iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** VII **Month of publication:** July 2026

DOI: https://doi.org/10.22214/ijraset.2026.84313

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VII July 2026- Available at www.ijraset.com

XRF Studies of Low Z Elements during Plant Growth, Sprouting and Fermentation: An Experimental Study in the Context of Biological Transmutations

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Abstract: ***One of the most intriguing, contentious, and perplexing occurrences in both physics and biology is the biological transformation of elements. There are many proponents and even more opponents of this issue, which has been discussed numerous times in recent decades. In the current studies, the idea of transmutations was investigated using samples obtained from both short-duration (fermentation and sprouting) and long-duration (plant growth) biological processes in closed and regulated environments. The onset of biological process is the initiation of biotic life under the action of micro-organisms. Nutrient elemental alterations have been examined from the standpoint of transmutation in samples taken both before and after the biological process began. From these experiments and research, a calculated change in elemental composition for K, Ca and Fe over the duration of each experiment has been found.***
Keywords: Biological Transmutation, Sprouting, Fermentation, Plant Growth, Low Z elements, XRF technique.

I. INTRODUCTION

Biological life is well explained by chemistry, but certain processes are known to occur which are beyond the reach of chemistry and transmutation is one of those processes (Kervran, 1972).

Transmutation, the conversion of one element into another, is a nuclear process and involves a huge amount of energy. The biological transmutation is a non-radioactive low energy nuclear transmutation of light elements occurring in any living organism. For quite a long time, it has been a matter of debate that the biological transmutations are the very core of living nature and several groups of workers have postulated the existence of elemental transmutations in living systems (Kervran, 1982; Vysotskii & Kornilova, 2011; Moawad, 2013). Kervran (1982) in his study stated that living matter employs energies which are not electromagnetic, that nature also operates right into the heart of the atomic nucleus, which has nothing to do with Lavoisier's laws. Though the exact mechanisms remain unknown, but, are believed to take place through catalytic effect caused by enzymes facilitating combination or splitting of elements (Cuthbertson, 2007; Biberian, 2012; Biberian, 2019). Some scientists and agriculturalists from their experimental analyses and observations have discovered that the plants seem to transmute one element into another in alchemical fashion (Kervran, 1982). Most transmutations have been observed to take place within first twenty elements of the periodic table. Also, it has been suggested by scientists that biological transmutations may be affected by lunar forces and earth's magnetic field (Kervran, 1982).

In order to establish whether transmutation is there or not, a pot experiment was planned to study the closed system of soil, water, air and plant for concentration of elements K, Ca and Fe. Further, to find any effect of lunar forces, sprouting of mung beans was done under different phases of moon and sprouted beans were tested for changes in elemental concentrations with perception of transmutations. Similarly, the enzyme activity in fermentation may lead to transmutations of elements, thus, an experiment on wheat dough fermented with yoghurt was analyzed for biological transmutation process. The mentioned experiments of plant growth, sprouting and fermentation involved a complete system of biological processes under controlled environment. The details of interpretation of the findings and inferences drawn are being discussed in the subsequent sections.

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II. MATERIALS AND METHODS

A. Plant Growth

A plant's growth and development largely depend on the combination and concentration of nutrient elements available in the soil and the soil to plant transfer of elements is considered as a part of chemical element cycling in nature. Besides this, a number of experimentalists have proved that the plants are capable of creating material elements (Kervran, 1982).

1) Sample Preparation

In the present case, a pot experiment was conducted in a closed laboratory room of dimensions ~ 24' X 21' X 12' with proper light (day time luminance of 150-200 lx) and no artificial luminance at night. Ten pots were used and 80-100 uniform sized seeds of fenugreek were germinated in each pot. The soils for plant growing media were prepared by mixing sewage soil, clay soil and sand homogeneously in fixed proportions (1:1:1). The experiment was carried for 40 days. Regular watering was done during the course. On the 15^{th}, 21^{st} and 35^{th} day after sowing of seeds, fertilizations with $CaCO_3$ (calcium fertilizer) (Mumivand et al., 2011) and KCl (potassium fertilizer) (Kafkafi et al., 2001) were done. POT-1 was left untreated. The four pots (POT-2, POT-3, POT-4, POT-5) were treated with $CaCO_3$ solutions in moles as; 5 mM, 15 mM, 25 mM, 40 mM. The POT-6 was treated with 20 mM solutions of both $CaCO_3$ and KCl fertilizers, whereas the remaining four pots (POT-7, POT-8, POT-9, POT-10) were treated with KCl solutions; 5 mM, 15 mM, 25 mM and 40 mM respectively (The photograph of the fenugreek plants during their growth has been shown in fig. 1).

Fig. 1. Photograph of fenugreek plants in pots during their growth.

For sampling, after full growth, the plant and soil samples were collected and their targets were prepared. The plants were dried at room temperature for 2-3 days and then in oven at 100-120°C for 5-6 hours for consecutive 3-4 days. Similarly, the soil samples from individual pots were dried at 70-80°C for 5-6 hours for 4-5 days. After drying, the soil samples were sieved through sieve mesh no. 300 having aperture width of 53 micron. The dried plant samples were grinded in an electric grinder and electric agate pestle mortar. The finely powdered samples, thus obtained, were weighed with digital weighing machine imported from Scientech, USA, having an accuracy of 0.1 mg. After that, the samples of plants and soils were prepared in the form of thick pellets (Mittal et al., 1993) in a die (of 2.5 cm diameter) with 25 tons semi-auto Hydraulic pressing machine. The prepared sample pellets were analyzed for their mineral K, Ca and Fe contents.

2) Measurements and Data Analysis

The sample pellets were irradiated, in turn, with photons from low power X-ray tube with operating voltages (4, 5 and 8 kV) just above the K edge energies of K, Ca and Fe in the single reflection geometrical set-up (Gupta et al., 2010). Amptek X-123 spectrometer was used to record the emitted fluorescent X-rays. To account the scattering of photons at 90° from sample pellets, the background spectra were recorded with equivalent borax targets and subtracted from the spectra of sample pellets. The fenugreek plant and soil samples showed the presence of K, Ca and Fe elements. For determining the amounts of K, Ca and Fe in fenugreek plant and soil samples from selective excitations; KNO_3, CaO and $FeSO_4.7H_2O$ were used as reference materials. For each element in every sample, the counts under the respective elemental X-ray photo peaks were collected for sufficient time to obtain the statistical accuracy in counts < 1%.

The samples were irradiated with photons from the X-ray tube operated at 4 kV/0.35 mA (for K), 5 kV/0.2 mA (for Ca) and 8 kV/0.05 mA (for Fe) in the set-up to keep the dead time losses <10%. A typical net background subtracted spectrum of each, fenugreek plant and soil sample from POT-9 for K, Ca and Fe excitations are shown in figs. 2-4.

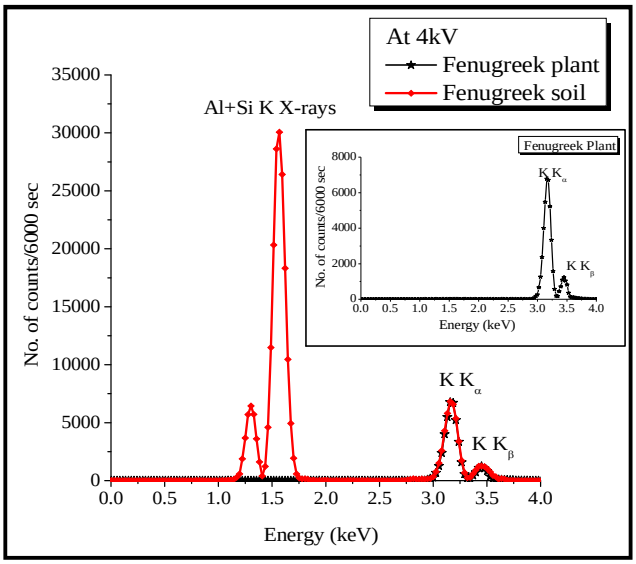


Fig. 2. Background subtracted spectrum of fenugreek plant/soil at 4 kV/0.35 mA (inset showing the plant spectrum).

