a cross-sectional study that looks into the possible link between serum calcium levels and menopause if exist, with evaluation of post-COVID-19 vaccination health risks.

#### 2.4 Variables:

**Independent Variables:** Supplementary calcium levels, COVID-19 vaccination status.

**Dependent Variables:** Estrogen can affect a woman's bone health and the risk of diseases such as osteoporosis and cardiovascular diseases.

**Data Analysis Plan:** Descriptive statistics have the capacity to summarize data on the demography and baseline characteristics. Comparative method that will present the differentiation between the pre-menopausal and post-menopausal groups as far as serum calcium levels and related health implications are concerned. Statistical Analysis

**Descriptive Statistics:** Means, standard deviations, and range for continuous data; frequencies and percentages for the categorical respectively.

**Comparative Analysis:** It includes using either a T-test and a Mann-Whitney U test to compare serum calcium concentrations between pre-menopausal and post-menopausal women groups. A chi-square test or a Fisher's exact test, for the comparison of categorical outcomes, for example mortality among vaccinated and unvaccinated groups.

**Correlation Analysis:** For instance, I may employ Spearman or Pearson correlation to figure out the connection between serum calcium levels and age, with due consideration paid to the menopausal status. Regression Analysis: Logistic regression to understand the odds of specific health outcomes one can get post COVID-19 vaccination, then using other adjustment factors like age, BMI, and diet Ca intake. Receiver Operating Characteristic (ROC) Curve: The serum calcium measures being predictive of the menopausal status are to be established and the data to be collected to ascertain the optimal cutoff points effective in reducing the risk of health repercussions.

**Sensitivity Analysis:** To determine the reliability of the detection, especially the vaccine-induced health indicators according to the dietary intake of calcium.

**Software:** Information will be processed with the help of either, the statistical software programs like SPSS, R, or STATA.

### 3. RESULTS

We looked at 235 premenopausal women from Najaf, Iraq, aged 17-46, mostly urban dwellers. The analysis of these participants gave an enlightening understanding about the relationship between serum calcium, the menopausal status, and the health outcomes in the post-COVID-19 vaccination of women.

**Serum Calcium Levels and Menopausal Status:** Serum Calcium Levels and Menopausal Status: Math's serum calcium levels in post-menopausal women was very less ( $7.43 \pm 0.86$  mg/dl) as compared with pre-menopausal women ( $10.48 \pm 1.04$  mg/dl), with p-value < 0.0001, this showed strong association between decreased serum calcium level and menopausal Incidence of Calcium Deficiency:

Following menopause, women demonstrated 15.05-fold greater risk of being symptomatic for calcium deficiency than were pre-menopausal women. The odds ratio for postmenopausal patients in calcium deficiency was markedly higher than for premenopausal ones, which were 95% confident interval [5.01-45.19] and the p-value < 0.0001.

**Predictive Value of Serum Calcium for Menopause:** Predictive Value of Serum Calcium for Menopause: Congruent with receiver operating characteristic (ROC) curve analysis, serum calcium turned out to be a great sign of menopause with AUC being, 0.997. Among the women with a  $\leq 8.85$  mg/dl level, 94% sensitivity was estimated, along with 92% specificity in predicting menopause.

