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Research Article

To Study the Effect of *Arachis hypogaea* and *Cicer arietinum* on Serum Calcium Levels of Women between 17-25 years of Age group in Shekhawati region of Rajasthan

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Abstract: Peanuts are considered as one of the rich sources of healthy nutrition. India is among the major producers of peanuts in the world but ironically, India also has the largest number of malnourished people. In such a case, consumption of peanuts can be extremely advantageous. Allergies from peanuts are consonantly less widespread in India. Peanut is employed in many traditional dishes within the country through the schemes of Mid-day meal and on the lines of plumpy nuts, the undernourished are often fed and the dual burden of malnutrition and overweight can be reduced. Thus, dual outlook of appreciable industrialisation and organisational creativity of peanut products can create a healthy population. It is for sure, that there's an enormous extent for the industrialisation of peanut products. Hence, the market mania looks extremely hopeful due to these footnoted factors. Further, peanuts can reduce the daily use of unwanted supplementation from non-dietary roots. Chickpeas (also referred as garbanzo beans) are referred as one of the earliest eaten crops within the world and hang in the air today, nearly in every continent. Chickpeas are the part of many long-established diets for more than 7,500 years. Still, they are included in the diets of the healthiest populations living around the world today, counting those who eat traditional cuisines that rise from the centre east side, the Mediterranean sea region and African tribes too. Next to the soyabean, chickpeas is the bean generally grown and eaten worldwide. Chickpeas are a kind of legume that gives so many health benefits. Chickpeas also helps to extend satiety, fasten digestion, manage blood glucose levels, increase the body's ability to fight against diseases and many more such benefits. Chickpeas are nutritionally dense, packaged with lots of proteins, vitamins and minerals, which is one of the reasons why they are specifically included in various healing diets. In the present scenario, life-style changes which incorporate mimicking westernisation, sedentary lifestyle, calorie and meal over-intake, increase fluoride content in soil and water, and drug interplay/medicine, along with reduced physical activity are causing a lot of nutrient deficiency. But mostly, it affects the calcium and vitamin D status in humans, which results in diseases like fluorosis, rickets, osteopenia and osteoporosis. During the study total 60 subjects (17-25 years women) were undertaken in which along with their normal diets, 20 subjects were on peanuts, 20 were on chickpeas and remaining 20 were on placebo. To compare the effect on serum calcium levels this study was done over a period of 60 days with regular monitoring and counselling done during this period. As the study was not completed due to the COVID-19 pandemic, the results should reveal that there was not much significant difference in the serum calcium levels. But the subjects who were taking chickpeas showed some significant differences than those with peanuts and placebo along with the diet because it was a short period of research. If the duration of study would have been for long, probability of getting higher significance results. Therefore, it can be concluded that chickpeas have a higher role than peanuts in increasing the serum calcium levels of a person over a short period of time.

Keywords: COVID-19, Women,

INTRODUCTION

Calcium is a macro mineral that all life forms require, along with human beings. It is the foremost abundant mineral within the body, and is required for bone health. Humans ought to have calcium to form and maintain bone density. From the total, 99 percent of the calcium in our body is used for building bones and teeth. Along with bone health, calcium has the utmost importance in oocyte activation, regulating heartbeat,

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blood clotting, nerve impulse, transmission, and fluid balance within cells, for maintaining a healthy message between the brain and the body, muscle movement and cardiovascular function. Calcium occurs originally in many foods and other manufacturers fortify food with calcium to increase its uptake. With calcium, people also require vitamin D, as it helps the body to absorb the calcium. Vitamin D is found from animal oil, some well fortified dairy by-products, and exposure to sunlight at a particular wavelength. Calcium is important for overall health. Most of the cells in our body consume calcium somehow. Some of the areas where calcium is consumed are - in our systema nervosum, muscles, heart, and bone. As we grow old, the calcium in our body is not fully absorbed, which causes our body to shed more calcium ions from the bones. Over a period of time, this increase in age can lead to osteoporosis. Our body tries to maintain the quantity of calcium in our blood within an exceptionally shallow range. This permits the cells in our body to remain healthy and do their necessary work for all times. When we have very low vitamin D levels, we will develop an adult sort of rickets, called osteomalacia. The requirements are greatest during the growth spurts such as childhood, during pregnancy and lactation. Calcium plays an immense role in the body. Calcium also acts as cofactor for several biochemical processes. In its absence, some chief enzymes cannot work effectively. Some studies have also shown that consuming appropriate calcium may result in:

- lower risk of developing brain condition
- improved cholesterol values
- lower risk of colorectal adenomas, a kind of non-cancerous tumor

Calcium-rich foods

People can obtain calcium from a wide source of foods and drinks. The following are good sources:

- Fish - sardines and salmon
- Soybeans and its products like tofu.
- green leafy vegetables, such as Agatha leaves, amaranth leaves, fenugreek leaves, colocasia leaves, curry leaves, parsley, mint leaves, broccoli, spinach, turnip leaves, watercress, kale, etc
- fortified fruit juices
- nuts and seeds, especially chia, ajwain, figs, almonds, sesame - both black and white
- Grains like finger millet, amaranth flour, and fortified cereals
- Legumes like whole horse gram (moong), moth beans and whole bengal gram, rajma and whole red gram
- Milk cheese yogurt and other milk products
- Fortified alternatives, like soy milk, almond milk

Dark green leafy vegetables also contain calcium. But, they have oxalic acid present in them, which acts as inhibitors and reduces the uptake of calcium by body.

Calcium Requirements

As shown in table below, according to DIETARY GUIDELINES FOR INDIANS. Manual by NIN Hyderabad, INDIA, (NUTRITION, 2011) is the calcium requirement during different phases of life.

Additional calcium is required for:

- Women started having menopause
- Lactose intolerance
- Follow an animal-free or vegan diet

Supplements can be given to these people.

Group	Particulars	Body weight kg	Net Energy Kcal/d	Protein g/d	Visible Fat g/day	Calcium mg/d	Iron mg/d
Man	Sedentary work	60	2320	60	25	600	17
	Moderate work		2730		30		
	Heavy work		3490		40		
Woman	Sedentary work	55	1900	55	20	600	21
	Moderate work		2230		25		
	Heavy work		2850		30		
	Pregnant woman		+350	+23	30	1200	35
	Lactation 0-6 months		+600	+19	30	1200	21
	6-12 months		+520	+13	30		
Infants	0-6 months	5.4	92 Kcal/kg/d	1.16 g/kg/d	–	500	46 µg/ kg/day
	6-12 months	8.4	80 Kcal/kg/d	1.69 g/kg/d	19		5
Children	1-3 years	12.9	1060	16.7	27	600	09
	4-6 years	18	1350	20.1	25		13
	7-9 years	25.1	1690	29.5	30		16
Boys	10-12 years	34.3	2190	39.9	35	800	21
Girls	10-12 years	35.0	2010	40.4	35	800	27
Boys	13-15 years	47.6	2750	54.3	45	800	32
Girls	13-15 years	46.6	2330	51.9	40	800	27
Boys	16-17 years	55.4	3020	61.5	50	800	28
Girls	16-17 years	52.1	2440	55.5	35	800	26

Figure 1: Recommended Dietary Allowance for Different age group

I performed this study in the shekhawati region of Rajasthan. Shekhawati is the semi-deserted historical region, situated in north-eastern area of Rajasthan including Sikar, Churu, Jhunjhunu and few areas of Jaipur and Nagaur. The boundaries of Shekhawati region comprises of - the Jangladesh region on the northwest side, Haryana on the northeast side, Mewat on the easten side, Dhundhar on the southeast side, Ajmer on the south side, and the Marwar region on the southwest side. Shekhawati covers the desert area, transitional plains and the Aravalli hill region. The climate of the desert region is harsh and extreme. The temperature ranges from below 0 °C (32 °F) in winter to more than 50 °C (122 °F) in summer. The summer brings hot waves of air called loo. The groundwater is as deep as 200 feet (60 m), and in some places, the groundwater is hard and salty. Water is the most important thing for the perpetuation of life on this planet. Water fills in about 3/4th of the earth's surface,

but only 3% of it is fit for human use. Good quality of water is essential for all people. Groundwater is a remarkable source of water supply around the world and is the primary source of drinking water in most of the rural areas. The quality of groundwater is continuously changing as a consequence of natural and human activities. During the last decade, it was observed that groundwater is getting contaminated exceedingly as a hike in human interest (Jain & Singh, 2014). Polluted groundwater is the prime reason for the spread of epidemics and chronic diseases in humans. The problem of hydro-fluorosis is rampant in the state. Fluoride is naturally obtained in soil, water, and eventually in the crops (Choubisa). Various mouth care products including mouth wash freshener, toothpaste and drinking water uses synthetically manufactured floride. With all the possible benefits, there comes the toxic side effect of excessive fluoride which drastically is becoming a reason for a number of health issues (Jain & Singh, Prevalence of Fluoride in Ground Water in Rajasthan State: Extent, Contamination Levels and Mitigation, September 2014). This side effect includes:

Acute, high-degree susceptibility to fluoride can lead to

- abdominal pain
- excessive saliva
- nausea and vomiting
- seizures and muscle spasms

This will not result from drinking tap water. It is rare and probably will occur only in case of accidental contamination of potable water, due to an industrial fire or explosion, for instance.

It is wonderful how some substances are harmful in large quantities but helpful in small amounts (MITHARWAL & YADAV, 2011).

Chronic, high-degree susceptibility to fluoride can cause

- dental fluorosis - discoloration of teeth,
- skeletal fluorosis - pain and damage to joints and bones
- Thyroid complications - hyperparathyroidism
- Neurological problems - could lead to poorer cognitive development

It may also contribute to the following health problems

- pimples and other dermis problems
- cardiovascular problems (problem in heart vessels) , involving arteriosclerosis i.e., clot in arteries and arterial calcification i.e., clot with calcium in arteries, high blood pressure, myocardial damage, cardiac insufficiency, and heart failure
- reproductive issues, such as lower fertility and early puberty in girls
- neurological problems, possibly leading to ADHD (Attention Deficit Hyperactivity Disorder)

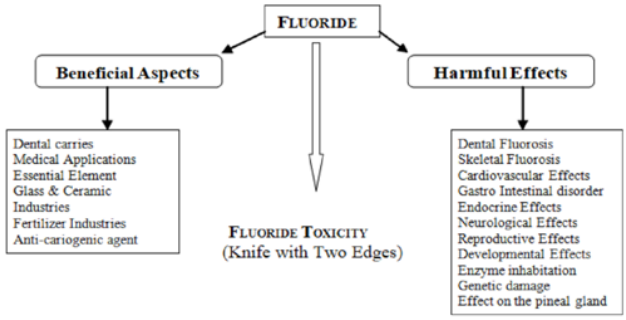

Figure 2: Some beneficial and harmful effects of fluoride

Below figure 3, shows the Fluoride Cycle in nature (HUSSAIN, SHARMA, & HUSSAIN, 2004). So basically, all the extra fluoride leeches directly into the soil causing the fluoride content in groundwater and crops to increase.