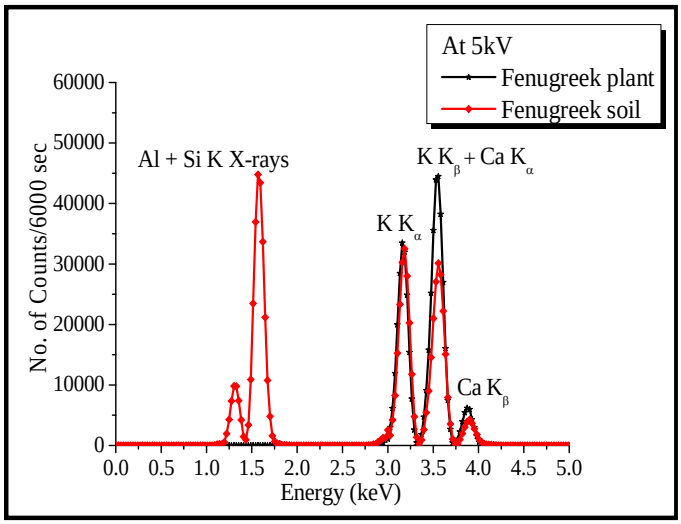


Fig. 3. Background subtracted spectra of fenugreek plant and soil at 5 kV/0.2 mA.

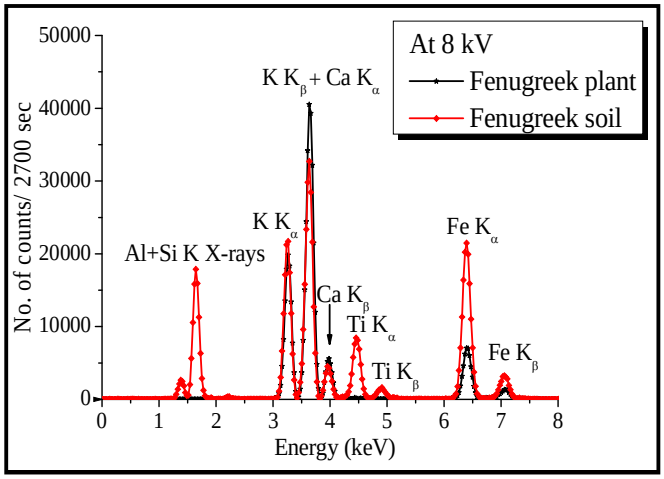


Fig. 4. Background subtracted spectra of fenugreek plant and soil at 8 kV/0.05 mA.

The fractional amounts of K, Ca and Fe were calculated using the methodology developed in the lab (Mittal et al., 1987) are listed in table I.

TABLE I

Determined fractional amounts of K/Ca/Fe in dried fenugreek plants and K/Ca/Fe in pot soils treated with different amounts of K/Ca fertilizers

Pot	Fertilizer Treatment Solution	Determined amounts in unit amount of dried fenugreek samples (g)	
		Plant(K/Ca/Fe)	Soil(K/Ca/Fe)
I	Untreated	0.0153(10)/0.0113(8)/0.0083(6)	0.0201(14)/0.0181(13)/0.0497(35)
II	5 mM $CaCO_3$	0.0111(8)/0.0111(8)/0.0151(11)	0.0255(18)/0.0224(16)/0.0486(34)
III	15 mM $CaCO_3$	0.0157(11)/0.0150(10)/0.0121(8)	0.0318(22)/0.0265(18)/0.037(26)
IV	25 mM $CaCO_3$	0.0156(11)/0.0125(9)/0.0103(7)	0.0158(11)/0.0379(26)/0.0623(44)
V	40 mM $CaCO_3$	0.0128(9)/0.0117(8)/0.0091(6)	0.0247(17)/0.0351(24)/0.0492(34)
VI	20 mM $CaCO_3$ + 20 mM KCl	0.0174(12)/0.0139(10)/0.0158(11)	0.0290(20)/0.0241(17)/0.0565(40)
VII	5 mM KCl	0.0083(6)/0.0075(5)/0.0172(12)	0.0242(17)/0.0168(12)/0.0554(39)
VIII	15 mM KCl	0.0110(8)/0.0136(10)/0.0119(8)	0.0359(25)/0.0293(20)/0.0557(39)
IX	25 mM KCl	0.0212(15)/0.0040(3)/0.0082(6)	0.0313(22)/0.0186(13)/0.0542(38)
X	40 mM KCl	0.0111(8)/0.0116(8)/0.0045(3)	0.0237(17)/0.0158(11)/0.0656(46)

**Values in brackets are the errors in the rightmost digit of results*

For the purpose of analysis, the K, Ca and Fe contents of the fenugreek seeds used for germination and that of the sewage soil taken as the growth medium were added to evaluate the total of each element before the biological process i.e. plantation. The contents of the fenugreek plants and soils after the growth were also added which yield the total K, Ca and Fe amounts in the plant-soil system after the growth. The contents in the seed-soil system have been taken as the reference to scan changes in the respective contents after the seed matures into the plant. The total K, Ca and Fe amounts obtained for all pots are listed in the table II along with their variations from the reference value.

TABLE II

Variation in the fractional total amounts of K, Ca & Fe before and after fenugreek plant growth in pot experiment

Pot	Fractional amount	Total content/gram of system	Change in fractional total

	of added fertilizer content/pot		K (before growth, seed-soil=0.0221)	Ca (before growth, seed-soil=0.0101)	Fe (before growth, seed-soil=0.0301)	amount after growth		
	K ($\times10^{-4}$)	Ca ($\times10^{-4}$)	Plant-soil (after growth)	Plant-soil (after growth)	Plant-soil (after growth)	K ($\times10^{-4}$)	Ca ($\times10^{-4}$)	Fe ($\times10^{-4}$)
I	0	0	0.0177	0.0147	0.0291	-43.5	+46.0	-9.5
II	0	0.99	0.0183	0.0167	0.0318	-37.5	+66.5	+18.0
III	0	3.00	0.0237	0.0207	0.0245	+17.0	+106.5	-55.0
IV	0	4.98	0.0157	0.0252	0.0363	-63.5	+151.0	+62.5
V	0	8.00	0.0187	0.0234	0.0291	-33.0	+133.0	-9.0
VI	3.99	3.99	0.0232	0.0190	0.0311	+11.5	+89.0	+11.0
VII	0.99	0	0.0162	0.0121	0.0363	-58.0	+20.5	+62.5
VIII	3.00	0	0.0234	0.0214	0.0338	+14.0	+113.5	+37.5
IX	4.98	0	0.0262	0.0113	0.0312	+42.0	+12.0	+11.5
X	8.00	0	0.0174	0.0137	0.0350	-46.5	+36.0	+50.0

The changes in the fractional amounts of K/Ca/Fe elements in the plant-soil system under different K and Ca fertilizers' treatments are also quantified relative to those in the untreated plant-soil system as listed in table III.