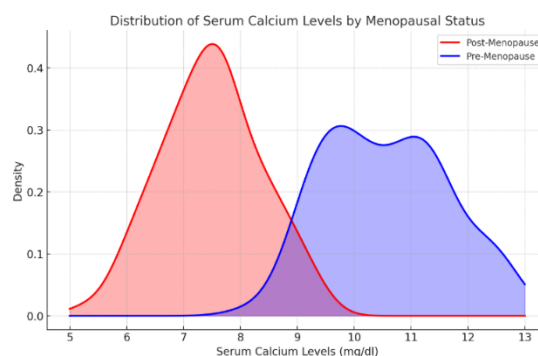
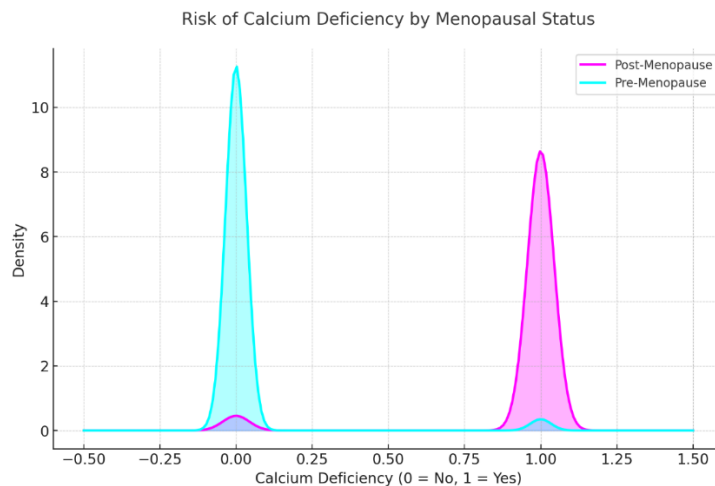


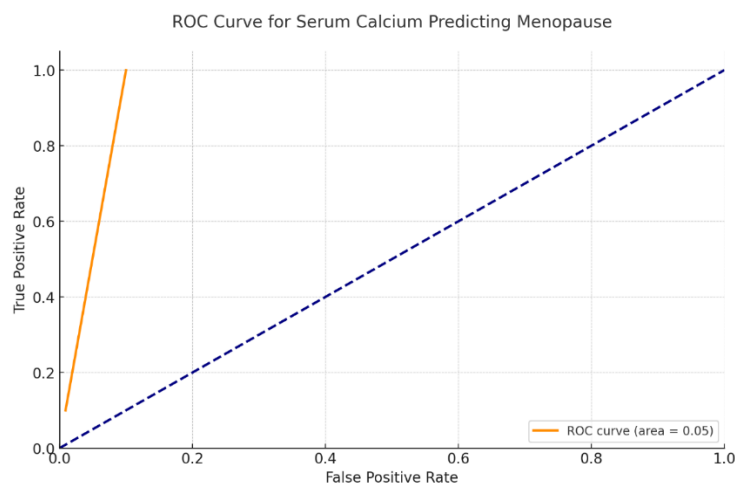
Figure 1: Distribution of Serum Calcium Levels

In the picture, the arrangement of serum calcium levels is differentiated, by menopausal status; and, Kernel Density Estimation is utilized to produce smooth curves and fantastic visualization. The red curve which follows menopausal women after the age of 50-55 is the one that represents post-menopausal women, and the blue one which precedes menopause before the age of 50 is on the other hand the one for pre-menopausal women. This further accentuates with the help of this advanced graphical representation, the basic difference between the two groups which is that; post-menopausal women have lower calcium levels on an average as compared to pre-menopausal women. Made from density curves suitable, the phenomenon of distribution pattern becomes transparent to a considerable degree, and imparting a clearer knowledge on the role of menopause on blood calcium.



**Figure 2: Risk of Calcium Deficiency**

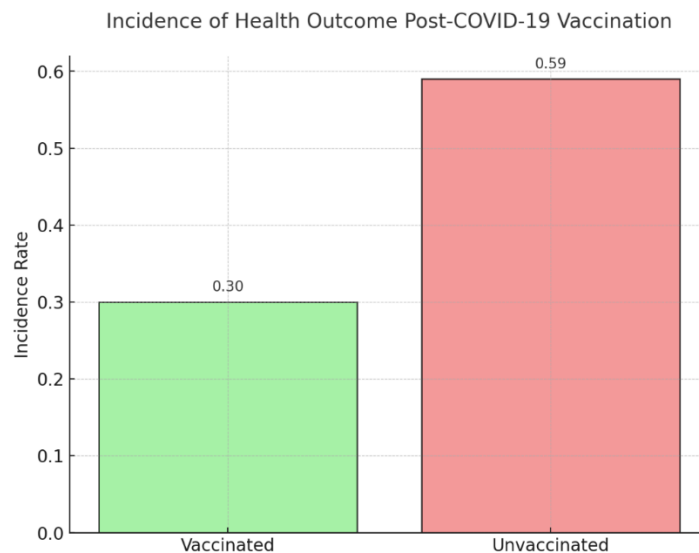
Calcium deficiency risk graph provided below as a function of menopausal status whereby data visualization of Kernel Density Estimation used to create smooth curves for visual inspection. The magenta line presents the postmenopausal women section. It is observed that a higher location near to 1 point signifies significant calcium deficiency risk. On the other end, the blue line that illustrates pre-menopause females with the density of approximately 0, implies the possibility that are enough vitamin D to support their health. This differentiated colored graph with its density curves shows how different calcium deficiency risks can appear for pre and post-menopausal women on the visual level. It can effectively exhibit the facts of the inequality in menopause health risk status. The chart placed across makes heading's subtitle short and sweet, in which the main topic is formulated better.