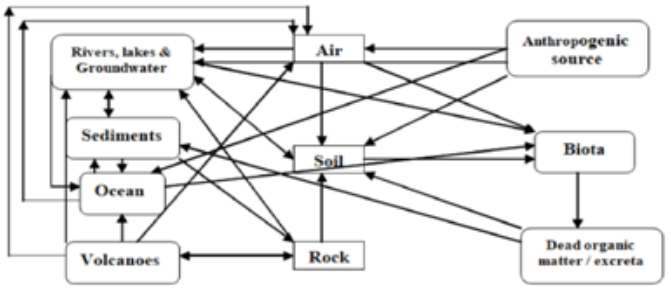

Figure 3: Accumulation of fluoride in water (Biogeocycle)

Figure 4, shows the degree of fluorine intolerance in different districts of Rajasthan. 4 groups were built through the spectrum of all fluoride endemic districts on the F scale, viz. 1.0–5.0 ppm (Group 1), 5.1–10.0 ppm (Group 2), 10.1– 20.0 ppm (Group 3) and >20.0 ppm (Group 4). Based on F scale, 22 districts union to the third and fourth groups are highly prone to chronic F poisoning in Rajasthan (HUSSAIN, SHARMA, & HUSSAIN, 2004).

Group one F 1.0–5.0 ppm +	Group two F 5.1–10.0 ppm + +	Group three F 10.1–20.0 ppm + + +	Group four F > 20.0 ppm + + + +
Jhalawar	Chittorgarh	Dungarpur	Udaipur
Baran	Bundi	Jhunjhunu	Jodhpur
Rajsamand	Hanumangarh	Jaisalmer	Bhilwara
Karauli	Alwar	Jalore	Jaipur
Banswara	Sawai Madhopur	Dausa	Sri Ganganagar
Pratapgarh		Sika	Churu
Kota		Tonk	Nagaur
Dholpur		Sirohi	
		Ajmer	
		Pali	
		Bharatpur	
		Barmer	
		Bikaner	

+, + +, + + + and + + + +, Degree of F intolerance.

Figure 4: Degree of Fluorine intolerance

Research suggests that when exposed to high value of fluoride, it was found that skeletal lesions were developed as a result of a homeostatic elevation of calcium removal rate from bone and a mechanism of primary inhibition of calcium absorption. Studies have shown, along with intake of sodium fluoride, the absorption of calcium in intestine and the calcium balances did not improve. According to ICMR, the desirable limit of fluoride in water is 1.0 mg/L and permissible limit is 1.5 mg/L. But, in the present study, it is noted that the fluoride concentration varied from 1.4 to 4.0 mg/L. As a result, calcium metabolism is hindered by high fluoride in the body which makes calcium unavailable causing insufficiency of it in the body. Hence, people living in these areas have a low serum calcium. The entire calcium in our blood is measured by serum calcium biopsy. 8.5 to 10.2 mg/dL is the normal values range for serum calcium. However, normal value scale may alter slightly among various laboratories. The serum calcium levels in the body decides whether the person has hypocalcemia or hypercalcemia.

A diet high in fluoride is a disaster for our health. Thus people in these regions depend on rainwater harvesting. The harvested rainwater in the monsoon season (during July and August) is stored in pucca tanks and used around the year for drinking purposes. Also, rainwater has less fluoride content then that of ground water (Whitford, 1334).

Calcium deficiency causes

The following conditions or lifestyle habits may end in low calcium levels, also referred to as hypokalaemia:

- Eating disorders
- Poor diet
- High stress
- Intestinal inflammation
- Growth spurt
- Medications and long-term use of laxatives - antacids, corticosteroids
- Higher intake of caffeine, soda or alcohol
- Mercury exposure
- Overconsumption of magnesium
- Chelation therapy in Metal Intoxication
- Inactive parathyroid gland-lack of parathyroid hormone
- People who eat lots of sodium or protein can emit calcium.
- Various cancers due to chemotherapy
- Hormonal imbalance
- Some conditions, like disorder, inflammatory bowel disease, Crohn's disease, and a few other digestive diseases
- Some surgical procedures, including removing the stomach
- Kidney failure
- Pancreatitis
- Vitamin D deficiency
- Phosphate deficiency

The body throws out some calcium in sweat, urine, and faces (Khan & Gotter, 2019). Foods and activities that encourage these functions may lower the calcium proportions within the body.

Calcium deficiency and symptoms

Calcium deficiency diseases mostly known as hypocalcemia, occur if the levels of calcium in the blood are low. Prolonged inadequacy can lead to tooth damage, cataract, a mutation in the brain, and osteoporosis, which results in brittle bones. Hypocalcemia is the condition defined by having too little calcium in the blood. It usually occurs in infants. This may be caused due to some formulas with high levels of phosphate. They are responsible for lowering the levels of blood calcium. Signs of hypocalcemia entail - irritability, muscle twitching, willies, shock, narcosis and sieges. Age is not considered as a factor of calcium insufficiency. Prolonged calcium insufficiency can cause rickets in children and osteomalacia to osteopenia and later osteoporosis in adults. Also, it may induce interference in the basal rate and other body

illnesses such as chest pains, numbness in fingers and toes, muscle cramps, flakey nails, dry skin and tooth decay. There are no early symptoms of calcium deficiency. Hence, is difficult to diagnose, except in critical cases (Khan & Gotter, 2019).

I choose to experiment on groundnuts and chickpeas because both have an excellent nutrient profile.

The groundnut nut also named as the goober (US), or peanut (UK), taxonomically, maybe a legume is cropped exclusively for its seeds which has a potent nutritional profile. Both of them are a great source of proteins (especially plant-based protein), fiber, along with lots of other key vitamins and minerals. Apart from their healthy nutritional benefits, peanuts are also a calorie-rich food; hence it should be taken care while consuming them as they are most healthful when consumed carefully due to their high calorie contents. In particular, we find peanuts as an extensive source of helpful fats, high proteins and more fiber. Potassium, phosphorus, magnesium, calcium, and B vitamins are also present in plenty. Peanuts are nutritive-rich and less in carbohydrates regardless of being calorie dense. In an diverse Indian diet, groundnuts have a foothold over numerous other foods because of their nutritive value, taste, blending ability in sweets and savories, time, and also low-cost savories. 13th most vital food crop and the third-largest oilseed produced in the world by groundnut. The greatest manufacturer as well as user of groundnut in the world is China with 166.24 lakh tonnes followed by India (69.70 lakh tonnes), Nigeria (30.28 lakh tonnes), and United States (25.78 lakh tonnes). Countries like Philippines, Vietnam, Indonesia, Malaysia, Ukraine, Russia and UK import groundnuts from India (Arya, Salve, & Chouhan, 2015) (Longvah, Ananthan, Bhaskarachary, & Venkaiah, 2017).

NUTRIENT	CONTENT
Moisture	6.97 g
Protein	23.65g
Ash	2.11 g
Total fat	39.63 g
Dietary fiber	10.38 g
Carbohydrates	17.27 g
Energy	2176 kJ
Potassium	679 mg
Phosphorous	391 mg
Magnesium	167 mg
Calcium	54 mg
Sodium	12.21 mg
Iron	3.44 mg
Zinc	3.18 mg
Vitamin B3 (niacin)	11.35 mg
Vitamin E (alpha-tocopherol)	1.72 mg
Vitamin B1 (thiamine)	0.57 mg
Vitamin B6 (pyridoxine)	0.23 mg
VitaminB2 (riboflavin)	0.12 mg
VitaminB9 (folate)	90.87 µg

Figure 5: Nutrient profile per 100g groundnuts

Figure 6: Peanuts

The chickpea (Cicer arietinum) is an annual legume of the family Fabaceae, subfamily Faboideae. It is referred to as bean, Bengal gram, garbanzo bean, chickpea. While they need to become more popular recently, chickpeas have been grown in Middle Eastern countries for thousands of years. Their taste is similar to nuts and the texture of grain, balanced well with various other foods and ingredients. As a high-end root of micronutrients and fiber, chickpeas may provide an overspread of health benefits, like improving digestion, aiding weight management, and reducing the danger of several diseases. Moreover, chickpeas are protein dense thus,used as a substitute for meat in vegetarian and vegan diets. Chickpeas also provide a spread of vitamins and minerals, also as an honest amount of fiber and protein. Chickpeas are cultivated in over 35 countries, however the major countries belong to South and Southeastern Asia (ca. 70%), in which India (ca. 60%) as well as Pakistan (ca. 10 to 15%) are the main developers. Other than these countries, Western Asia accounts for almost 15% of the world's chickpea producing areas, along with Iran, Turkey, and Syria being the highest producers in this area. Apart from these, Africa contributes to almost 5% of the chickpea producers, mostly coming from Ethiopia, Malawi, and Tanzania in Eastern Africa and Morocco in North Africa. From the remaining parts of the Earth, about 3% area is accounted by North America (mostly Canada), 2% by Australia, and 1% by Europe (mostly Spain) (J.SINGH & JAUHAR, 2005) (Longvah, Ananthan, Bhaskarachary, & Venkaiah, 2017).

NUTRIENT	CONTENT
Moisture	8.56 g
Protein	18.77 g
Ash	2.78 g
Total fat	5.11 g
Dietary fiber	25.22 g
Carbohydrates	39.56 g
Energy	1201 kJ
Potassium	935 mg
Phosphorous	267 mg
Magnesium	160 mg
Calcium	150 mg
Sodium	26.56 mg
Iron	6.78 mg
Zinc	3.37 mg
Vitamin B3 (niacin)	2.10 mg
Vitamin E (alpha-tocopherol)	0.28 mg
Vitamin B1 (thiamine)	0.37 mg
Vitamin B6 (pyridoxine)	0.36 mg
Vitamin B2 (riboflavin)	0.24 mg
Vitamin B9 (folate)	233 µg

Figure 7: Nutrient profile per 100g chickpeas

Figure 8: Chickpeas

Besides, who doesn't like munching on roasted chickpeas or groundnuts, and what better time to do it than now, when it's the season of a fresh harvest. Also in winter, people here, in the Shekhawati region, tend to eat more of these foods. Commonly known as *Singh Danna* and *Channa* are consumed to gain more fats and protein to fight the extreme winter.

Justification

A nation wherein numerous individuals remain under the 'poverty line', calcium deficiency appears to be a far-off issue. In any case, India is under attack: junk meals, liquor, sedentary lifestyle, lots of Indian population has now begun depending on processed food that contain an immense level of trans-fat, sugars, and other undesirable and artificial ingredients that is leading to self destruction, making most Indian women obese or overweight. Research suggests that when exposed to high levels of fluoride, it was seen that bone lesions were developed as a result of a process of primary hindrance of calcium incorporation as well as a homeostatic promotion of calcium transfer rate from bone. (Simon, et al., 2014). Studies have shown, along with intake of sodium fluoride, the absorption of calcium in intestine and the calcium balances did not improve (SPENCER, LEWIN, FOWLER, & SAMACHSON, 1969). Monitoring patients who take medications to prevent hypocalcemia. Older adults need to be closely monitored as their intake of many medications and higher renal insufficiency may be a risk factor for hypocalcemia. Teach samples how to incorporate foods which are potent of calcium and vitamin D into their diets. The thought processes in such a quick upward push of illness in Indians are their lifestyle and pattern of eating; however frequently imbalanced diets and increased bodily inaction because of monetary liberalization, urbanization and mechanization. Groundnuts and chickpeas have been a piece of our eating regimens for lots of years, and individuals usually experience it. It is commonly used in Indian kitchens and easily joined in the diets.

