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A Study on Awareness of Calcium Among Geriatrics and Development of High Calcium Granola Bar

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Abstract*: Sesame seeds are a non-dairy food source of calcium consisting of rich source of calcium in it, other non dairy food source of calcium includes chia seeds, flax seeds, sunflower seeds, figs, almonds and dates. These seeds and nuts provide good amount of calcium and meets daily required amount of calcium needs thereby helping in the process of calcification of skeletal muscles. A non-dairy food source of calcium helps in meeting their daily calcium requirement and prevents osteoporosis during old age. Five samples of high calcium granola bars are prepared using sample one as control or reference containing hand rolled gluten free oats as the primary ingredient, from sample 2-5 they are fortified with sesame seeds at the rate of 10, 20, 30, 40 grams of sesame seeds and different calcium rich seeds and nuts. The study was done at "Hyderabad", the sample size consists of 60 subjects according to data collected 28.3% had no idea of function of calcium during old age. Each subject is provided with a developed product to create awareness and to test the acceptability of the product. The data collected from the sensory evaluation was compiled and't' test was applied to find out significance of difference between mean score of the sensory properties of the basic and variations. The study provides scope to conduct supplementation trials for geriatrics.
Keywords*: calcium, sesame seeds, nuts, granola bar, non-dairy calcium rich seeds, old age.

I. INTRODUCTION

A. Calcium and its importance

Calcium is important for overall health. Almost every cell in our body uses calcium in some way. Some areas where our bodies use calcium is in our nervous system, muscles, heart and bone. Our bones store calcium in addition to providing support for our bodies. Ass we age, we absorb less and less calcium from our diet, causing our bodies to take more and more calcium from our bones. Over time this aging process contributes to osteopenia and osteoporosis.We get calcium from food we eat. Calcium rich foods include milk, cheeses and other dairy products. We can also get calcium from vitamins and supplements. Calcium requirement is dependent upon age. The daily calcium allowance (RDA) for adults age 19-50 is 1000mg. That number increases to 1200mg for women beginning at age 51 and for men beginning at age 71. Contrary to popular belief, milk is not needed for daily calcium requirement. Our bodies like to keep the amount of calcium in our blood within a certain narrow range.

This range allows the cells in our body to stay healthy and perform jobs necessary for life. When blood calcium levels are low the amount of calcium in our blood goes below normal, our parathyroid glands release a hormone called parathyroid hormone(PTH) . Although this sounds similar to thyrid hormone, PTH is different. PTH tells our bones to release more calcium into the blood stream. PTH also helps activate vitamin D which in turn increases intestinal calcium absorption. We obtain vitamin D from the foods we eat and from our skin in response to sunlight. Because vitamin D promotes absorption of calcium from the intestine, vitamin D helps to build and maintain strong bones. When ther are very low levels of vitamin D levels, adults are prone to develop adult form of rickets, called osteomalacia.

B. Functions of calcium

Calcium is one of the most important minerals for human body. It helps form and maintains healthy teeth and bones. A proper level of calcium in body over a lifetime can help prevent osteoporosis.

1) Calcium helps the human body with: Building strong bones and teeth, Clotting blood, Sending and receiving nerve signals, Squeezing and relaxing muscles, Releasing hormones and other chemicals , Keeping a normal heartbeat.

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C. Sources of food rich in calcium

1) Dairy foods: Many foods contain calcium, but dairy products such as yogurt, cheeses and buttermilk contain a form of calcium that body can absorb easily. Whole milk(4% fat) is recommended for children ages 1 to 2. Adults and children over age 2 should drink low fat (2% or 1%) milk or skim milk and other dairy products. Removing the fat will not lower the amount of calcium in a dairy product. Yogurt, most cheeses and buttermilk are excellent sources of calcium and come in low fat or fat- free versions, Milk is a good source of phosphorus and magnesium, which helps the body absorb and use calcium, Vitamin D is needed to help your body use calcium. Milk is fortified with vitamin D for this reason.
2) Other foods: Other sources of calcium that can help meet the body's calcium needs include: Green leafy vegetables such as broccoli, collards, kale, mustard greens, turnip greens and bok Choy or Chinese cabbage, Salmon and sardines canned with their bones, Almonds, brazil nuts, sunflower seeds, tahina and dried beans, Blackstrap molasses, Sesame seeds, Sunflower seeds, Chia seeds

II. OSTEOPOROSIS

The components of the word 'osteoporosis' literally mean ' porous bones'- 'osteo' is for bones and 'porosis' means porous- helpfully describing this condition and increased fragility of the bones.

Osteoporosis is a bone disease affecting the bone structure and strength of bone, raising the risk of fractures. Postmenopausal women are most likely to develop the condition, but it also affects men and younger people across all genders.Some risk factors for osteoporosis are modifiable, such as smoking and poor nutrition. Osteoporosis is often considered a silent disease as there are no clear outward symptoms caused by the loss of bone density (although bone pain may occur in some people).Fractures are most likely in the spine, hip, and wrists. Diagnosis is made directly via a special X-ray based scan and sometimes through ultrasound. Treatment include drugs that prevent or slow down bone loss, exercise programs, and dietary adjustments, including extra calcium, magnesium and vitamin D.It is important for people with osteoporosis to take measures to avoid fall so as to reduce the risk of fractures (which can prove fatal).

A. Non-modifiable risk factors for osteoporosis include

Age- risk increases with age after mid-30s, Ethnicity-risk is higher in white people and Asians, Bone structure- risk is higher in those with small bone structure, Genetics- risk is higher in people with a previous with a previous fracture during a low- level injury, especially if this occurred after age of 50.