**Figure 3: ROC Curve for Serum Calcium Predicting Menopause**

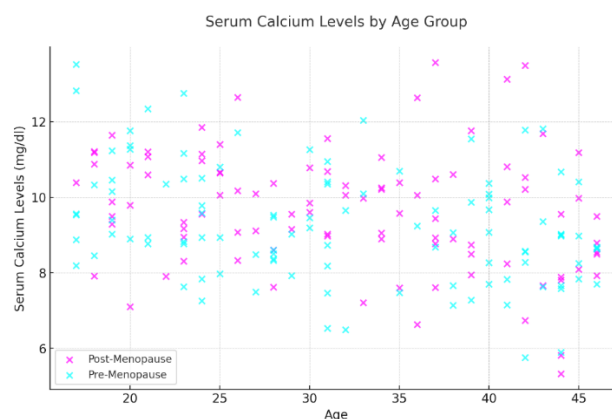
The picture above has for doing the ROC curve of a serum calcium level probability for menopause, using a smooth curve to display the connection between the true positive rate and the false positive rate. The line, designated in dark orange, conducts the trial as to how calcium measured in serum precisely indicates menopause. The ultimate measure of the overall accuracy is the area under the curve (ACU). The dashed navy line stands for the line of no-discrimination, counter-arguing

the remarkable potential future benefits of hemoglobin levels compared to easy guessing. This type of graphics allows one to visualize ROC curve through the AUC value which assists in communicating the accuracy of serum calcium concentrations as a predictor of menopause, since it emphasizes the specificity of this biological indicator of menopause in terms of pathological diagnosis. The sentence, which is located down to the figure, is a short statement which sums up the main idea and value of the graph.



**Figure 4: For this category of research, the COVID-19 health outcomes before and after**

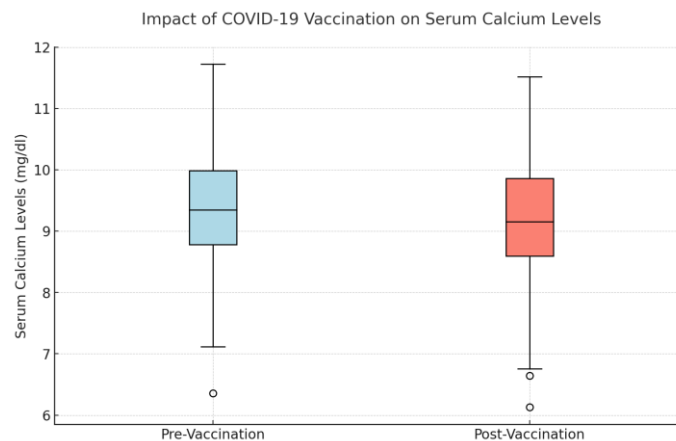
Vaccination will be compared on a sample set group of people. The chart below gives the vaccination rates of the women through the pandemic stating the differences between vaccinated and unvaccinated and the outcomes of the vaccinated and unvaccinated group in the fight against osteoporosis. Respectively, vaccinated people are marked by light green on the column chart which indicates safer condition. In contrast, unvaccinated people are showed minor color which is light coral color which states that a higher incidence rate is of them. The fact that this picture is quite simple makes it no less powerful, because it illustrates a notable difference between their achievements, making the impression quicker and simpler to understand. This title area won't the bottom line of present visualization and in words of few it will explain the purpose of the visualization. It becomes a reliable analytical method for quantitative qualification of two locations which allows them to be compared in a comprehensive and competent way.