Working Hypothesis

Is there any significant increase in serum calcium levels of individuals when they are subjected to regular use of groundnuts and chickpeas?

Null Hypothesis

There is no significant increase in serum calcium levels of individuals when they are subjected to regular use of groundnuts and chickpeas.

Aims & Objectives

The main aim of this study is to know whether peanuts and chickpeas help in increasing the serum calcium level of girls, between the age group of 17-25 years, living in the Shekhawati region of Rajasthan, along with the high fluoride content of water. If yes, then how much difference can they make in an individual's body. This is a time of life when absolute smallness is normative. It is a time lap of constant change and observation that covers many aspects of life: home, family, work, school, resources, and role. The process of becoming an adult is more cautious and diverse today than before. Economic and psychological autonomy are achieved after prolonged time by young people and early adulthood experiences differ highly by gender, race and ethnicity, and social class. Thus being calcium deficit during such a young age is terrifying.

Specific Aim

- To see the effect of groundnuts on calcium deficit people.
- To see the effect of chickpeas on calcium deficit people.
- To provide a normal diet to all people.

- To improve the nutritional status of the person.

Objective

- Increase in serum calcium levels, maintain normal serum calcium in the body over the long term, and prevent decrease in serum calcium levels.
- Increase physical activity
- Check the patient's motivation and dedication to enforce the plan.
- Right dietary counseling and management is necessary.

Outcome Measures

- Sample reported level of understanding
- Sample reported knowledge of food
- Sample reported level of motivation
- Sample reported diet history
- Sample reported experience

Duration of the Project

The duration of the project is 4 months starting from mid January (2020).

Problems Anticipated

- Difficulty in convincing individuals to make changes in their lifestyle.
- Difficulty in correcting the dietary habits.
- Difficulty in improving their appetite.
- Difficulty in managing de-motivated individuals

REVIEW OF LITERATURE

The review of literature is discussed in depth to understand the various aspects of serum calcium and their various anthropometric measurements to calculate it. And also, to understand about the cinnamon and its various health benefits.

Peanuts: An overview

Peanut, also called "groundnut" in some parts of the Earth, is the edible part of the seed of a legume. Technically, peanuts (scientific name: Arachis Hypogaea) are categorized as peas and are included among the family (fabaceae) of legume or beans. Even though they belong to the legume family, peanuts are also included among the oilseeds due to the high oil content. Due to their wide usage all over the world, they form a part of a variety of traditional food items globally. Peanuts have notably been shown an extremely positive sign of eradication of malnutrition amongst the people in most African countries within the past few years (Guimón & Guimón, September 2012).

History of peanuts

Peanuts' history falls far back to the times of the ancient Incas, who were from Peru. Incas were the first to grow and harvest peanuts. They called the peanuts by the name ynchic. As a part of their daily religious commitments, they offered them to the Sun God. Peanuts started to get popular during the times of civil war during 1860 in the USA. Mr. George Carver or the father of the peanut industry as he was fondly known had created approximately 300 varieties of different products obtained from peanuts (Carver, 1925). After that, peanut butter was created during the 1890's by the St. Louis physician as a soft protein substitute for people with weak teeth. Subsequently, in 1895, Dr. John Harvey Kellogg had developed and patented the "Process of preparing nut meal" and during the war time, peanuts were also supplied to the army. As per the encyclopedia named 'Encyclopedia of American Food and Drink,' by John Mariana, the process of roasting shelled peanuts using oil was developed in 1900's and peanuts were packed in sealed bags under the name "Planters''. Joseph L. Rosenfield had provided his patented discovery to the pond company, who were the creators of a unique type of peanut butter called the peter pan peanut butter. In 1928, Rosenfield began the manufacturing of his own brand of peanut butter, which was the commencement of popularization of peanut within the land of America which gradually spread around the world in Europe and Asia.

Peanut Product	Brand and company details	Price in Rs/100 g
Roasted Peanuts	Planters	110
	Bhikharam Chandmal Bhujiawala (Plain peanut)	25
	Haldirams (Salted nuts)	25
Peanut snacks	Haldirams tasty nuts	42
	Gardens fried nuts	38
	Snackup Masala peanuts(MTR)	
Peanut Butter	Skippy (Unilever)	78
	Peterpan (ConAgra Foods)	68
	Savoury (Bajaj foods)	58
	American Garden Foods	68
	Navadarshanam handmade peanut butter	60
	Sundrop creamy peanut butter	35
Peanut Caramel Bars	Paypals (Hersheys)	100
	National Chikki	38

Figure 9: Popular peanut based branded products available in the local market

Nutrient Value

Principle	Nutrient Value	Percentage of RDA
Energy	567 Kcal	29
Carbohydrates	16.13 g	12
Protein	25.80 g	46
Total Fat	49.24 g	165
Cholesterol	0 mg	0
Dietary Fiber	8.5 g	22
Vitamins		
Folates	240 µg	60
Niacin	12.066 mg	75
Pantothenic acid	1.767 mg	35
Pyridoxine	0.348 mg	27
Riboflavin	0.135 mg	10
Thiamin	0.640 mg	53
Vitamin A	0 IU	0
Vitamin C	0mg	0
Vitamin E	8.33 mg	55.5
Electrolytes		
Sodium	18 mg	1
Potassium	705 mg	15
Minerals		
Calcium	92 mg	9
Copper	1.144 mg	127
Iron	4.58 mg	57
Magnesium	168 mg	42
Manganese	1.934 mg	84
Phosphorus	76 mg	54
Selenium	7.2 µg	13
Zinc	3.27 mg	30

Figure 10: Groundnut Nutritional value per 100g(USDA)

Figure 11: Peanuts

Peanuts are abundant in multiple natural micronutrients (fig.10) including vitamins, minerals, and bioactive compounds such as resveratrol that are favourable to health, making them a feasible option for upgrading the nutritional status of those who are malnourished, developing, growing, or in need of critical nutrients in peanuts are vital for growth, development, metabolism, and immunity (Gülçin, 2010) . It is probably that the individual nutrients in peanuts work by numerous mechanisms and that they have synergistic effects regarding improving health status. As per a study carried out in a group of more than 15,000 people, it had been observed that those people who were consuming peanuts and its products had higher levels of vitamins (A and E), zinc, folate, calcium, magnesium, iron and dietary fiber compared to those who didn't consume peanuts (Griel, Eissenstat, Juturu, Hsieh, & Kris-Etherton, 23 December 2004)

Health Benefits of Peanut

Consuming either peanuts or processed peanuts is beneficial to health, because of their desirable lipid profile. This lipid profile is higher in unsaturated fatty acids compared to saturated fatty acids. Groundnut oil free of trans-fat, cholesterol and is low in saturated fats content. Various constructive biological effects are seen for its high mono-unsaturated fatty acid content. A number of studies have shown the unique properties of this carboxylic acid and therefore the importance of maintaining its intake at as high A level as possible. A number of studies have proved that the intake of peanuts or groundnut oil should lead to lower heart disorder (CVD) risk and should also improve the serum lipid profiles, lower LDL oxidation, and mask a cardioprotective effect. Peanuts and its products (peanuts, spread, and peanut oil) are often utilized in scheming a high-monounsaturated fatty acid, cholesterol-lowering diet that's preferable to a diet in

reference to CVD protection. Peanuts are also helpful in reducing the risk of diabetes, especially type-2 diabetes. Normally, people with type-2 diabetes are not able to produce sufficient quantities of insulin for the requirements of the body and/or also cannot use insulin effectively in their body. Health-preventive effects were even seen on utilization of processed peanuts and its by-products. Frequent intake of peanuts and its subsidiaries may limit the chances of colorectal cancer. Some people possess allergies to peanuts (Woodroof, 1983). All the 20 amino acids are present in Peanuts and fully 20 vital nutrients (vitamins and minerals) in every seed. Further to the regular nutritional benefits, consumption of peanuts results in future health benefits. Peanuts have high antioxidant properties compared to wine and tea, ((Halvorsen, et al., july 2006). Even the skin of peanuts possess rich antioxidant properties. If consumption of peanut is done with its skin, the antioxidant property increases two fold. Furthermore, roasting of peanuts can also increase this capacity (Craft BD, 2010) (Yua, Ahmednaa, Goktepea, & Daib, 2006). Some recent studies have also suggested that antioxidant characteristics are improved by boiling the peanuts. An increase by 2-4 fold had been seen in isoflavone antioxidants biochanin A and genistein content, respectively, when peanuts are boiled (Craft BD, 2010). It has been proved that the mortality rate reduced by 40% when peanuts were a part of the daily diet (Fraser, Sabaté, Beeson, & Strahan, 1992). Reduction in deaths thanks to cardiovascular diseases especially was found in the population who consume peanut or spread regularly (Fraser, Sabaté, Beeson, & Strahan, 1992). As per a report, it has been found that consumption of peanuts lowers the factors of risk related to heart diseases for individuals of all ages, among both the genders and also in patients who have many other risk factors related to blood sugar (Fraser, Sabaté, Beeson, & Strahan, 1992). Higher blood pressure leads to higher risks of heart diseases as well as stroke. Scientists have researched that the blood pressure is directly impacted by the dietary choices made. Peanuts and spread consist of health monounsaturated fatty acids, potassium, magnesium, fiber, arginine, plant proteins, and lots of bioactive components, all of which contribute to lowering vital signs. Studies have consistently shown that heart disease related risks reduce when peanuts are consumed on a daily basis in small amounts (Sabaté & Ang, 2009).

Diabetes and blood glucose

Jiang, Wang, & Davis (2002) have mentioned the less risks of diabetes by 1 / 4 when peanuts are consumed in diet on a day to day .Magnesium (DE, Mainous, Geesey, & Ellis, 2007) and dietary fibers (Gartside, Wang, & Glueck, 1998) have been attributed as the main contributory factors for improved health status. The term Glycemic Index refers to an index that assess carbohydrates according to the rate of their glycemic response. In simple words, it is the conversion of carbohydrates to simple sugars within our body). This index utilizes a range of 0 to 100, with 100 indicating the maximum rise in blood glucose levels and 0 indicating no rise in blood glucose levels. To make a reference point, the Glycemic Index of 100 is set for pure glucose including food items like white bread, etc. When blood glucose is kept comparatively constant, the body gives best results. We feel lazy and/or feel extremely hungry if our blood glucose goes down. When it shoots too high, our brain signals pancreas to secrete more insulin. Insulin levels our blood glucose back to track, by mostly converting the extra sugar to stored fat. Also, if the time period of increase in blood glucose is higher, then our body will release insulin in excess amount and drive our blood glucose back down too low. thus, if you eat certain food with high GI once, it will cause an outsized and rapid glycemic response, you'll feel an initial elevation in energy and mood as your blood glucose rises, but this is often followed by a cycle of increased fat storage, lethargy, and more hunger, that's the reason why people with high blood sugar are advised of low GI food.