TABLE III
Variation in the fractional total weights of K/Ca/Fe contents of treated plants with respect to the changes in the untreated pot contents

Fractional amount of added fertilizer content/pot	Change in fractional amount after growth with respect to untreated pot contents			Total relative fractional weight changes of elements K/Ca/Fe in the treated system
	K ($\times10^{-4}$)	Ca ($\times10^{-4}$)	Fe ($\times10^{-4}$)	
0	-43.5	+46.0	-9.5	-8.0
Pots treated with Ca fertilizer				
0.99	+6.0	+20.5	+27.5	+54.0
3.00	+60.5	+60.5	-45.5	+75.5
4.98	-20.0	+105.0	+72.0	+157.0
8.00	+10.5	+87.0	+0.5	+98.0
% Variance w.r.t mean (96.125)				2049
Pots treated with K fertilizer				
0.99	-15.5	-25.5	+71.5	+30.5
3.00	+57.5	+67.5	+46.5	+171.5
4.98	+85.5	-34.0	+21.0	+72.5
8.00	-3.0	-10.0	+59.5	+46.5
% Variance w.r.t mean (80.25)				4984

B. Sprouting

Sprouting is a natural biological process by which seeds come out of the latency stage and changes occur in terms of quantity and type of nutrients within the seed depending upon the kind of vegetable, variety of seed and conditions of sprouting (Sangronis & Machado, 2007; Benincasa et al., 2019)). It is a nutritional phenomenon with its own enzymes. The sprouts are biogenically alive and hence, are capable of transferring their life energy to a human body. In the present studies, the sprouting has been undertaken to review the effect of moon activity on any existing change in mineral composition of sprouts.

From theancient times, it has been believed that the lunar phases and life existing on earth are inter-related. There are evidences that parameters such as germination rate (Sivasankar & Thimmaiah, 2021), water uptake (Sivasankar & Thimmaiah, 2021; Gullari, 2025), root growth rate (Barlow & Fisahn, 2012), tree bud morphology (Edwards, 2006; Zürcher, 2011), DNA formation (Rossignol et al., 1990), tree trunk expansion and contraction (Barlow et al., 2010)), crop yield (Kollerstrom & Staudenmaier, 2001; Gurudevan et al., 2022), wood properties (Zürcher et al., 2010; Roschak, 2026) and patterns of plant potency (Cole & Balik, 2010) etc. respond to the lunar phase cycle of 29.5 days. Steiner (1924) in his lectures on agriculture pointed out that the plants being extremely sensitive to tiny energy fluctuations in their environment are found to respond to particular phases of the moon. It has been demonstrated in the literature that transmutations in germinating systems are influenced by the cosmic conditions such as the type of light involved and phase of moon etc. (Kervran, 1982; Tomkins & Bird, 1989).

Bearing in mind, the distinguished impact of moon on plant's behavior (biological life), the subject was explored with sprouting of mung beans. Among the seeds, mung beans have high sprouting character and since the beans are fair source of K and Fe, so, the K and Fe contents have been monitored from beans to their sprouts in different phases of moon for a month.

1) Sample Preparation

Healthy mung beans (Vigna Radiata *cv.Pusa Vishal*) were taken and cleaned by rubbing to remove the foreign materials. The whole mung seeds were soaked in water for 7-8 hours at room temperature (around 25°C), then the soaked seeds were transferred to the sprouting jar and allowed to sprout for the time corresponding to a particular moon phase (1½ -2½ days depending upon the moon's rotation, average 2 days). The processing was repeated in every phase for a synodic month of 29.5 days that is for 14 different phases, 14 sprouted samples were obtained. The photograph of one of the sprouted mung beans samples is shown in fig. 5.

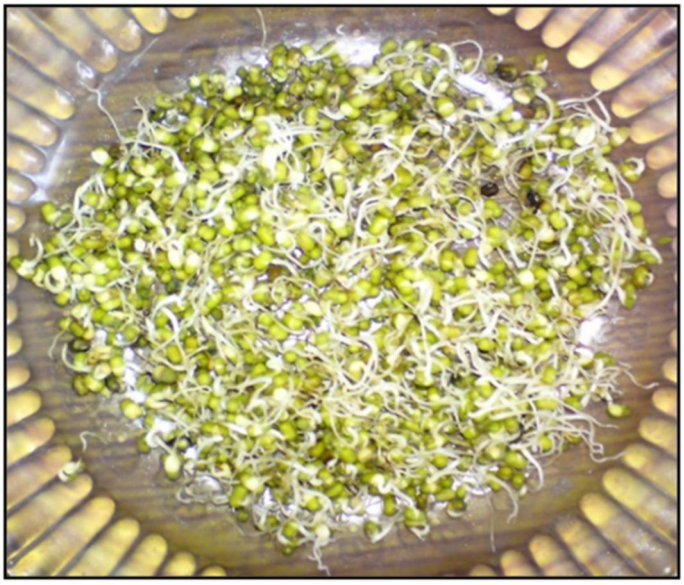


Fig. 5. Photograph of Sprouted Mung Beans.

The samples, thus sprouted, were dried and tails were separated manually. Fourteen briquette targets of each sprouted seeds and its tails (sprouts) were prepared following the procedure as described in the above section for plant-soil system. The samples were preserved in desiccators to avoid them from moistures.

2) Measurements and Data Analysis

The targets (briquette) of the original beans/sprouted mung beans/sprouts were, in turn, irradiated and recorded in the set-up (Gupta et al., 2010) as described above with photon output of low power X-ray tube operated at 15 kV/0.005 mA. The background spectrum was recorded by placing a borax target at the place of experimental target. The background was then subtracted from each recorded spectrum of experimental targets. The obtained spectra showed the presence of K and Fe in beans, sprouted beans and sprouted tails (fig. 6).

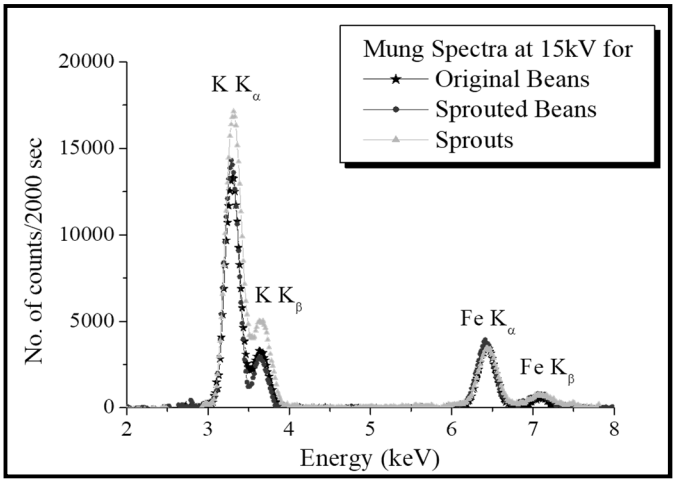


Fig. 6. Background subtracted spectra of original mung beans/sprouted beans/sprouts in 90° single reflection geometry at 15 kV/0.005 mA.

The determined K and Fe contents (table IV) have been monitored from beans to their sprouts under different phases of moon.

TABLE IV
Determined fractional K/Fe amounts in sprouted mung seeds/ sprouts along with % age deviation from original seed sample (0.0110/0.0007)