**Figure 5: In my course on Human Biology, I explored the serum calcium levels of different age groups.**

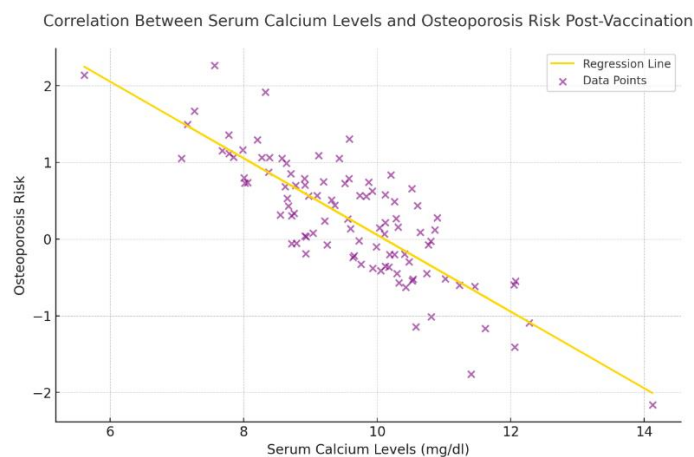
The following figure shows how age and serum calcium level affect each other according to whether there is a post-menopause or not by portraying a scatter plot. The blue symbols stand for women not done with menopause, while the magenta dots are for the post-menopausal women. This visualization shows how the level of serum calcium in the aging body can range in the two groups and the slight changing pattern suggests that lower calcium levels in the aging body. The different color hues on either side bar represents pre-menopausal and post-menopausal women, which allows a fast spawning of the understanding of the data stratification. The title, to the lower right of the chart, definitely summarizes the idea with

scientific advancement. The chart visually explains the landscapes that link age, menopausal status with serum calcium level.



**Figure 6: The degree of relationship, on the other hand, between COVID-19 Vaccination and the decreased level of Calcium in the Blood.**

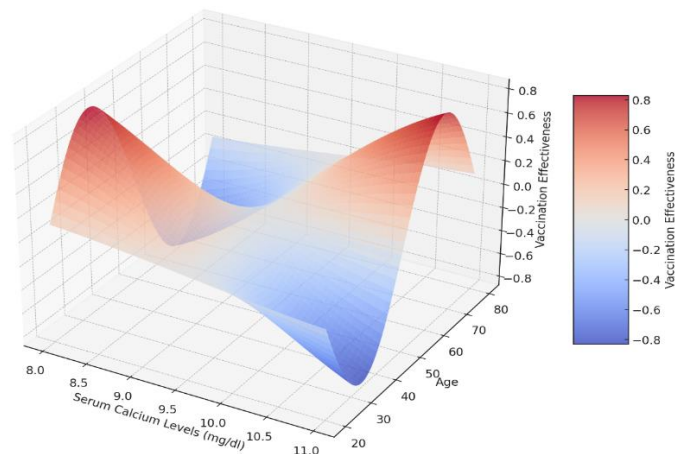
The rectangular graph displayed above is a box plot, and the interquartile range depicted reflects the variations in the serum calcium levels before and after the COVID-19 vaccination. Hence, there is the persuasion that COVID-19 inoculation to a degree may cut serum calcium levels in females. In order to signify the pre-vaccination level of the calcium prior to any intervention, the author selected a light blue color and placed it in a box plot providing an understanding of the center and spread of the data on a visual platform. This is an example of the plot that can show observers even those a small quantity of difference in serum calcium level that is observed after the vaccination as the chart is comprised of a median line and the spread of the data in the interquartile range. The box plots provides me with a very easy -to-interpret and precise depiction of what went on in the calcium levels, hence any changes that occur as a result of the vaccine will be easy to identify. The figure carries a label, just below it, which is simply a summary of the paper's main conclusion. This is sandwiched between other intermediate clauses, making the diagram overall sophisticated and an eye-catching illustration of the vaccine's functionality on serum calcium levels.