Inflammation

Inflammatory factors in the blood like C-reactive proteins (CRP) have been identified as predictors of cardiovascular disease. Diet constituents can play a part in lowering inflammation (Nettleton, et al., 2006). Certain ingredients like- fats, antioxidants, dietary fiber, arginine, and magnesium have been shown to help regulate inflammation (Salas-Salvadó, Casas-Agustench, Murphy, López-Uriarte, & Bulló, 2008). An association between frequent peanut consumption and reduced inflammatory factors has also been noted.

Cancer

Bioactive components, unsaturated fats, certain macronutrients, have shown to possess cancer-preventative effects, which are all wrapped up in a kernel of peanut (González & Salas-Salvadó, 2006). Phytosterols in particular are studied with regard to cancer (Woyengo, Ramprasath, & Jones, 2009), they have been reported to cut the occurrences of cancer spreading to other parts of the body and diminish prostate tumor growth by over 40 attempts. Signs of not receiving blood supply to the expanding cancers and to stop cancer cell growth has also been seen by resveratrol, like phytosterols (Nabavi, Seyed, Li, & Daglia, 2014).

Gallstone disease

Gallstone disease occurs when there is a high level of cholesterol or bilirubin in the bile or when the emptying of gallbladder does not occur accurately. Peanuts are known to possess beneficial effects on cholesterol, primarily thanks to their unsaturated fats. As an exclusive fertilizer, however, peanuts hold extra nutrients and bioactive compounds that are more likely to be provided to the present effect. As per studies, it

has been found that the risk of diseases related to gallbladder dysfunction reduced by 25% in those people who consume peanuts and its products like peanut spread, peanut butter at least five times every week. (Tsai, Leitzmann, Hu, Willett, & Giovannucci, 2004)

Alzheimer‘s disease

Peanuts are a great source of niacin as well as Vitamin E (Fig. 10). Both these groups of vitamins are helpful in protection against Alzheimer;s disease and other age-related disorders.. As per a research regarding Alzheimer’s disease, (published in the Journal of Neurology, Neurosurgery and Psychiatry) it was indicated that regular use of niacin rich food components like peanuts helps in reducing the effects of Alzheimer and other similar age related disorders. Reduced rate of cognitive decline was seen in almost 4000 people who were 65 years or older when niacin was present in food. (Morris, *et al.,* 2004). It has also been noticed that vitamin E ingestion from food has a protective effect whereas the ingestion of vitamin E from supplements did not have any effect on the occurrence of Alzheimer’s (Morris M. C., et al., 2002). In those people who were present in the top fifth list of uptake, incidence of Alzheimer’s disease was lowered by 70%. A beneficial component has been recognized in treating Alzheimer’s disease and other nerve degeneration disease. This beneficial component is resveratrol. (Chen, *et al*., 2005).

Peanuts and Weight Management

Adding peanut and other products like peanut butter in regular diets do not result in an increase in weight (Mattes, Kris-Etherton, & Foster, 2008). In the research associated with the load loss, diets which included peanuts, spread and groundnut oil is widely considered amongst the people of each and every age group and have shown to provide chronic weight maintenance (McManus, Antinoro, & Sacks, 2001). There was one more research conducted which suggested that the peanut fed group found decrement in weight whereas the control group saw increment in weight during a span of two years, exclusively on school children(Johnston, Tyler, McFarlin, & Post, 2007). Similar data has been published in many more epidemiological studies where it was found that peanuts reduced the total and LDL cholesterol (Pelkman, Fishell, Maddox, & Pear, 2004)

Hunger Maintenance

It has been studied by research that people had an improved satiety feeling and were pleased with the consumption of peanuts and peanut butter compared to consumption of snacks full of carbohydrates like rice cakes in the same proportions (Kirkmeyer & Mattes, 2000). Other study also showed that the subjects had fullness effects due to peanut consumption as it curbed their appetites. There are other emerging evidences also which show that peanuts may give rise to a fat which is a hormone sort of healthy monounsaturated fat, which helps people in feeling satisfied after their meal (Schwartz, et al., 2008).

BODY MASS INDEX (BMI)

Regular consumers of peanut, spread etc. are prone to have a reduced BMI i.e. Body Mass Index. Researches showed that even though it is very resourceful, they have much more filling value and chronic utilization calls up strong dietary gain and minor variations in energy balance. Peanuts enhance the satiety and energy gain. Incomplete consumption of whole peanuts or increased resting energy expenditure could be the procedure related to this conversation (Holt et al., 1995; Kirkmeyer and mattes 2000; Burton – Freeman,2000) (Kirkmeyer & Mattes, Effects of Food Attributes on Hunger and Food Intake, 2000)

Malnourishment

Although not very popular, Peanut milk can be used extremely in situations of extreme emergencies and acute malnutrition for speedy recovery and gain of health. Earlier, peanut derived products like “Plumpy-nut”, a RUTF (Ready-to-Use Therapeutic Food) had been prepared to resist acute malnutrition within Africa. It is nothing but a fat based food, containing ground, roasted peanuts. In addition, oil, dry milk, micronutrients, and sugar are added. Peanuts are added because the basis for RUTF enables better delivery of a complete range of balanced lipids, EAA’s and micronutrients required by gowing kids. Peanuts are calorie dense and full of nutrients, and protein-rich, enough for small stomachs in malnourished kids who can absorb only small amounts. Treatment in children with RUTF has frequently shown better recovery rates and lesser duration to thrive in weight-to-growth goals in few African nations like Malawi, Sudan and Haiti, compared to plain World Health Organization (WHO) therapies for malnutrition rehabilitation (Patel, Sandige, Briend, Ashorn, & Manary, 2005) in 2003, (Diop, Dossou, Ndour, Briend, & Wade, 2003) showed that moderately malnourished RUTF-users had higher intake of energy, fat, iron and zinc in contrast to a circle consuming corn/soy therapy as the intake of staple foods reduced within the corn/soy group. The result lasted for a long period for the RUTF group even though both therapies resulted in good weight gain, but.

Peanut as a Functional Food

Added health benefits have been seen beyond regular nutrition by researchers in many compounds of peanuts. Peanuts are proclaimed to be the food with numeral functional compounds like Coenzyme Q10 that protects the guts during the amount of lack of oxygen, for example in high altitudes and during clogged arteries. peanuts also are an honest source of dietary fiber and supply a good amount of essential nutritional components, including many group B vitamins, vitamin E, minerals like zinc, potassium, magnesium and iron, antioxidant minerals (copper, selenium and selenium), plus other antioxidant compounds (such as resveratrol

and flavonoids) (Gülçin, 2010). These bioactive components are recognized for having disease preventative properties and a few are antioxidants while other is to market longevity. Their antioxidant capacity is thankful to the entire biological matter in peanut seed like vitamin E in oil or chlorogenic acid, caffeic acid, coumaric acid, ferulic acid, flavonoids and stilbene (resveratrol) (Yua, Ahmednaa, Goktepea, & Daib, 2006). Fermented peanut meal (Zhao, Liu, Zhao, Ren, & Yang, 2011) has been used to research regarding the antioxidant property and free radical scavenging quality.

Chickpeas: An Overview

Chickpeas (Cicer arietinum L.), commonly called channa or garbanzo beans, are an old earth pulse (i.e., edible seeds) within the Leguminosae and have traditionally been used into many culinary creations because of their nutty taste and variable sensory uses in food.

Nutritive value

In figure 12, table shows the amount of each nutrient in 1 cup of chickpeas, according to the United States Department of Agriculture (Ware, RND, & L, 2019).

Chickpeas: Origin

The available evidence suggests that chickpea originated in the Fertile Crescent areas of south-east Turkey and nearbySyria (van der Maesen, Saxena, & Singh, 1987). The proposed wild progenitor and various other annual Cicer species are there (Ladizinsky, A, Adler, & Bot, 1975). Further proof of its origin dates back to about 5450 BC, unearthed from prehistoric excavations at Hacilar near Burdur in Turkey (H. & Mellaart, 1970). It is believed that chickpeas emerged and spreaded from Turkey in two directions—to the west and to the south-easten parts. In the western part, it is produced in summer and spring. and in the eastern and southern parts it is produced in the cool dry seasons. The wide range of wild chickpea species are seen in the West Asia and North Africa region including Turkey in the north to Ethiopia in the south, and Morocco in the west to Pakistan in the east. Botanically, the cultivated chickpea has been split into two groups, microsperma and macrosperma, like seed size and in much an equivalent way because it has been finished lentils(Cubero, Saxena, & Singh, 1987). From a practical point of view, chickpea is also classified into kabuli and desi types.

Nutrients	Amount in 1 cup of chickpeas (164 g)	Requirements per day
Energy (calories)	267	1,800–3,200
Protein (g)	14.4	46–56
Fat (g)	4.2	20–35% of daily calories should be fat
Carbohydrates (g)	44.7, including 7.8 g of sugar	130
Fiber (g)	12.5	22.4–33.6
Calcium (mg)	80.4	1,000–1,300
Iron (mg)	4.7	8–18
Magnesium (mg)	78.7	310–420
Phosphorus (mg)	274	700–1,250
Potassium (mg)	474	4,700
Zinc (mg)	2.5	8–11
Copper (mcg)	0.6	890–900
Selenium (mcg)	6.1	55
Vitamin C (mg)	2.1	75–90
Folate (mcg)	280	400
Choline (mg)	69.7	425–550
Beta carotene (mcg)	26.2	700–900
Vitamin E (mg)	0.6	15
Vitamin K (mcg)	6.6	75–120

Figure 12: Nutrient in 1 cup of Chickpeas

Chickpea has one of the highest nutritional compositions of any dry edible grain legume and does not contain significant quantities of any specific major antinutritional factors. On an average, garbanzo beans have 23% of highly bioavailable protein, 64% total carbohydrates of which 47% is starch and 6% soluble sugar,, 5% healthy fat (primarily linoleic and oleic acids), 6% crude fiber, and 3% ash. The mineral part is rich in phosphorus (343 mg), calcium (186 mg), magnesium (141 mg), iron (7 mg), and zinc (3 mg) (Williams, Singh, Saxena, & Singh, 1987). Chickpea is good for human health as well as for soil health. It meets 80% of its nitrogen (N) need from a symbiotic rhizobial interaction (Saraf, Rao, J.V.D.K., Johansen, & Rego, 1998). It leaves substantial amounts of residual nitrogen behind for subsequent crops and adds much needed organic matter to maintain and improve soil health, long-term fertility, and sustainability of the ecosystems. (MS, RD, CDCES, & CDN, 2020)

Health Benefits of Chickpeas

The chickpea consumption in western culture is kind of driven through the usage of hummus. Traditional hummus is nothing but a dip of spread made from mashed, cooked chickpeas, mixed with tahini, lemon juice, olive oil, and spices. Chickpeas, tahini, olive oil, lemon juice, and spices unique combination makes up traditional hummus that helps to provide extra benefits over fulfilling nutrient requirements. While the scientific literature suggests the consumption of hummus/chickpea in order to control weight, CVD, cancer, and/or GI health (Wallace, Murray, & Zelman, 2016).