Sample no.	Determined fractional K content in Sprouted Mung		% age K deviation from Original Seed contents		Determined fractional Fe content in Sprouted Mung		% age Fe deviation from Original Seed contents	
	Seeds	Sprouts (tails)	Seeds	Sprouts (tails)	Seeds	Sprouts (tails)	Seeds	Sprouts (tails)
1	0.0145(10)	0.0073(5)	32	34	0.00070(10^{-5})	0.0018(1)	0	157
2	0.0108(8)	0.0371(26)	2	237	0.00060(10^{-5})	0.0016(1)	14	129
3	0.0132(9)	0.0148(10)	20	35	0.00080(10^{-5})	0.0014(1)	14	100
4	0.0122(9)	0.0120(8)	11	9	0.00050(10^{-5})	0.0024(2)	28	242
5	0.0139(10)	0.0073(5)	26	34	0.00070(10^{-5})	0.0012(1)	0	71
6	0.0118(8)	0.0243(17)	7	121	0.00070(10^{-5})	0.0012(1)	0	71
7	0.0110(8)	0.0184(13)	0	67	0.00060(10^{-5})	0.0015(1)	14	114
8	0.0103(7)	0.0110(8)	6	0	0.00070(10^{-5})	0.0008(0)	0	14
9	0.0114(8)	0.0167(12)	4	52	0.00080(10^{-5})	0.0016(1)	14	129
10	0.0112(8)	0.0083(6)	2	25	0.00070(10^{-5})	0.0012(1)	0	71
11	0.0152(11)	0.0242(17)	38	120	0.00080(10^{-5})	0.0012(1)	14	71
12	0.0085(6)	0.0101(7)	23	8	0.00070(10^{-5})	0.0009(0)	0	29
13	0.0135(9)	0.0126(9)	23	15	0.00070(10^{-5})	0.0012(1)	0	71
14	0.0102(7)	0.0142(10)	7	29	0.00070(10^{-5})	0.0009(0)	0	29
% age Variance w.r.t mean	0.029	0.50	---	---	$<10^{-3}$	0.013	---	---

The relative changes in fractional amounts of K and Fe contents in the sprouted samples (seeds + sprout tails) from table IV with respect to the raw seed contents are listed in table V. For the fractional total weight change, dropping the error, only the central values (table IV) have been used.

TABLE V
K and Fe fractional amount change in seeds before sprouting and seed-sprouts after sprouting

Sample no.	Fractional content in system after sprouting		Change in fractional weight after sprouting		Total change in fractional amounts of K & Fe in the system	Moon Phase
	K (seed=0.0110)	Fe (seed=0.0007)	K ($\times10^{-4}$)	Fe ($\times10^{-4}$)		
1	0.0109	0.00125	-1.0	+5.5	+4.5	Full Moon
2	0.0239	0.00110	+129.0	+4.0	+133.0	
3	0.0140	0.00110	+30.0	+4.0	+34.0	
4	0.0121	0.00145	+11.0	+7.5	+18.5	Last Quarter
5	0.0106	0.00095	-4.0	+2.5	-1.5	
6	0.0180	0.00095	+70.0	+2.5	+72.5	
7	0.0147	0.00105	+37.0	+3.5	+40.5	New Moon
8	0.0107	0.00075	-3.0	+0.5	-2.5	
9	0.0141	0.00120	+31.0	+5.0	+36.0	
10	0.0097	0.00095	-13.0	+2.5	-10.5	
11	0.0197	0.00100	+87.0	+3.0	+90.0	First Quarter
12	0.0093(9)	0.00080(8)	-17.0	+1.0	-16.0	
13	0.0130(13)	0.00095(10)	+20.0	+2.5	+22.5	
14	0.0122(12)	0.00080(8)	+12.0	+1.0	+13.0	Full Moon

C. Fermentation

Fermentation is a metabolic process in which degradation of starch and soluble sugars takes place by the action of bacteria or yeast and results in many chemical changes that enhance the biosynthesis and bioavailability of minerals (Maicas, 2020). Bacteria have the enzymes to digest and utilize many substrates making fermentation a biological process involving enzymatic decomposition. The modern food processing is to ensure that food is maintained at an acceptable level of quality from the time of manufacture through the time of consumption and fermentation is one of the oldest technologies to meet the purpose. Fermented foods have great nutritional qualities and are indispensable components of the diet of people throughout the world (Nout, 2009; Tamang et al., 2020). Cereals such as wheat, rice and maize belonging to the grass family *Graminae*, are important staple food crops as they are good sources of carbohydrates, proteins, dietary fibres, vitamins and minerals but bioavailability of minerals is usually low (Wrigley, 2017). In order to enhance the content and quality, the cereal grains are traditionally processed by roasting, soaking, germination and fermentation prior to consumption (Nkhata et al., 2018; Benhura et al., 2024). Out of them, wheat (*Triticum Aestivum*) is the main cereal crop used for human consumption which is processed widely by fermentation (Sakandar et al., 2019).

For fermentation, one of the cheapest modes of production of fermented foods is from inoculation of the raw material with a small quantity of a previously performed successful fermentation (Teng et al., 2021). It represents a way to shorten the fermentation process and to reduce the risk of fermentation failure. It is generally in use in the production of sourdough. Among the various cultures used for fermentation, lactic acid bacteria (LAB) are commonly applied for the purpose (Leroy & De Vuyst, 2004; Bintsis, 2018). So, with the understanding of the fermented foods and microbial cultures, it was planned to study changes in mineral content (K) of the wheat flour treated with varying amounts of yoghurt. Yoghurt was opted for being a good source of lactic acid bacteria.

The details of the experiment, sample analysis and the outcomes along with their interpretations are illustrated in the following sections.

1) Sample Preparation

From random checks, it was found that wheat flour contains K in the detectable range of the set-up (Gupta et al., 2010). The net background subtracted spectrum for wheat flour at tube operating conditions of 5 kV/0.25 mA employing Amptek X-123 spectrometer is shown in fig. 7 which ascertains the presence of K. Hence, wheat flour was taken and fermentation was carried with yoghurt treatments.

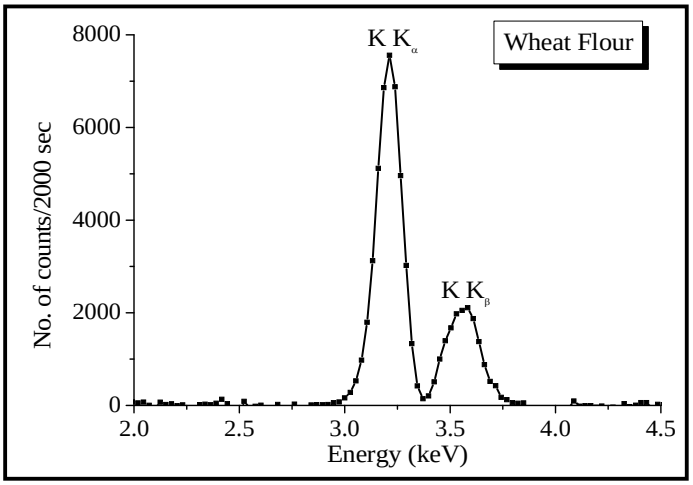


Fig. 7. Background subtracted spectrum of wheat flour at 5 kV/0.25 mA.

The doughs were prepared by mixing wheat flour (94 g), distilled water (60 ml) and variable yoghurt culture. Ten yoghurt treatments were given in the quantities; 2.5 ml, 5 ml, 10 ml, 15 ml, 20 ml, 25 ml, 30 ml, 35 ml, 40 ml and 45 ml to the dough samples for sourdough fermentation. One dough sample, A, was used as a control sample which was kept without yoghurt addition. The fermentation of the dough samples was performed for 12 hours at 35°C. After that, the samples were transferred to an oven and were dried at 80°C for 7-8 hours daily and the process of drying was carried for 5-6 days. The yoghurt used as a starter was dried at room temperature. Thick pellets of the dried fermented and yoghurt samples were prepared as described in above section. The pellets were stored at room temperature prior to analysis. The photograph of the dough cakes has been incorporated in fig. 8.