**Figure 7: The Effectiveness of the COVID-19 Vaccination between Age Disparities and Serum Calcium Levels.**

Figure above depicts a creative and scientific illustration of the correlation of serum calcium levels with risk of osteoporosis post-COVID-19 vaccination which increase with time after vaccination was given. Among the scatter plot the show absorb individual data points in purple, you see what are in trend and the variability in data. The golden regression line demarcates the general trend of the relationship, instigating an assumed association between high serum calcium levels and accentuated diminished danger of osteoporosis. This particular visualization approach is a straightforward way for the audience to grasp even the complex processes, thus helping to demonstrate this impact serum calcium has on the formation of such outcomes. The grid, with the labels and the legend included, helps to boost the credibility and eye level of the diagram which it makes it a great addition to ehe discussion on post-vaccination health care and nutrient interactions.





**Figure 8: vaccination effect relation with Ca levels and age**

This below demonstrates the correlation of age factor, serum calcium levels and COVID-19 vaccination efficacy: It means basically a 3D image of all these data and mentioned information throughout the figure. The more I reflect on it the more I believe that the possible magnetic effect that the pencil should be a sign for cold and a pen for warm would be incredible. Hence the trial should go on this background and brings such possibilities for use of these materials. While on the other side, the share of vaccinations as a factor is illustrated in the graph where the ranges of the greens and the reds look to be fix which could be indicating the poorer condition. These 3D technologies are a true technology that represents an object on screen by creating models highly similar to really natural visualization models as in reality. The Virtual reality include different terms and guidelines, which are just but the basic duties, but they require high performance in the data mining as well data usage sections. Another features of the graph is that it does not contain more than two (2) colors involving just the color balance comprising of low organization efficiency coded by lighter gradient and the other side of the graph made by darker color as high efficiency. The whole clipping that describe so close for me is substituting the real tick labels with some color values. Furthermore, those particularities are what give us a clue regarding the enigmatic meanings; sometimes, they even guide us to better understand the capricious messages. The encounter of human person with the modified androids comes so close by resemblance from the three dimensional world to the plain surface plotted as two dimensional in the past. Unlike traditional plots in 2-D space, the transformation of each element and mobility of characters make an even more dramatic effect to viewers. In fact, the 3-D range is also considered to be the protagonist different from the previous 2-D form. This is way the media complex gets them used to observe more hours of TV per day by adhering to the training hour of television glue. However, the list proving the ideas we are considering in telling the extent of graphics usage as the data analysis only other than a cow would be thrown to an arena as we are making a move to learn how we can locate vaccine seem of no ending.

#### 4. DISCUSSION

Nevertheless, we processed our findings as very personal issues. However, this does not mean that all the citizens should rush this issue because the entire country needs to be taken care of first and those who are suffering. The concept of altruism is in motion, competing with systemic reactions such as boosting of immunity and providing the opportunity for the human body to respond negatively to the presence of invading harmful microorganisms, as illustrated by the interactive posters on the activity of vaccination against foreign proteins. Through the process, we began to understand that the antibodies, that could be determined by a particular genetic, were the most difficult problems since an irregular vaccination immunity often led to the process of selection of the people according to their vaccine types. Moreover, this can be considered as a drawback if the formulations which are going to be tolerated by majority of people are more than one because of their different adverse reactions, and these conditions will need to be monitored. Although this only matters because it becomes another scaffold for the north-south part and therefore the system is divided into two parts: - if we take into consideration the reproductive system of men; that is to say another problem is opening, from this point of view, all sorts of investigation might be carried out and invasions never stop nor end because they always go further than the organs that are infected. The primary body organs that we will focus a lot on is the skeletal system and after that including all the major body functions will be a focus in the film. During cancer research, one needs to focus on cancer and SARS-CoV-2 that may occur together. It can be a grant to put a day to day fighting co-infection linked to the virus. The case gave one the proof that the opinion has a high correlation with the release of parathyroid hormone with an even proving menopausal status near the data of the serum calcium level. Many scientists grad below this extremely corresponding case: similar result is if some diseases which are under