Diabetes

One cup of chickpeas, weighing 164 g, gives 12.5 g of fiber. Fiber aids people who are having diabetes, so the American Diabetes Association (ADA) endorses chickpeas as a reservoir of dietary fiber. A 2014 study concluded that eating at least 30 g of fiber everyday could help remove inflammation in persons with type 1 stage of diabetes (Jukanti, Gaur, Gowda, & Chibbar, 2011). A 2018 review of meta-analyses found that a diet containing high fiber may help reduce blood glucose levels and decrease the risk of developing type 2 diabetes. The Dietary Guidelines for Americans recommends that every adults shoud consume 25.2–28.0 g of fiber every day , relying on age and sex. Both dried and canned chickpeas have reduced glycemic index and low glycemic load, a resistant starch that digests slowly. These factors assist in reducing sudden surges in blood sugar and insulin levels, which improves blood sugar regulation in people having type 2 diabetes (Ware, RND, & L, 2019).

Bone Health

The calcium, iron, and other nutrients in chickpeas may all help in healthy bone structure and strength. Chickpeas can be an important part of the diet of people who want to avoid osteoporosis (Ware, RND, & L, 2019).

Blood Pressure

A high blood pressure can be prevented by limiting the amount of added sodium, or salt, and increasing the amount of potassium. Current guidelines suggest that the consumption of potassium in adults is at least 4,700 milligrams (mg) per day. A cup of chickpeas, weighing 164 g, provides 474 mg of potassium. People who consume canned chickpeas should check the proportion sodium the manufacturers have added. Cooking with dry chickpeas can help regulate the quantity of salt during a meal. Adults should restrict their sodium intake under 2,300 mg per day, while individuals aged 51 or over and those who have chances of cardiovascular disease should consume less than 1,500 mg per day (Jukanti, Gaur, Gowda, & Chibbar, 2011) (MS, RD, CDCES, & CDN, 2020).

Heart Health

The fiber, potassium, B vitamins, iron, magnesium, and selenium in chickpeas all keep up hearts health. Fiber helps decrease the chances of heart disease by lowering cholesterol levels in the blood. Chickpeas contain no cholesterol (Wallace, Murray, & Zelman, 2016). There is a plant sterol called sitosterol in chickpeas that looks structurally similar to cholesterol in the body. It mixes with the body's absorption of cholesterol and hence can be useful to lower blood cholesterol levels. The unsaturated fats and fiber in chickpeas may also favorably affect blood lipid levels (TALESZIA, 2017).

Cancer

A toxic substance like free radicals that accumulate in the body, which is due to metabolism and other factors. As these radicals increase, they can harm cells and result in various health problems, such as cancer (Ware, RND, & L, 2019). A cup of chickpeas has 6.1 micrograms (mcg) of selenium. The Office of Dietary Supplements (ODS) recommend that adults consume 55 mcg of selenium each day (Jukanti, Gaur, Gowda, & Chibbar, 2011). They also note that selenium's antioxidant activity may help protect the body from cancer. In addition, there's evidence that fiber, which chickpeas contain, can help reduce the danger of colorectal cancer (Wallace, Murray, & Zelman, 2016).

Cholesterol

During a study conducted in 2006, it was observed that the participants had reduced rarity lipoprotein (LDL), which is also known as the "bad" cholesterol in their blood after they commenced usage of chickpeas in their food, compared to a diet with additional wheat for 5 weeks. During the research, it was also found that the fibre content present in chickpeas could be the reason for the reduction in LDL cholesterol (MS, RD, CDCES, & CDN, 2020).

Mental Health

A cup of chickpeas contains 69.7 mg of choline, which helps with brain and systema nervosum function. Choline plays a role in mood, muscle control, learning, and memory, as well as the body's metabolism. The ODS recommeds that an average adult consume around 400–550 mg of choline each day, counting on sex and whether or not they are pregnant or breastfeeding. A research suggested that the deficiency of selenium might increase the possibility of cognitive decline in elderly people. This would suggest that selenium can accomplish cognitive health, as well as memory and thinking. (Wallace, Murray, & Zelman, 2016) (Ware, RND, & L, 2019)

2.2.3.8. Digestion and Regularity

The digestive tract stays healthy with the fibres.Chickpeas has a dissolvable fiber known as raffinose, a kind of oligosaccharide that is fermented in

the colon through favourable bacteria known as Bifidobacterium. As the bacteria break down fiber, a small chain of fatty acids is built called butyrate. These acids help in nurturing regularity inside the intestines, lessening flammation inside the cell wall of the colon, and perhaps arrest colorectal cancer by assisting cell apoptosis (death).

Weight Management and Satiety

Dietary fibers behave as bulking agents in the digestive system. Bulking agents enhance the notion of fullness after eating, and proteins have similar results on our body. Feeling fuller for longer after eating can help reduce the appetite and lower a person's caloric intake. The satiating result of the high fiber and protein content of chickpeas may help with weight management.

Anemia

The body cannot deliver oxygen without iron to its cells, and this can result in iron deficiency anemia. Its symptoms include tiredness and weakness. In some severe cases, life threatening complications can be seen. A cup of chickpeas contains 4.7 mg of iron, or between a half and one-fifth of a person's daily requirement, depending on the individual. It also provides some vitamin C, which helps the body absorb iron (MS, RD, CDCES, & CDN, 2020).

Chickpeas as Functional Food

Even though pulses have been consumed for many years for their nutritional qualities, it is observed during the last two to three decades that there is a comprehensive increase in interest in eating pulses as food and its impact on human health. The consumption of chickpeas is noticed to have few benefits that may remove the chances of chronic diseases and improve health. So, chickpeas could be considered as potential 'functional food'. There were several different definitions proposed describing the functional foods: (i) "one encompassing healthful products that includes, modified food which may provide health benefits more than traditional ingredients" (ii) "foods that, occurs by presence of anatomically-active constituents, that impart health benefits further than the customary elementary nutrition" (Jukanti, Gaur, Gowda, & Chibbar, 2011). As mentioned above, chickpea is a comparatively inexpensive source of multiple vitamins, minerals and several bioactive compounds that could help potentially lowering the risk of chronic diseases. Due to its higher nutritional value, chickpea is getting consumer acceptance as a functional food.

Calcium

Calcium is the most abundant mineral in the body; it makes up about 1.5% to 2% of the bodyweight and 39% of total body minerals. Almost 99% of calcium is present in teeth and bones. Rest l% is present in our blood and extracellular fluids and within cells of all tissues, where it controls several major metabolic functions. The body of an infant contains 27.5 g of calcium whereas the body of an adult contains 1000-1200 gms of calcium. All these calcium is formed in the bones during the growth of the body.

Functions

The Calcium plays an important role to maintain some important body functions such as

- It regulates the impulse of nerves. This effect is normally on the peripheral neuromuscular process. Fibrillary twitching can be obtained by integrating a muscle with calcium free fluid.
- It is important for the maintenance of the integrity of the skeletal muscles. An increase in the ionized Calcium results in an increase in contractility and vice versa.
- It is very important for maintaining the tone and contractility of the heart. Calcium is antidotal to the depressant action of potassium.
- It aids in the coagulation of milk inside our stomach.
- It is important for the clotting of food. It depreciates cellular permeability. It is therefore used in allergic conditions to reduce exudation which generates wheals and rushes.
- Calcium takes part in the formation of certain tissues and bones. Normally 25 – 35% is removed from the urine and the rest in the stools (Piste, Sayaji, & Avinash, 2012).

Factors Affecting Calcium Absorption

Various factors affect calcium absorption from the diet is

- Vitamin D: Is essential for calcium absorption.
- Sulphur: The higher ratio of sulphur to calcium metal gradually increases the Calcium excretion which can cause demineralization of bone .
- Proteins: High levels of protein in the diet can increase the calcium absorption. A high protein diet especially made from animal foods results in loss of calcium in the body.
- Phosphates and Phytic Acid: Excess amount of phosphates lowers calcium absorption whereas phytic acid forms insoluble calcium salts and interferes with the calcium absorption.
- Fats and Fatty acids: Fat mal-absorption gives the presence of a large amount of fatty acids in the stools which interfere with the calcium absorption by the formation of insoluble calcium salts of fatty acids.
- Fibers: Excess amount of fiber in the diet interferes in the calcium absorption.
- Oxalic acid: Oxalic acid present in certain foods forms insoluble calcium oxalate which lowers the calcium absorption.
- Reaction of Intestinal Content: Calcium is well absorbed at the normal pH of the intestines but if the content becomes alkaline then calcium

absorption is lower due to the formation of insoluble tricalcium phosphate.

- Lactose: It increases the intake of calcium.This is because of increased acidity due to lactic acid.
- Post menopausal women are more prone to osteoporosis because they produce less oestrogen which protects the skeleton in younger women.

Calcium Deficiency

Calcium deficiency is the state in which our body has an insufficient quantity of calcium.

Types of Calcium Deficiency

Calcium deficiency is classified into two categories:

- The diet related calcium deficiency is a condition where calcium intake is inadequate, which results in thinning and weakening of the bones,depleted calcium stores in the bones,osteomalacia, leading to osteopenia, and further to osteoporosis.
- Hypocalcemia is a low proportion of calcium in blood. It can be observed from taking medications, such as medical treatments; diuretics; or disease processes, namely renal failure or hypo parathyroidism.

Calcium less than your required amount in your diet will usually not cause hypocalcemia. This is because the proportion of calcium in the blood is very important to many vital body activities of the brain, nerves, muscles, and heart, that anybody will extract calcium from the bones whenever required to maintain blood calcium levels. This allows important processes in the body to perform efficiently. Although, dietary calcium deficiency can lead to osteoporosis and thinning of the bones over time. The carelessness in treatment of calcium deficiency can move to some critical complications, such as hypertension, osteopenia, and cardiac arrhythmias (Piste, Sayaji, & Avinash, 2012). If you, or someone you are with, have chest pain, a seizure, difficulty breathing, or an unusual change in alertness or consciousness,then you should consider getting your calcium checked.

Sign of Deficiency in Calcium

All individuals start to drop bone density from the age between 30 and 40. Increased bone loss influences more than 20 million people, and it is mostly seen in women who are aged 45 and older.

Muscle Cramping

The initial indication of deficiency of calcium is a nervous disorder known as tetany, which can be spotted by arising of cramps in muscles, pricking and numbness or insensibility in legs and hands. Muscle Cramping can be the first early stage symptom that we are having a calcium deficiency. These kinds of cramps generally occur at night, mostly in the legs.

Dry Skin and Brittle Nails

A normal acute calcium deficiency is often seen in our nails and skin. When our fingernails break with minimum effort and your skin gets dry very often, ee could be in deficiency of calcium. If these symptoms are visible, you should also check if our teeth are getting yellow. The teeth and bones can be adversely affected from calcium deficiency.

Increased PMS Symptoms

Women in their menstrual times might undergo increased cramping or a shift in the menstrual flow. Using more calcium to their diet helps to prevent these indications.