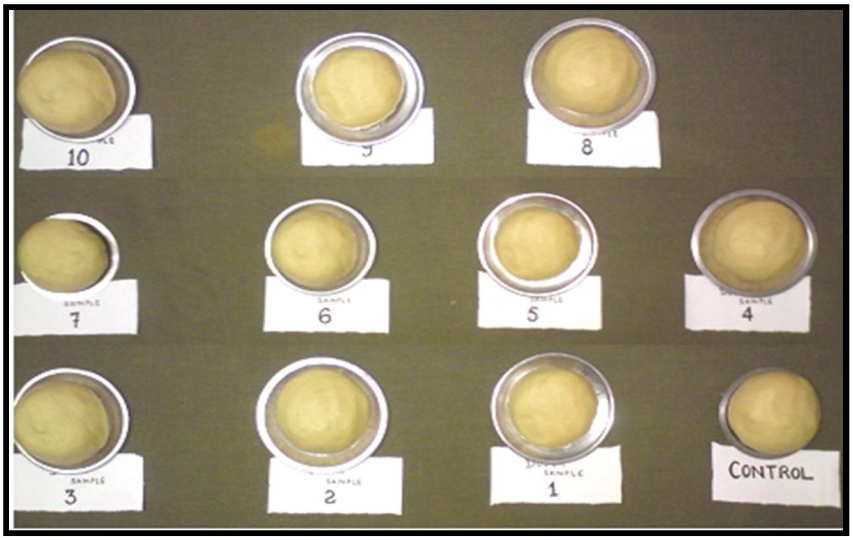


Fig. 8. Photograph of wheat dough cakes fermented with different amounts of yoghurt.

2) Measurements and Data Analysis

The pelletized targets of the fermented wheat flours were irradiated in the set-up (Gupta et al., 2010) with photon output of low power X-ray tube operated at 5 kV/0.25 mA for K determinations, while the yoghurt sample was analyzed for K and Ca with the tube operated at 4 kV/0.35 mA and 5 kV/0.22 mA respectively. The contents (K for dough samples and K/Ca for yoghurt) were evaluated using the existing XRF method for thick samples with selective excitation of analyte K X-rays. The typical background subtracted net spectrum of one of the fermented dough samples along with the control (A) sample for K excitation is shown in fig. 9 and that of yoghurt at K/Ca excitation is shown in fig. 10.

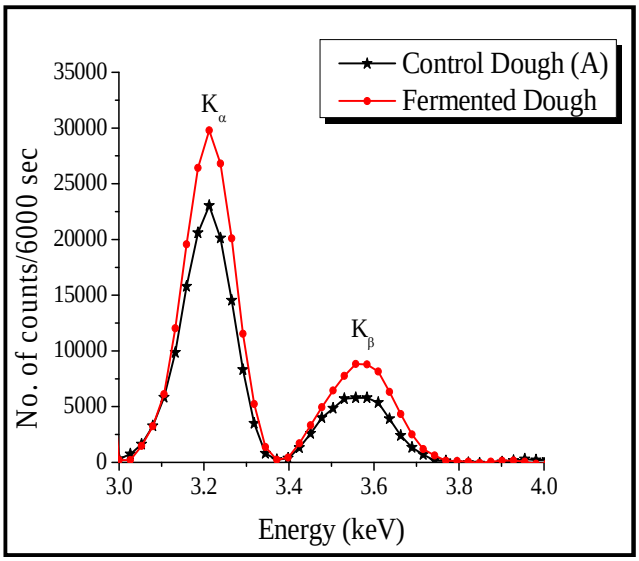


Fig. 9. Background subtracted net spectrum of the fermented dough sample together with control dough sample (A) at 5 kV/0.25 mA.

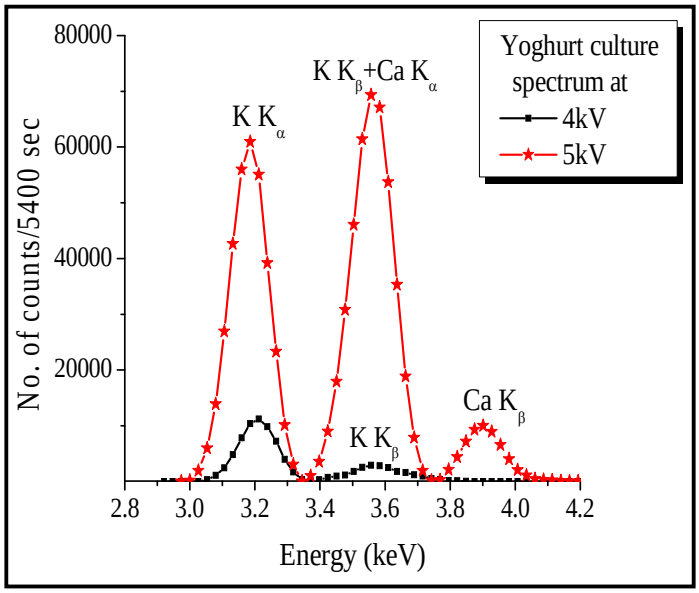


Fig. 10. Background subtracted net spectrum of the yoghurt sample at 4 kV/0.35 mA & 5 kV/0.22 mA.

The K/Ca contents for yoghurt determined are 0.0343/0.0107 (per gram) while the fractional K amounts in fermented samples are listed in the table VI.

TABLE VI
Determined K fractional amounts in fermented dough samples along with % age deviation from control (A) sample (0.006)

Sample No.	Amount of yoghurt added (ml)	Determined Fractional amount of K in Fermented dough	% age deviation from control sample (A)
1	2.5	0.007(5)	17
2	5.0	0.0056(4)	7
3	10.0	0.0072(5)	20
4	15.0	0.0073(5)	22
5	20.0	0.0066(5)	10
6	25.0	0.0067(5)	12
7	30.0	0.0085(6)	42
8	35.0	0.0207(14)	245
9	40.0	0.0089(6)	48
10	45.0	0.0085(6)	42

Data from processing of the determined amounts of K per gram of the fermented samples from table VI is listed in table VII.

TABLE VII
Variation in the fractional amounts of K before and after fermentation with respect to added Ca

Sample No.	Fractional amount of Ca added per gram of the sample ($\times 10^{-3}$)	Amount of K per gram of the dough-yoghurt sample		Change in fractional amount of K in fermented sample ($\times 10^{-3}$)
		Before Fermentation	After Fermentation	
1	0.03	0.0061	0.0070	+0.9
2	0.07	0.0062	0.0056	-0.6
3	0.13	0.0063	0.0072	+0.9
4	0.19	0.0065	0.0073	+0.8
5	0.26	0.0067	0.0066	-0.1
6	0.32	0.0068	0.0067	-0.1
7	0.38	0.0070	0.0085	+1.5
8	0.44	0.0072	0.0207	+13.5
9	0.5	0.0073	0.0089	+1.6
10	0.56	0.0075	0.0085	+1.0

The change in the weight of K after fermentation is negligible for different amounts of yoghurt addition except for sample 8 in which a prominent weight change is observed (table VII).
This may be due to the increase in the bacterial action as a result of rise in their population with addition of K (yoghurt) as Komaki's research had proved that different families of micro-organisms create K during their growth and bacterial population increases in the presence of K (Biberian, 2019).

II. RESULTS AND DISCUSSION

The present study investigated variations in the elemental compositions of three biological systems, namely plant growth, sprouting, and fermentation, under controlled experimental conditions. The analytical studies were carried out using X-ray fluorescence (XRF) spectrometry keeping counting statistics <1% and the measured changes in elemental composition and observations are subsequently discussed in the context of the corresponding biological processes and relevant scientific literature.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VII July 2026- Available at www.ijraset.com

A. Plant Growth

From the studies, the observations drawn (table II) are:

1) In the untreated pot, Ca content is higher while the other two elements K and Fe are found lower in amounts compared to the reference amounts, so, it looks that the rise in Ca is at the expense of K and Fe in the system.

2) Final contents of Ca in the system after growth show an increasing trend almost proportional to the increase in Ca fertilizer amount and are certainly higher with no particular trend in case of treatments with K fertilizer. While the K content in the plant-soil system decreases with most of the Ca treatments and increases or decreases with no definite pattern for K fertilizer applications.

3) On similar lines, the fractional total amount of Fe in the plant-soil system is found either increasing or decreasing with Ca fertilizers, but with the K treatments, the amounts certainly depict an increasing trend in relation to the Fe of the seed-soil system.