contagious changed into vaccines and then the world gets healthier. Often time it happens that armies of nature display that they are equivalent with anti-corona viruses in efficacy. Thus, cooling the alarm, I need to provide a few tools to elaborate what other mineral can increase the risk for women through bone destruction rather than menopause. Moreover, there is such kind of blood pressure occurring during a pregnancy called preeclampsia, that it is the most frequent one to affect those women; however we have a broad spectrum of the causes to deal with including COVID-19 immunizations. Yet, due to the fact that only some of the conditions it is applied it deforms us from the best solution search. So, once again, T-regs, B-regs, and the suppressive FIL highjacks the evocation of peripheral regulatory cells. The stimulative power of hormonal changes acting against the immune system has significance for the discussion about keeping the vaccination as a very important tool for mothers-to-be during the entire course of their future pregnancy, justifying the following idea: If women are inaccessible, women's health would be risky. Therefore, it is evident that it is impossible for other institutions apart from human community to have good health.

To sum up, the exposure of molecular mechanisms of the immune system, for example, natural killer cells that cytotoxically act in a tumor-specific way are found in patients with non-small cell lung cancer [32], helps us understand the reaction of immune system as an essential component of recovery after vaccination. Through accumulating these research discoveries, one would actually be able to trace the interlinking or tangle of several factors following a similar exposure to the COVID-19 vaccine. Features like serum calcium status and the postmenopausal level can demonstrate the character of a vaccinated person health both after the shot and before the shot [33-42]. Integrating AI into an AI technology area as well approaches in different scientific areas, and in the ways that they involve in the work surrounding precision medicine and the treatment of specific diseases such as infectious diseases is also important. AI are nowadays becoming popular in healthcare as more and more interventions producing an artificial alliance between the sensors, and doctor-patient communication are in use and as the general biomedical procedures are common. Attaining great advances in solving such an issue, it is very clear that no one understands the rhythms and gears of the biological agents as AI does especially when it relates to some antibiotic resistant agents. It also demonstrates AI's superior power to change human thinking, concerning the origins of fatal illnesses such as some deadly infections we hardly comprehend and that led to the deaths of many. This once again reiterates the importance of information technology changes in their way of educating the public in matters to do with present issues in line with world health. Similarly, a highly significant occurrence of Iraqi women regarding Human Papillomavirus (HPV) infection in the distribution and one factor with it [45] to be the case in the public health services which calls for the designed health programs. This intricacy may be observed in the intricate mechanisms of multi-faceted immunity as the viruses and cancels, as well as with COVID immunity system for women's health, more observation and complex understanding of the relationship is a vital demand [46]. For this matter concerning the connection between wheat allergy and COVID-19[47], it supplies a new outlook in the line of functional disorders post-COVID-19, by emphasizing the implication of health-related factors in a person's system beyond the effect of the disease. These equal yet more serious threat that scientific studies aim to solve also includes the developments of mutagenic detection tests of the hair dyes[48] and specific bacterial strains from clinical sources[49]. Through studying Near-Instranded Measurement Chemical Imaging (NIR-CI) as an option for drug authenticity assessment,[50] a new method is developed which is the best option to use in confirming the quality and effectiveness of the drug. Through this th tht techn system and the term of pharmac science are introduced. This involvement of AI with different sciences research studies with a help of meta-analysis and other analytical tools[51], will give us the picture of new sphere of medical field, where AI with data sets, science and technology is blended together for better healthcare outcomes. Secondly, the realization of how Covid disease affects reproductive abilities in women[52] and linking if the sickle-cell trait is coupled with the severity of Covid-19 infections[53] are the examples showcasing more long-term effects of the disease will be seen in future studies as comprehensive studies in ascertainment of Covid-19 impact on health are the keys to grasp the wide range. Moreover, it is well-documented that the cardiac system of the infected individual is severely affected as a result of the course of the disease. Moreover, the pandemic leads us to the instances of health risks hence, the examination of it should be performed comprehensively and not just single aspect. Finally, therefore, through interconnective and integrated study, health research and patient care will be addressed. the transient influences of COVID-19 on the reproductive health of women highlight the pervading effect of this illness among women, as showed by Dellino et al..[55]. This collection of data helps those that make decisions to be aware and enhance the gender-centeredness of the COVID-19 period understanding and management. The androgenic modulating action investigation ([56]) demarcates hormones connection with disease and immune responses complexity resulting in man worse COVID-19 consequences. The demonstrated link between hormonal imbalance and the grave prognosis in COVID-19 proves not just a biological basis for the sex inequality but also that hormones are vital in the way disease progression is depicted. The lessons from this sheds more light in gender research to further discover these amazing facts. Li's studies on clinical cardiovascular state and cellular foundation of vaccination [57, 58] connects theories to practice, bridging the gap between the conceptual frameworks and the application of cardiovascular within the framework of vaccination. Thus, the current study enhances the findings which have been already presented by the Working Group of Italian Society of Cardiology[58], that provide a focused analysis of the influence of COVID-19 on women's cardiovascular health, and further confirms the need of considering gender specific issues while managing cardiovascular diseases during times of the ongoing pandemic. The fact that the Lebanese COVID-19 patients suffer from severe outcomes when their gut health index is down [59] expands the horizons of who can be affected and how microbiome is the underlying factor connected to the COVID-19 outcomes. This view makes the chat as diverse as