Bone Fractures or Breakage

If you feel like suffering from small bone fractures, bone breakage, you should check the proportion of calcium in your diet. This is an obvious sign of calcium deficiency. Calcium is essential to make bones and to strengthen them. Deficiency of calcium makes our bones weak. Due to this, fractures and breakage can occur. It can give on to osteoporosis, a situation in which the bones become soft, brittle and penetrable as calcium gets rapidly withdrawn from our bones at greater speed than it is deposited into them.

Average calcium deficiency cases may lead to heart palpitations, cramps, increased cholesterol levels, joint pains, insomnia, slow pulse rates,excessive irritability, impaired growth, or nerves, brittle nails, muscle cramps, eczema and numbness in arms and legs (Piste, Sayaji, & Avinash, 2012). Insufficiency might be due to an unavailability of vitamin D or abnormal concentrations of hormones that regulate the availability from the bones to the blood, not to a dietary inadequacy.

Regulators of Blood Calcium

Early diagnosis and proper treatment of calcium deficiency reduces the chances of having serious complications, like osteoporosis and hypertension. The treatments include replacing the body's damaged calcium stores.

Calcium is one of the resourceful minerals in the living organism and has many important functions. This mineral is the reason for strong bones. Calcium is a basic integral part of the skeletal, and it is evenly divided in soft tissue where it is a part of enzymatic, neuromuscular, hormonal, and various metabolic activities. Calcium absorption relies over the requirement of the body and the quantity of calcium in the foods eaten. Calcium absorption gradually becomes low with growing age for both genders. Greater than 99% of the whole body calcium is available in the skeleton and the teeths where it works to aid their structure. The other 1% is present all over the body in muscle, blood and fluid in between cells. Due to its biological significance, the requirement of calcium is

carefully regulated in different compartments of the body. Three of the important governors of serum calcium are vitamin D, parathyroid hormone (PTH), and calcitonin (Piste, Sayaji, & Avinash, 2012).

Disorders of Calcium Metabolism

Disorders happen as the body has extremely less or extremely high amounts of calcium. The serum calcium level is sufficiently controlled within a restricted range inside the body. In a healthy body, extracellular calcium levels are well maintained within a range with the actions of vitamin D, parathyroid hormone, and the calcium sensing receptor. Calcium metabolism disorders may result in hypocalcemia, (decreased plasma levels of calcium) or hypercalcemia, (elevated plasma calcium levels).

Hypocalcemia

Hypocalcemia is very common and it can occur without being noticed with negligible indications or, in extreme cases, can have dramatic indications and be life-threatening. Hypocalcemia can be of two types - it can be related to parathyroid or it can be related to Vitamin D (Piste, Sayaji, & Avinash, 2012). Symptoms of hypocalcemia, muscle cramps are numbness in fingers and toes, impaired mental capacity, irritability, and muscle twitching.

Hypercalcemia

Hypercalcemia mostly occurs in approximately 1 in 500 people. Similar to hypocalcemia, hypercalcemia can also be non-severe and exists with no symptoms. Hypercalcemia is mostly caused by hyperparathyroidism, and commonly by intoxication of vitamin D, Hyperparathyroidism takes place most commonly in women who are in the post menopause phase (LAU & BAYLINK, 1999). Hyperparathyroidism is caused by an adenoma, or tumor in the parathyroid gland or by an increment in levels of parathyroid hormone due to hypocalcemia. Symptoms of hypercalcemia are nausea, vomiting, anorexia, nausea, abdominal pain, constipation, lethargy, depression, polyurea, confusion, polydipsia, and general aches and pains (Piste, Sayaji, & Avinash, 2012).

Plasma Calcium

The amount of active calcium differs with the amount of serum albumin, a kind of protein to which calcium is interrelated, and hence ionized calcium levels are better than a total calcium; Although, we can control level of calcium if the albumin level is known.

Usually, ionized calcium level ranges from 1.12-1.45 mmol/L (4.54-5.61 mg/dL).

A standard total calcium level is 2.2-2.6 mmol/L(9-10.5 mg/dl).

Total calcium level of less than 8.0 mg/dL is hypocalcaemia, with levels below 1.59 mmol/L(6 mg/dL) generally fatal.

Total calcium level of more than 10.6 mg/dL is hypercalcaemia, with levels above 3.753 mmol/L (15.12 mg/dL) is usually fatal.

Calcium deficiency for a long term can lead to osteopenia, which leads to reduction bone density. Osteopenia may gradually progress into osteoporosis, a condition where bones become brittle and weak. A large amount of adults need around 1,000 to 1,200 milligrams of calcium every day. A balanced diet can cover all the requirements. When you don't consume enough calcium over a large amount of time, chances of osteopenia and osteoporosis increases, which will increase your chances of bone fractures. You won't possibly feel any indications related to deficiency, Symptoms of hypocalcemia are lethargy, numbness, muscular cramps, tingling sensation in the fingers and problems with rhythm of the heart. These are all signs of other health conditions too, so whenever you have them, you need to consult your healthcare provider (Piste, Sayaji, & Avinash, 2012).

Absorption of Calcium and Hormone

Absorption depends upon the presence of enough amounts of Vitamin D, which functions with the parathyroid hormone to manage the amount of calcium in the blood. Phosphorus is required in similar amounts but should not exceed calcium amount. The body utilizes them together to give strength to the bones. If additional an amount of either mineral is taken, that excess cannot be used efficiently. Vitamin A & C are also necessary for absorption. Fat content in moderate amounts, moving slowly through the digestive tract, helps facilitate absorption as does bile and bile salts. To work effectively, Calcium should go hand in hand with magnesium, phosphorus, boron and the Vitamins A,C,D, K and possibly E. If the intake of calcium is too high, magnesium levels also need to be high. Magnesium deficiency results in extra calcium accumulations in certain parts of muscles, heart and kidneys. Excessive calcium can interfere with the activities of the muscular and nervous systems. An additional blood causes calcium severity, which is noticed by muscles that contract and lose energy to relax. This additional calcium is added to blood plasma, which does not result in coagulation. Excessive calcium will decrease the body's absorption capacity of zinc and iron. The parathyroid and thyroid glands work to manage the blood calcium level. Calcium is essential for many metabolic operations like blood clot development, formation of bones, and muscle cell shrinkage except nerve impulse conduction. If low blood calcium condition exists, the parathyroid glands take action by releasing parathyroid hormone (PTH). This hormone releases osteoclasts to crack down bone tissue, and post that, calcium salts are spreaded into the

blood. Along with it, if calcium level is considerably high, the thyroid gland acts by releasing a hormone named calcitonin. Its effect is opposite that of parathyroid hormone; it inhibits osteoclast activity allowing osteoblasts to form bone tissue. As a result, the excessive calcium is preserved in the bone matrix (Piste, Sayaji, & Avinash, 2012). The works of these hormones are an amazing example of important negative feedback loops in our bodies. Without these important chemicals, the bones will not develop or grow normally.

Calcium as a Natural Tranquilizer

Calcium acts as a Natural Tranquilizer. It tends to calm the nerves. When taken 20-40 minutes before bedtime it promotes a deep sleep. Energy generation as well as maintenance of the immune system benefit from calcium. Calcium is also useful in treating cardiovascular disorders by reducing blood cholesterol. Calcium supplements up to 1500 mg have reduced blood pressure in persons with or without hypertension and they do so because of the state of the smooth muscle which surrounds the blood vessels. Early supplementation may also help prevent arthritis. Rheumatism can also be helped accurately with calcium therapy. The hormones involved are innervated by the proportion of calcium ions in the serum. Issues of menopause like irritability, insomnia, nervousness, and headaches have been reduced with management of calcium, magnesium and vitamin D. Elimination of premenstrual tension and menstrual cramps has also been noticed. Absorption occurs in the duodenum and moves to the lower intestinal tract when food content becomes alkaline. Interfering factors in absorbing Calcium when additional fat, sugar or protein combine with calcium and an insoluble compound is generated which cannot be absorbed. Excessive phosphorus and magnesium or insufficient vitamin D intake slows down the soaking up of calcium. Heavy amounts of phytic acid present in upraised seed may also reduce uptake by the body. Other traits include lack of physical exercise, emotional stress, excitement, depression and very rapid a flow of food in the intestinal tract. The parathyroid gland in the neck part helps to adjust the body's calcium storage. If these glands are not functioning properly, accumulation may occur. Calcium requires acid for good assimilation. If acid is not present in the body in some form, the mineral will not dissolve and hence cannot be used. Instead it may add up in joints or tissues as layers, which results in disturbances. (Piste,Sayaji, & Avinash, 2012).

MATERIALS AND METHODS

Many people are at an increased risk of calcium deficiency at this age. Though symptoms are not seen during acute deficiency, but during a long term deficiency, the process almost gets irreversible. The growing importance of calcium in a populace is an early sign of rising the worldwide epidemic of health burden. Therefore, the present examination was planned to find out the value and developments of calcium deficiency amongst young adults (17-25 years) of Shekhawati region. The materials and methods used to examine are:

Place of the study

The study was carried out in Shekhawati region of Rajasthan, mostly between Jaipur and Churu. It was performed in the Mody University of Science and Technology Lakshmangarh 332 311, Dist. Sikar, Rajasthan, India, itself. The subjects taken were directly or indirectly part of the organisation.

Locale: Laxmangarh

Selection of the subject

All the adults from 17-25 years were taken for the study: Simple Random Sampling was used for the selection of the subject keeping in mind the objective of the study. 60 respondents were selected for the study. Consent of each individual was taken through an online google questionnaire.

Inclusion and Exclusion criteria

Inclusion Criteria

a) Adults above 17 years to 25 years
b) Randomized trial
c) Intervention included on diet, exercise or both
d) Indian subjects
e) Adults living in shekhawati region

Exclusion Criteria

a. Children either younger than 17 years or elder than 25 years
b. People with any medication were taken.
c. People with any supplementation were taken
d. Samples with one month prior serum calcium test were also taken

Experimental Plan

General Information

On enrollment following information was taken From the subject

a) Name, Age
b) Height, Weight
c) Vegan/Vegetarian/Non-vegetarian/Eggetarian
d) Medication
e) Sunscreen and Sun exposure
f) Physical activity
g) Food intake
h) Serum Calcium levels

Details of the Parameters studies

Assessment of the overweight and obesity

The measurement of weight, height of the subject was recorded using standards methods. Their **Ideal Body Weight and Adjusted Body Weight was taken out.**

Height

The Subjects stood with their scapula, buttocks and heels facing towards a wall, the neck in a natural

non-stretched position, the heels were touching each other, the toe positions formed a 45° perspective and the head was placed immediately with the inferior orbital border in the same horizontal aircraft as the outside auditive behaviour (Frankfort's plane) with the help of Stadiometer.

Weight

Bathroom scale was calibrated. It was calibrated everyday with known weights. Scales should be accurate, sensitive and robust. They must be carefully maintained, calibrated, regularly checked for accuracy using known weights. The scale was adjusted to zero mark regularly before taking the measurements. The weight was recorded three times to an accuracy of 0.1 kg. The subject was asked to stand on the scale with her hand straight and looking straight to the wall.