4) Further, it can be seen that with Ca fertilizer at least one element out of the three in the fully grown system has increased relative to its content in the seed-soil system before the growth. However, in case of K fertilizer, both Ca and Fe contents have increased from that of the reference, while K contents show no fixed trend. When both K as well as Ca fertilizers were applied to the system, all of the three elements rise in the system.

From table III, it has been found that in all the treated pots, the total of change in elemental contents is greater while in the untreated pot, the same is deficient (last column of table III). Thus, the treatments lead to accumulation of elements in the after grown system. The % variance 2049 with respect to the mean content 96.125 for Ca treatments and 4984 with respect to the mean content 80.25 for K treatments are much higher than the reproducible limits of the set-up (Gupta et al., 2010) that clearly signals to the presence of some additional effect in the closed controlled system of the plant growth that diverts the controlled elemental concentrations.

The variability in the K/Ca/Fe contents in different pots subjected to varying fertilizer treatments can be due to the fact that the plants have mutualistic symbiotic associations with the soil microbes which can respond dramatically to a small alteration in the physio-chemical properties of the soil (Rajkumar et al., 2012; Jacoby et al., 2017). In addition to the relative transportation of elements from soil to plants, the K and Ca treatments of pots provide K and Ca amounts too meager to account for such a noteworthy change in the system contents after the growth.

Moreover, the Fe content of the system is found variable in different pots even when no iron is being added from outside. As the plant-soil system is an isolated system of seed, soil and distilled water, thus, the occurrence of elements in the higher or lower amounts as compared to those from the initial seed-soil system, points to the creation of elements at the expense of the others. All this prospects the involvement of elemental transmutations which provide the observed imbalance in the nutrient quantities.

B. Sprouting

The current results (table IV) depict a change of 0-237% in K content and 29-242% for Fe in the sprouts with the moon phases. These outcomes are in line with the studies conducted on oats' germination (Biberian, 2019) in context of Ca content variation with moon phases which was found uneven with the cycle and the increase observed was between 54-616% for Ca.

It can be seen from the table V that there is an appreciable weight change of K and Fe contents after sprouting with the moon activity. The total mass content is being created as well as destroyed with the cycles of moon; Fe in the sprouted samples has been created at different phases while the fractional weight of K has decreased most of the times after a particular phase.

The rhythmic behavior witnessed in the studies with moons' activity can be a result of unavoidable natural factors. One such inescapable environmental factor is the earth's magnetic field i.e. the geomagnetic field (GMF) that has been found to be biologically active and plants are known to have high sensitivities towards permanent magnetic fields having strengths of GMF to lower ones (Belyavskaya, 2004; Hafeez et al., 2023). The geomagnetic effects are exerted at a very low level, even at a subatomic level, in the framework of weak energy interactions and these effects vary with cosmic factors such as solar proton showers, lunar activity etc (Stolov & Cameron, 1964; Nykyri et al., 2025). Also, Vysotskii and Kornilova (2003) had illustrated that natural geo-transmutations in the atmosphere and earth occur at the points of strong change in geo and electromagnetic fields. Therefore, the fluctuations in mung K/Fe contents can be seen in perspective of the varying weather and geomagnetic field due to the lunar influence.

Recent studies have also supported the notion that plants perceive the moonlight as a stress signal triggering a developmental transition characterized by changes in genome structure and functions and in cell activity (Sannidhi et al., 2025).

The present process of sprouting is in an isolated system of seeds, water and air; therefore, the variation between the two, K and Fe, in sprouted mungs can be a consequence of biological transmutation process from some low Z elements in the beans. Additionally, it can be seen as the cumulative effect of changes in GMF and lunar motion that modify the coding for synthesis of enzymatic proteins which underline the fate and chemistry of an atom in a biological process.

C. Fermentation

For fermentation, it is stated that in the fermentation of foods, a complex mixture of carbohydrates, proteins and fats, etc. undergoes modifications simultaneously under the action of variety of present microorganisms and enzymes and the nature and extent of these changes depend upon the food, types of microorganisms and conditions affecting their growth and metabolic pattern (Shakuntala & Shadaksharaswamy, 1987). The observations (table VII) point towards the absence of Ca in the fermented product in spite of being introduced as yoghurt culture. Two aspects can be attributed to this observation:

- One, there can be a possibility of low amount of Ca in the fermented wheat that is below the minimum detection limit of the experimental set-up (1-100ppm).
- Second, it may be possible that the Ca added to the wheat dough system through yoghurt may have got transmuted with the involvement of the micro-organisms as the biologists supporting the paradigm of transmutations have always proposed that the elemental transmutations take place at cellular level with enzymes as the mediator (Goldfein, 1978; Kervran, 1982; Kurup & Kurup, 2012).

The present findings are preliminary and are in agreement with earlier observations reported in studies involving wheat seeds and *Lactobacillus*, which described variations in mineral concentrations (Biberian, 2012; Biberian, 2019). However, further investigations are required to establish the underlying mechanism responsible for these observations.

Based on the overall pattern of elemental variations observed in the present study, it may be hypothesized that additional elements not investigated here could also contribute to the observed transformations.

Therefore, the present observations suggest that certain biological systems may be associated with elemental changes that warrant further investigation within the framework of biological transmutation. Previous studies have explored the concept of biological transmutation, and the present work provides additional experimental observations obtained from selected living biological systems. The interpretations have been given entirely on the basis of observations and analytical studies and should be regarded as hypotheses requiring further experimental validation. The observed elemental variations are consistent with hypotheses proposing that enzymes present in the cells of animals, plants and microorganisms may participate in processes leading to elemental transformations (Kervran, 1972; Kervran & Ohsawa, 2011). However, the present study does not directly establish the underlying mechanism. Nevertheless, the possibility that factors other than those considered in the present study contributed to the observed elemental variations cannot be excluded.

III.CONCLUSIONS

In the present study, elemental analysis has been done for complete system of biological processes of plantation, sprouting and fermentation under controlled environment. The observed variations in elemental composition during plantation, sprouting and fermentation may be interpreted in the context of hypotheses proposing biological transmutation within living systems. If interpreted within the framework of biological transmutation, the observed elemental variations may be associated with low-energy nuclear processes occurring under specific biological conditions such as temperature, cellular architecture, molecular composition, and the surrounding environment consisting of enzymes, nutrients, and proteins. The present observations are consistent with the possibility that elemental transformations may occur within the structural components of biological entities, which are influenced dynamically (such as in growth zones, non-stationary transport systems, and responsive mechanisms to varying forms of agitation, etc.). Consistent with earlier reports, the current study observed elemental variations during seed germination, based on its biological activity requirements and environment, that may be interpreted within the framework of biological transmutation. However, further investigations are required to establish conclusively whether these observations result from biological transmutation or other underlying processes. These experimental findings demonstrate measurable variations in elemental composition during biological processes and provide motivation for further investigations into the mechanisms responsible for these observations. While there are variations observed in the elemental composition, the present study does not directly identify the mechanism responsible for these changes. It is essential to investigate biological transmutations thoroughly, as the implications of this research are crucial for science, agriculture, health, and medicine. So, future investigations using complementary analytical techniques, and independent replication are required to further evaluate the underlying processes.

IV. ACKNOWLEDGEMENT

The financial support received from DST in the form of INSPIRE Fellowship to Ms. Kanan Deep during her research period is highly acknowledged.

A. *Conflicting Interest*

The authors have no conflicts to disclose with respect to the research, authorship or publication of this article.