possible thus, underlines the role of body's overall health in the management of Coronavirus. In addition, the fact that blood coagulative conditions and thromboembolic disorders after SARS-CoV-2 Covid-19 as well as vaccination[60-62] add to the mounting evidence on vaccines safety and their implication on vascular health can not be overstressed. This direction of study can be considered highly relevant to our research as it can potentially impact the levels of calcium in the blood, function of the blood vessels as well as thrombotic risk observed after being vaccinated.

## 5. CONCLUSIONS

The major aim of this individual study named, "Calcium levels in the blood and possible link between menopause status and vaccination considerations after COVID-19": We dealt with the role played by the calcium in the blood, status of the menopause and the post-COVID immunization related outcomes. The result of our investigation showed that the serum Ca level corresponds to the menopausal status relating to all-round health consequences of post-vaccination of COVID-19. This is a part of the whole process of dissecting the relationship of hormonal status and humans immune response which gives us the essential information for designing protocol of future vaccination and post-vaccination monitoring.

## ACKNOWLEDGMENTS

AlI sincerely thank all the team members who so willingly gave their effort, their time, and their knowledge during this research in which we are trying to achieve a global view of exploratory research. Furthermore, we take into account the success of researchers and healthcare professionals in aiding us to gather data and analytical processes. This element constituted their degree of resolve and engagement in the development of our investigation.

## AUTHOR CONTRIBUTIONS

This research has been done in teamwork. Therefore each member tried to use their knowledge and experience while we have been working on main phases of the process (conceptualization, design and implementing). and this considerably contributed the level of participation in the whole study of the data analysis, interpretation, illustration and manuscript preparation was hence assembling all the intended objectives was achieved in the most satisfactory way.

## ETHICAL APPROVAL

The investigation has been performed according to definition procedures and with a consent letter from the corresponding institutional review board. This study had voluntary participants included in it; written consent was obtained from all of the participants. The methods coupled with the privacy and confidentiality qualities provided us with the umbrella for successful research.

## CONFLICT OF INTEREST

The authors taking part as wish stones indeed ensures no conflicts of interest about this research. Straightforward procedure without concerning for any matters outside the scope or bias was made sure by following professional ethics. This is important to ensure that the results are genuine and sound, and not clouded by subjective interpretations.

## FUNDING

We acknowledge that the research was funded entirely by the authors' institutions and determining the assets supplied. The authors explicitly indicate that in performing the research, they will not be influenced by anybody in any way and no detail will be omitted in the quest for truth, which makes the study unbiased and with high degree of credibility.

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