BODY MASS INDEX (BMI)

Body Mass Index (BMI) is defined as the ratio of weight in kilograms to the square of height in meters. A high BMI indicates Overweight/ Obesity/ Morbid Obesity.

BMI= Formula: weight (kg) / [height (m)]2

CATEGORY	WHO (2004)
Underweight	<18.5
Normal	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity	>/= 30
Obesity – I	30 .0 – 34.9
Obesity – II	35.0 – 39.9
Obesity – III	>/= 40

Figure 13: WHO BMI Classification

Assessment of Serum Calcium

The 60 samples got their serum calcium levels tested. Out of 60 samples, 48 samples got their test done by the ganpati laboratory in Laxmangarh and the rest 12 samples got their test done by themselves from their respective hometown during the winter break. Exact values of serum calcium were known, as the expertise from the laboratory had come to draw their blood and then the results were known.

Normal range for serum calcium was 8.8 - 11 mg/dl.

Research methodology used for this study was a simple comparative study. The 60 samples were further divided into 3 groups of 20 each - Group 1 was on groundnuts, group 2 was on chickpeas and group 3 was on placebo. 15 grams of groundnuts and 15 grams of chickpeas were given daily to group 1 and group 2 respectively, and group 3 was given buttermilk twice in a week. All the 60 samples ate these along with their normal diet. No changes to their diet were made. Only additional groundnuts, chickpeas and buttermilk were given.

Lifestyle Pattern/Activity Pattern

The general lifestyle information was asked to the subject. These are classified into sedentary, moderate and heavy activity.

- Sedentary or mild activity lifestyle: The occupations of people are such that don't call for a whole lot physical activity, not required to walk lengthy distances, generally use motor vehicles for transportation, do not work out or participate in sports activities frequently, and waste all of their leisure time doing nothing , with little body displacement (e.g. talking, reading, watching TV, paying attention to the radio, the use of laptop systems).
- Moderate or active life-style: Humans have occupations that don't go with availability of electricity, but have extra energy expenditure for sedentary lifestyles. Instead, they may be humans with sedentary occupations who often spend a certain quantity of time in sports activities, that is compulsory or the discretionary part of their everyday life.
- Vigorously or vigorously active lifestyles: Human beings interact frequently in strenuous artwork or in strenuous enjoyment sports activities for several hours.

Descriptive Analysis

The results had to be statistically analyzed. The aim is to achieve a remarkable rise in the serum calcium levels of the women by regular consumption of groundnut and chickpeas respectively, along with the normal diet. This helps in proving how relevant studies are. The standard deviation, mean, percentile, paired sample T-test, two samples assuming unequal variable T-test have to be adopted to generate the interpretation of the data.

RESULTS AND DISCUSSION

The socio-economic status is increasing with a rapid speed. This has resulted in co-existence of both - calcium deficit and excess calcium, in all ages. But with advanced sciences and technologies the country is able to overcome many nutritional deficiency and diseases among the country. These days more non-communicable diseases i.e. diabetes, hypertension, cardiovascular diseases etc., are more frequently observed in the population. Diet and exercise are the basic elements of almost any disease or deficiency. Although many supplements are used to treat calcium deficiency, some of which are truly authentic. The present investigation examined the effect of chickpeas and groundnut on the serum calcium levels in adult

females. The findings/result of the study are presented under the following sections.

Background Information of the Adults

The research approach used in the study was a quantitative approach using pre-experimental one group pre- and post-test research design. The study was conducted with 60 subjects. 3 groups were made of 20 each - Group 1 was of groundnuts, Group 2 has Channa and Group 3 was given placebo. These 60 samples were directly or indirectly linked with the organisation. The samples that were in the normal range and had lesser levels of serum calcium were selected for the study and the ones who were obese were in Group 3. Google forms were used to collect demographic variables, other parameters and then weight and height was measured by standardized and calibrated digital scale and stadiometer. Serum calcium was checked by the expertise of laboratory, BMI was calculated and samples were divided into obese, overweight and normal by the WHO norms. Background information of 60 samples which is shown in Table 1.

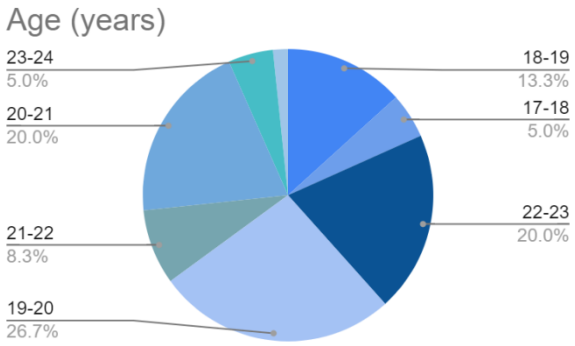

Figure 14: Age of Samples

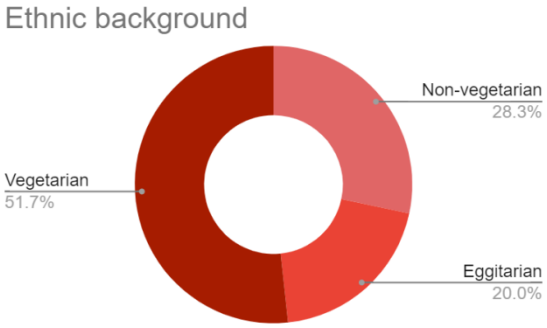

Figure 15: Ehtnic Background of Samples

Systemic Diseases and Medication Related Information

There are few drugs which may increase or decrease absorption of nutrients in the gut.

Drugs may increase the speed of the metabolism of specific nutrients,which results in higher requirements in the meal of that single nutrient. As you can see in table 2, out of the 60 samples, 12 were suffering from systemic diseases and from these 12 samples, 8 were on some kind of medication.

Sun exposure and usage of Sunscreen

Sun exposure period depends on the skin tone, age, health history, diet, and where people live. In general, around 5 to 15 minutes or max 30 is proper to get the most benefits out of sunlight without having any health problems. People can stay for a longer time if they use sunscreen. It also helps in better absorption of certain minerals, like calcium and phosphorus. And while most people get enough vitamin D from food, those who don't, can get rickets, osteopenia osteomalacia or osteoporosis. Primarily, skin cancer are of three types namely-melanoma, basal cell carcinoma, and squamous cell carcinoma. They are mostly caused by a lot of time in direct sunlight. So it's a good habit to use sunscreen if we're goin is sun exposure for more than 15 minutes or so. Although, small exposure of UV light may help in symptoms of few skin conditions such as vitiligo, psoriasis, and eczema. Table 3 shows the average sun exposure in the past week of 60 samples, before getting their serum calcium test done.

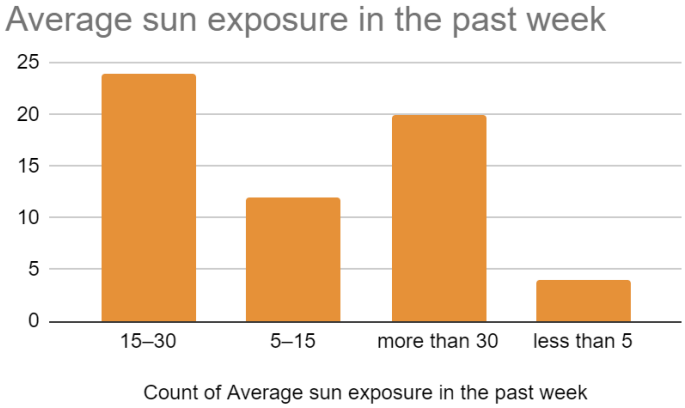

Figure 16: Sun exposure of sample per day before the study

From the 60 samples, only 12 samples use sunscreen to cover their skin. The names and Sun Protection Factor (SPF) used by 12 samples are listed Table 4.

Daily Milk Consumption Information

Milk is a superb source of minerals and vitamins viz "nutrients of concern," which are under-consumed by many populations. It provides potassium, B12, vitamin D and calcium which are absent in many diets. Milk is additionally an honest source of vitamin A, magnesium, zinc and thiamine (B1). Additionally, it's a superb source of protein and contains many different fatty acids, including conjugated linoleic acid (CLA) and omega-3s. Table 5 shows the milk consumption of 60 samples.

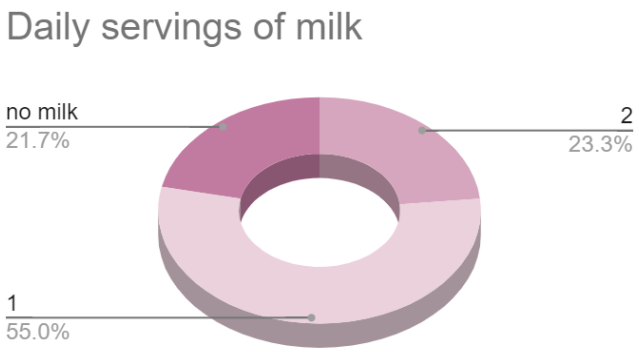

Figure 17: Milk intake of Samples

Vitamin D supplements

As you can see in table 6, 2 samples out of 60, were on vitamin D supplementation.

Serum Calcium Levels

Table 7, Table 8 and Table 9 gives the pre and post serum calcium levels of 60 subjects which were divided into 3 groups of Groundnut along with normal diet, Chickpeas along with normal diet and only normal diet.