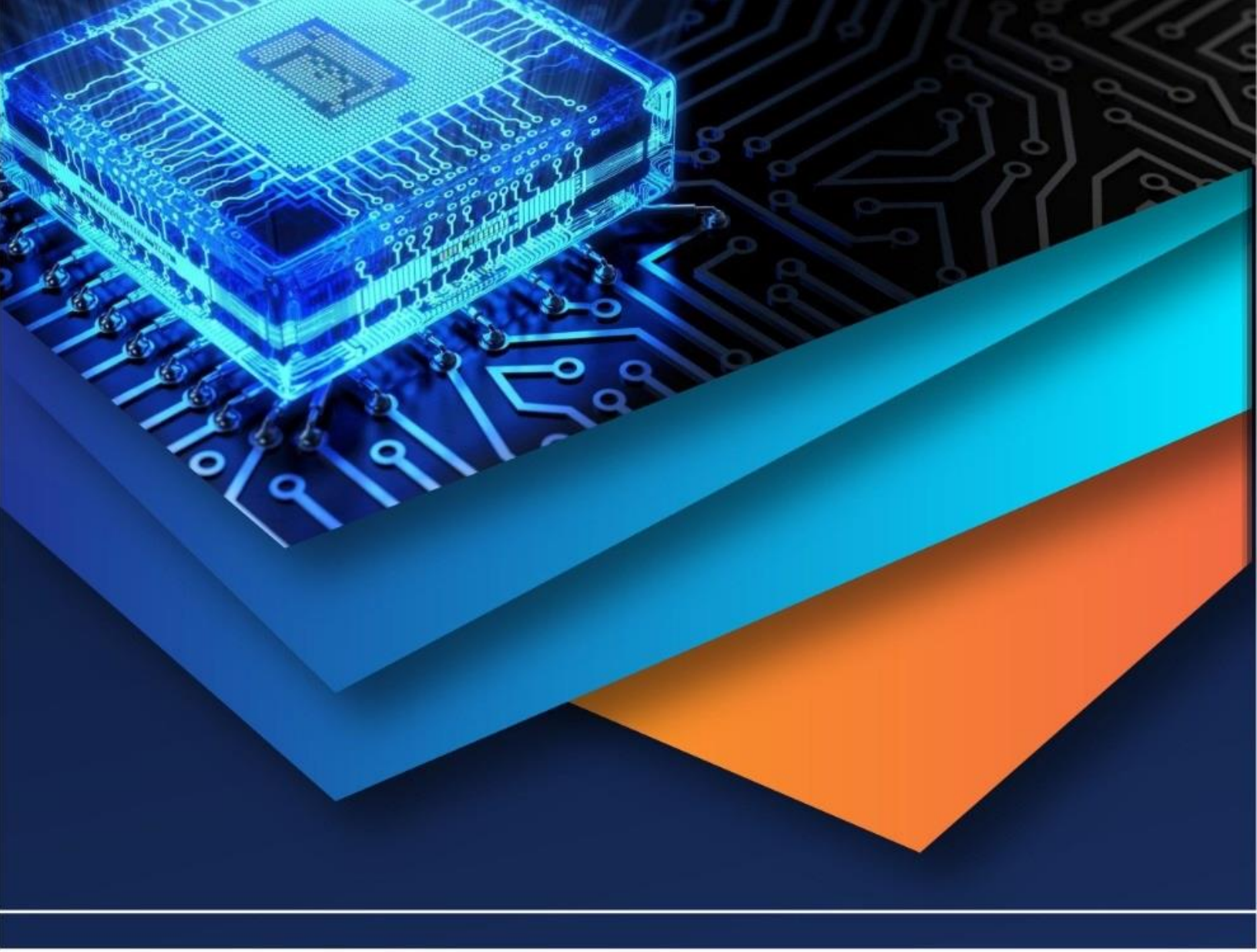
B. *Limitations Of The Study*

The present study is based on analytical measurements using X-ray fluorescence (XRF) spectrometry, which quantifies variations in the elemental composition in the biological processes but does not directly establish the mechanism responsible for these changes. Nevertheless, the elemental variations observed across three independent biological systems, together with their agreement with previously reported observations, provide a basis for interpreting these findings within the framework of biological transmutation. Still further investigations are required to elucidate the underlying mechanisms and strengthen the evidence supporting these observations.

REFERENCES

[1] Barlow, P. W., & Fisahn, J. (2012). Lunisolar tidal force and the growth of plant roots, and some other of its effects on plant movements. Annals of Botany, 110(2), 301-318.
[2] Barlow, P. W., Mikulecký Sr, M., & Střeštík, J. (2010). Tree-stem diameter fluctuates with the lunar tides and perhaps with geomagnetic activity. Protoplasma, 247(1), 25-43. https://doi.org/10.1007/s00709-010-0136-6
[3] Belyavskaya, N. (2004). Biological effects due to weak magnetic field on plants. Advances in space Research, 34(7), 1566-1574. https://doi.org/10.1016/j.asr.2004.01.021
[4] Benhura, C., Mushonga, N. G., Muguse, A., Kamunhukamwe, K., Mpezani, C., Chibira, L., ... & Patel, S. M. (2024). Traditional cereal processing technologies and their importance to African communities: A review. International Journal on Food, Agriculture and Natural Resources, 5(4), 39–48. https://doi.org/10.46676/ij-fanres.v5i4.409
[5] Benincasa, P., Falcinelli, B., Lutts, S., Stagnari, F., & Galieni, A. (2019). Sprouted grains: A comprehensive review. Nutrients, 11(2), 421. https://doi.org/10.3390/nu11020421
[6] Biberian, J. P. (2012). Biological transmutations: Historical perspective. Journal of Condensed Matter Nuclear Science, 7(1). https://doi.org/10.70923/001c.72176
[7] Biberian, J. P. (2019). Biological transmutations. Journal of Condensed Matter Nuclear Science, 28(1).
[8] Bintsis, T. J. J. B. M. (2018). Lactic acid bacteria: their applications in foods. J. Bacteriol. Mycol, 6(2), 89-94.
[9] Cole, I. B., & Balik, M. J. (2010). Lunar influence: Understanding chemical variation and seasonal impacts on botanicals. HerbalGram, 85, 50–56. Lunar Influence: Understanding Chemical Variation and Seasonal Impacts on Botanicals (Accessed on 24.03.2026)
[10] Cuthbertson, D. (2007). A Review of Research on the Biological Transmutation of Chemical Elements.
[11] Edwards, L. (2006). The Vortex of Life: Nature's Patterns in Space and Time. Floris Books.
[12] Goldfein, S. (1978). Energy development from elemental transmutations in biological systems. Final report December 1977--April 1978 (No. AD-A-056906; MERADCOM-2247). Army Mobility Equipment Research and Development Center, Fort Belvoir, VA (USA). https://doi.org/10.2172/6591888
[13] Gupta, S., Deep, K., Jain, L., Ansari, M. A., Mittal, V. K., & Mittal, R. (2010). X-ray fluorescence (XRF) set-up with a low power X-ray tube. Applied Radiation and Isotopes, 68(10), 1922–1927. https://doi.org/10.1016/j.apradiso.2010.05.001
[14] Gullari, J. K. (2025). The impact of moon phases on Earth, plants, and humans: A comprehensive study from Project Alpha. https://doi.org/10.2139/ssrn.5090101
[15] Gurudevan, S., Maragatham, N., Dheebakaran, G., Djanaguiraman, M., & Somasundaram, E. (2022). Effect of Varied Phases of Lunar on the Growth and Yield Parameters of Rice Varieties. International Journal of Environment and Climate Change, 12(11), 983-988.
[16] Hafeez, M. B., Zahra, N., Ahmad, N., Shi, Z., Raza, A., Wang, X., & Li, J. (2023). Growth, physiological, biochemical and molecular changes in plants induced by magnetic fields: A review. Plant Biology, 25(1), 8–23. https://doi.org/10.1111/plb.13459
[17] Jacoby, R., Peukert, M., Succurro, A., Koprivova, A., & Kopriva, S. (2017). The role of soil microorganisms in plant mineral nutrition—Current knowledge and future directions. Frontiers in Plant Science, 8, 1617. https://doi.org/10.3389/fpls.2017.01617
[18] Kafkafi, U., Xu, G., Imas, P., Magen, H., & Tarchitzky, J. (2001). Potassium and chloride in crops and soils: The role of potassium chloride fertilizer in crop nutrition.
[19] Kervran, C. L. (1972). Biological Transmutations. Swan House Publishing Co., New York.
[20] Kervran, C. L. (1982). Biological Transmutations and Modern Physics. Publi Malo SA, Paris.
[21] Kervran, C. L., & Ohsawa, G. (2011). Biological Transmutation. George Ohsawa Macrobiotic.
[22] Kollerstrom, N., & Staudenmaier, G. (2001). Evidence for lunar-sidereal rhythms in crop yield: a review. Biological agriculture & horticulture, 19(3), 247-259. https://doi.org/10.1080/01448765.2001.9754928
[23] Kurup, R., & Kurup, P. A. (2012). Actinidic archaea mediates biological transmutation in human systems—Experimental evidence. Advances in Natural Science, 5(1), 47–49.
[24] Leroy, F., & De Vuyst, L. (2004). Lactic acid bacteria as functional starter cultures for the food fermentation industry. Trends in Food Science & Technology, 15(2), 67–78. https://doi.org/10.1016/j.tifs.2003.09.004