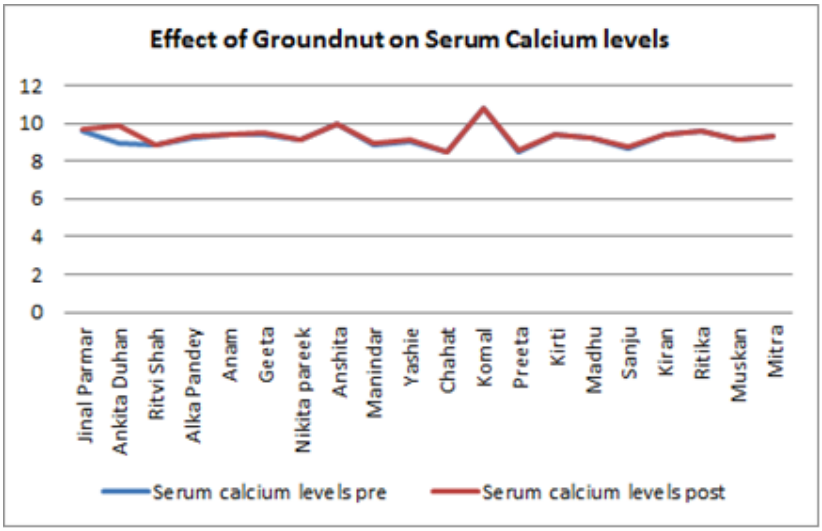

Figure 18: Pre and Post serum calcium levels of Samples having Groundnuts

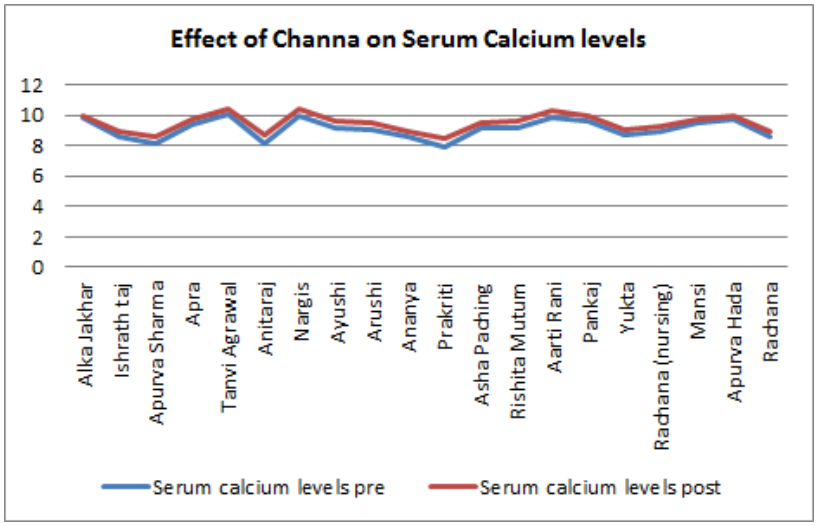

Figure 19: Pre and Post serum calcium levels of Samples having Chickpeas

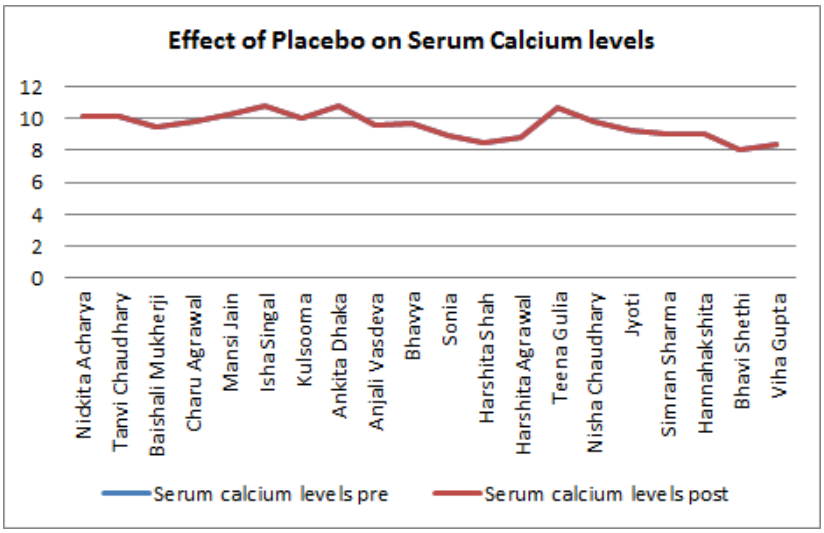

Figure 20: Pre and Post serum calcium levels of Samples having placebo

Physical Activity Information

Physical movements and activity along with proper calcium consumption collectively increase the bone strength.. Although calcium was calculated for a single time in the study and may therefore not show long term calcium intake, the insights from results were sufficient to point the rhythm between physical activities and appropriate consumption of calcium. In addition with many curative interventions, it is necessary to educate women about bone-promoting physical activities like aerobics, strength training, etc., to maximize bone density. We can see in Table 10 that out of all walking is the maximum form of exercise done by women. But to let Calcium get absorbed by the body we need some Vitamin D along with strengthening exercises.

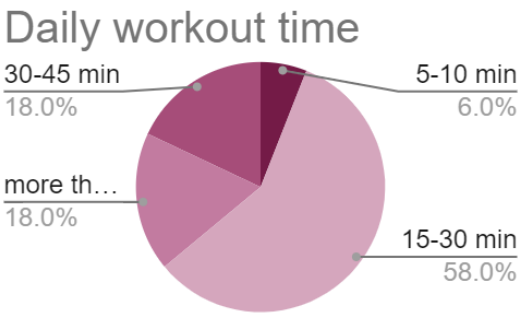

Figure 21: Workout Time Period of samples

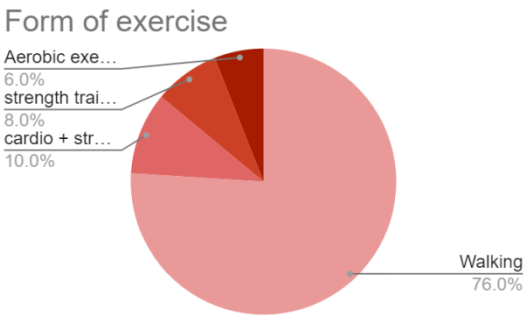

Figure 22: Exercise Form of Samples

Food Intake Information

The diets of women are relatively lower in many nutrients than the diets of males is that total caloric intake by women is lower

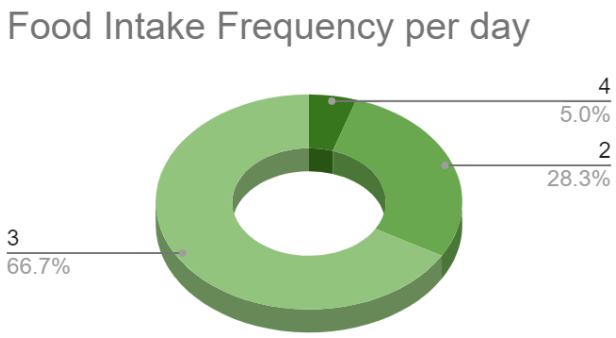

Figure 23: Food intake of Samples per day

Significance Using Chi Square Test

Intervention

Group 1 (Groundnut) paired sample T-test was conducted to evaluate whether a statistical difference existed between the mean serum calcium values before and after subjecting individuals to cinnamon in a duration of 4 months.

T-test for Groundnut Group

t-Test: Paired Two Sample for Means		
	post	*pre*
Mean	9.319	9.239
Variance	0.281125263	0.274441053
Observations	20	20
Pearson Correlation	0.914577326	
Hypothesized Mean Difference	0	
Degree of Variable	19	
t Stat	1.641656316	
P(T<=t) one-tail	0.058555096	
t Critical one-tail	1.729132792	
P(T<=t) two-tail	0.117110192	
t Critical two-tail	2.09302405	

Figure 24: Groundnut results of T-test; paired two samples for mean

The results of paired sample T-test were significant, t (19) = 1.64, p=0.117110192 P <0.117110192 indicating that there is not much significant increase in the initial and final serum calcium observation from the pre-test (M=9.239, N=20) to the post test (M=9.319, N=20). Mean increase was 0.08. The null hypothesis was rejected partially as the value P(T<=t) two-tail=0.058555096 which was very less significant.

T-test for Chickpea Group

t-Test: Paired Two Sample for Means		
	post	*pre*
Mean	9.473	9.0835
Variance	0.363411579	0.426139737
Observations	20	20
Pearson Correlation	0.992411712	
Hypothesized Mean Difference	0	
Degree of Variable	19	
t Stat	18.92901373	
P(T<=t) one-tail	4.32019E-14	
t Critical one-tail	1.729132792	
P(T<=t) two-tail	8.64038E-14	
t Critical two-tail	2.09302405	

Figure 25: Chickpea results of T-test; paired two samples for mean

The results of paired sample T-test were significant, t (19) = 18.929, p= 8.64038E-14 (i.e., 0.0000000000000864038) P <8.64038E-14 indicating that there is much significant increase in the initial and final serum calcium observation from the pre-test (M=9.0835, N=20) to the post test (M=9.473, N=20). Mean increase was 0.3895. The null hypothesis was rejected as the value P(T<=t) two-tail=4.32019E-14 (i.e., 0.0000000000000432019) which was very much significant.

T-test for Placebo group

The results of paired sample T-test for the placebo group had error indicating that there is no significant change in the initial and final serum calcium observation from the pre-test (M=9.561, N=20) to the post test (M=9.561, N=20). Mean was 0.

t-Test: Paired Two Sample for Means		
	post	*pre*
Mean	9.561	9.561
Variance	0.632977895	0.632977895
Observations	20	20
Pearson Correlation	1	
Hypothesized Mean Difference	0	
Degree of Variable	19	
t Stat	#DIV/0!	
P(T<=t) one-tail	#DIV/0!	
t Critical one-tail	#DIV/0!	
P(T<=t) two-tail	#DIV/0!	
t Critical two-tail	#DIV/0!	

Figure 26: Placebo results of T-test; paired two samples for mean

RESULTS

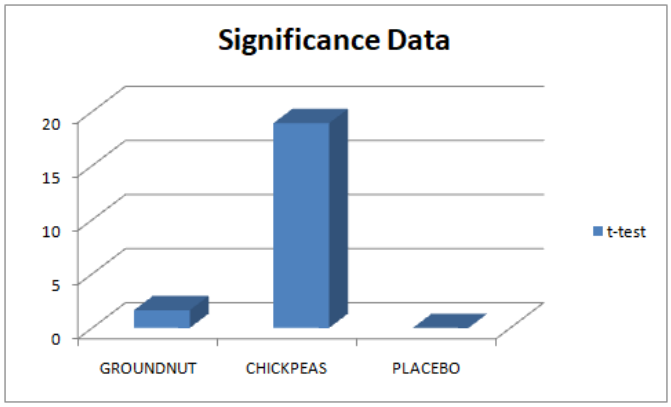

Figure 27: Significance of t-test result

From the above graph of t-Test: Paired Two Sample for Means, it shows that though there was less significant difference in the Serum calcium levels of subjects, chickpeas had maximum significant difference on the serum calcium as compared to groundnut and placebo.

CONCLUSION AND SUMMARY

Peanuts and Chickpeas are used without any side effects in daily life. Groundnut oil, which is extracted from peanuts, has been used as a functional product since old times. This oil is traditionally used for massaging, cooking and healing. Its chemical composition highlights the interest of many laboratories to use it in their best-selling products. Recently, it was found from various studies that peanut oil could be beneficial in preventing cardiovascular disease and its usage could protect from atherosclerosis with several biological mechanisms. The high contents of specific antioxidants and mono- and polyunsaturated fatty acids are the reason that peanut oil could be useful in protecting from cardiovascular diseases and cancer. Its consumption could also increase antioxidant compounds in the serum of healthy humans.

The composition of chickpeas provides the importance of this legume for the food industry. Besides providing an ample amount of protein and starch, it is full of bioactive components like isoflavones. Besides, there are many new technologies available, which are further decreasing the processing time for chickpeas.

The subjects were divided into 3 groups of 20 each. Two groups were given 15 g of peanuts and 15g of chickpeas per day on regular use for 3 weeks with a regular diet plan to see the effect on serum calcium levels. Third group was on placebo. Not much significant results would be seen. As peanuts and chickpeas are easily available in every household can be incorporated in the diet with lots of health benefits. Various statistical methods have been used to see significant change in the serum calcium of total 60 subjects (20 on peanuts, 20 on chickpeas and remaining 20 on placebo, all with regular diet). Subjects were considered from the Shekhawati region of Rajasthan and study was done in Mody University in Laxmangarh. Highest significant results were seen in the second group which had chickpeas along with normal diet. Peanuts also had a role in increasing the serum calcium, but significant results were not seen in peanuts as compared to chickpeas.

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