[25] Maicas, S. (2020). The role of yeasts in fermentation processes. Microorganisms, 8(8), 1142. https://doi.org/10.3390/microorganisms8081142
[26] Mittal, R., Allawadhi, K. L., & Sood, B. S. (1987). Quantitative analysis of binary mixtures using a simple x-ray fluorescence technique. X-Ray Spectrometry, 16(1), 37–39. https://doi.org/10.1002/xrs.1300160109
[27] Mittal, R., Allawadhi, K. L., Sood, B. S., Singh, N., Kumar, A., & Kumar, P. (1993). Determination of potassium and calcium in vegetables by X-ray fluorescence spectrometry. X-Ray Spectrometry, 22(6), 413–417. https://doi.org/10.1002/xrs.1300220609
[28] Moawad, E. Y. (2013). Cell growth energy represents a measure for man health; regulates nuclear transmutations and aberrant activation in human cell. Universal Journal of Medical Science, 1, 27–35. https://doi.org/10.13189/ujmsj.2013.010203
[29] Mumivand, H., Babalar, M., Hadian, J., & Fakhr-Tabatabaei, M. (2011). Plant growth and essential oil content and composition of Satureja hortensis L. cv. Saturn in response to calcium carbonate and nitrogen application rates. J. Med. Plants Res, 5(10), 1859-1866.
[30] Nkhata, S. G., Ayua, E., Kamau, E. H., & Shingiro, J. B. (2018). Fermentation and germination improve nutritional value of cereals and legumes through activation of endogenous enzymes. Food science & nutrition, 6(8), 2446–2458. https://doi.org/10.1002/fsn3.846
[31] Nout, M. R. (2009). Rich nutrition from the poorest–Cereal fermentations in Africa and Asia. Food Microbiology, 26(7), 685–692. https://doi.org/10.1016/j.fm.2009.07.002
[32] Nykyri, K., Di Matteo, S., Archer, M. O., Ma, X., Hartinger, M. D., Sarantos, M., ... & Paterson, W. (2025). Could the Full Moon Excite a Low-Frequency Perturbation on the Earth's Magnetic Field? Authorea Preprints. https://doi.org/10.22541/au.176176545.55114087/
[33] Rajkumar, M., Sandhya, S., Prasad, M. N. V., & Freitas, H. (2012). Perspectives of plant-associated microbes in heavy metal phytoremediation. Biotechnology Advances, 30(6), 1562–1574. https://doi.org/10.1016/j.biotechadv.2012.04.011
[34] Roschak, C. (2026). Moon wood: cultural beliefs and scientific scepticism: the effect of lunar cycles on plant growth and wood properties (A review). International Forestry Review, 28(2), 233–248. https://doi.org/10.1505/146554826841270485
[35] Rossignol, M., Benzine-Tizroutine, S., & Rossignol, L. (1990). Lunar cycle and nuclear DNA variations in potato callus or root meristem. In Geo-cosmic Relations: The Earth and Its Macro-environment (p. 116).
[36] Sakandar, H. A., Hussain, R., Kubow, S., Sadiq, F. A., Huang, W., & Imran, M. (2019). Sourdough bread: A contemporary cereal fermented product. Journal of Food Processing and Preservation, 43(3), e13883. https://doi.org/10.1111/jfpp.13883
[37] Sangronis, E., & Machado, C. J. (2007). Influence of germination on the nutritional quality of Phaseolus vulgaris and Cajanus cajan. LWT – Food Science and Technology, 40(1), 116–120. https://doi.org/10.1016/j.lwt.2005.08.003
[38] Sannidhi, S., Priyanka, G., Singiri, J. R., Novoplansky, N., & Grafi, G. (2025). Plants and the moonlight: A controversial subject revisited. Plant Science, 112841. https://doi.org/10.1016/j.plantsci.2025.112841
[39] Shakuntala, M. N., & Shadaksharaswamy, M. (1987). Foods (Facts and Principles). Mohinder Singh Sejwal Publishers, New Delhi/India for Wiley Eastern Limited.
[40] Sivasankar, J., & Thimmaiah, A. (2021). Lunar rhythms in agriculture-review on scientific perspectives. Int. J. Complement. Altern. Med, 14, 81-85.
[41] Steiner, R. (1924). Agriculture course. Trans. G. Adams. GA, 327
[42] Stolov, H. L., & Cameron, A. G. W. (1964). Variations of geomagnetic activity with lunar phase. Journal of Geophysical Research, 69(23), 4975–4982. https://doi.org/10.1029/JZ069i023p04975
[43] Tamang, J. P., Cotter, P. D., Endo, A., Han, N. S., Kort, R., Liu, S. Q., ... & Hutkins, R. (2020). Fermented foods in a global age: East meets West. Comprehensive reviews in food science and food safety, 19(1), 184-217. https://doi.org/10.1111/1541-4337.12520
[44] Teng, T. S., Chin, Y. L., Chai, K. F., & Chen, W. N. (2021). Fermentation for future food systems: Precision fermentation can complement the scope and applications of traditional fermentation. The EMBO Reports, 22(5), EMBR202152680. https://doi.org/10.15252/embr.202152680
[45] Vysotskii, V. I., & Kornilova, A. A. (2003). Nuclear Fusion and Transmutation of Isotopes in Biological Systems. MIR Publishing House, Moscow.
[46] Vysotskii, V. I., & Kornilova, A. A. (2011). Low-energy nuclear reactions and transmutation of stable and radioactive isotopes in growing biological systems. Journal of Condensed Matter Nuclear Science, 4(1). https://doi.org/10.70923/001c.72130
[47] Wrigley, C. (2017). The cereal grains: Providing our food, feed and fuel needs. In Cereal grains (pp. 27-40). Woodhead Publishing. https://doi.org/10.1016/B978-0-08-100719-8.00002-4
[48] Zürcher, E. (2011). Plants and the Moon–traditions and phenomena. HerbalEGram, 8(4), 1-14.
[49] Zürcher, E., Schlaepfer, R., Conedera, M., & Giudici, F. (2010). Looking for differences in wood properties as a function of the felling date: lunar phase-correlated variations in the drying behavior of Norway Spruce (Picea abies Karst.) and Sweet Chestnut (Castanea sativa Mill.). Trees, 24(1), 31-41. https://doi.org/10.1007/s00468-009-0376-2



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