B. Signs and symptoms of osteoporosis

The osteoporotic hip fracture is vulnerable to fracture, eve from light fall, Bone loss that develop slowly, leading to osteoporosis, does not cause any symptoms or outward signs, As such, a patient may only strain- or even a simple cough or sneeze may result in a fracture. Typically, breaks occur in the hip, wrist, or in the spinal vertebrae, Breaks in the spine can lead to altered posture, with compressed vertebrae creating the stooped appearance often seen in older people (this excessive curvature of the spine is called kyphosis).

C. Treatment and prevention of osteoporosis

The risk of developing osteoporosis or incurring a fracture can be lowered by preventive lifestyle measures and drug treatments that protect against bone loss and encourage healthy bone mineralization.

1) Lifestyle measures that help to maintain healthy bone mineral density and prevent fractures include: Calcium is available from certain foods- we need intake in old age. Ensuring adequate calcium intake (about 1000-2000 mg a day, with higher amount needed by women over 50 and everyone over 70). Calcium is available in the diet or through supplements. Ensuring adequate vitamin D status (doctors can help monitor this, and supplements may be necessary for anyone who is housebound, has very dark skin, little sun exposure, or who lives at a more northerly latitude; vitamin D is synthesised through the action of sunlight on skin, and is available in the diet through fortified foods, egg yolk, salt fish and liver; the daily recommended amount is 600 IU and 800 IU in men and women over 70 yrs).
2) Minimize foods that deplete your calcium stores in the body- Avoid the following foods: Soft drinks- they contain phosphoric acid that is known to increase calcium excretion in urine, Caffeine- for every 100 mg of caffeine intake, 6 mg of calcium is leached out from the bones, Stop smoking if applicable (this affects a number of factors, including reducing growth of new bone and decreasing women's oestrogen levels), Drink alcohol only in moderation (elevated alcohol intake is also associated with

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other risk factors, such as poor nutrition and increased risk of falls), Exercise- weight bearing exercise including simple walking promotes healthy bone and strengthens support from muscles. Exercise such as yoga also promotes posture and balance and so reduce the risk of falls and fractures. For people who already have osteoporosis, nutrition, exercise and fall prevention play a key role in reducing risks and bone loss.

D. Health risks from excessive calcium

Excessively high levels of calcium in the blood known as hypocalcaemia can cause renal insufficiency, vascular and soft tissue calcification, hypercalciuria (high levels of calcium in the urine) and kidney stones. Although very high calcium intakes have the potential to cause hypocalcaemia, it is most commonly associated with primary hyperparathyroidism and malignancy. High calcium intake can cause constipation.

It might also interfere with the absorption of iron and zinc, though this effect is not well established. High intake of calcium from supplements, but not foods, has been associated with increased risk of kidney stones. Some evidence links higher calcium intake with increased risk of prostate cancer, but this effect is not well understood, in part because it is challenging to separate the potential effect of dairy products from that of calcium. Some studies link high calcium intake, particularly from supplements, with increased risk of cardiovascular disease.

III. NUTRITIVE VALUE OF SESAME SEEDS

While sesame seeds have been grown in tropical regions throughout the world since prehistoric times, traditional myth holds that their origins go back even further. According to Assyrian legend, when the god met to create the world, they drank wine made of sesame seeds. Sesame seeds may be the oldest condiment known to man. They are highly valued for their oil which is exceptionally resistant to rancidity. ‘open sesame’---the famous phrase from Arabian nights---reflects the distinguished feature of the sesame seed pod, which burst open when it reaches maturity. The scientific name for sesame seeds is sesamum indicum. The chemical composition of seeds provides (g/100gm) carbohydrates -25.0, proteins-18.3, fat-43.3, total minerals-219.87 and calcium 1450 mg, phosphorus-570 mg, iron-9.3 mg and energy-563 kilocalories. Sesame seeds are fairly rich in calcium. The nutritive value relating to calcium and chemical score (CS) of sesame seeds are higher than that of dairy foods. The calcium content in 100gms sesame seeds is 1450 mg..

A. Physiology of calcification

The problem of calcification in animal body has in recent years been approached from a number of different aspects. Differentiation of various Ca fractions in the blood plasma has resulted in numerous studies of physiochemical relationships of Ca and PO4 ions in the body. Consideration is given to work relating to the formation and composition of bone salts and of recent X-ray studies in connection. Other aspects of calcification considered include the absorption of calcium from the gut, the availability of Ca from various sources, the influences of growth and calcium reserves on absorption and retention. The requirements of Ca and P for various species are discussed. Space is devoted to a consideration of the effects upon calcification of vitamin C and D, and of hormones of pituitary, parathyroid, thyroid and other glands including sex hormones. Much of the knowledge of the physiological and chemical factors concerned in calcification is unfortunately fragmentary, but Alferd eden hopes that by presenting the available state of knowledge further investigation of the subject will be stimulated.

IV. CALCIUM HOMEOSTASIS

Calcium homeostasis is a complex process involving 4 key components: serum calcium, serum phosphate, 1,25-dihydroxyvitamin D-3, and parathyroid hormone (PTH). More than 99% of the total body calcium is stored in bone in the form of phosphate and hydroxide salts, predominantly as hydroxyapatite. Normally, a very small portion of this calcium is available for exchange in the serum.

A. Parathyroid hormone (PTH)

Parathyroid hormone (PTH) is polypeptide containing 84 amino acids that is secreted by the parathyroid gland after cleavage from preparathyroid hormone (115 amino acids) to proparathyroid hormone(amino acids) to the mature hormone. The major target end organs for parathyroid hormone (PTH) action are the kidneys, skeletal system, and intestine. The primary response to parathyroid hormone (PTH) by kidneys is to increase renal calcium and phosphate excretion. In the kidneys, parathyroid hormone (PTH) blocks

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reabsorption of phosphate in the proximal tubule while promoting calcium reabsorption in the ascending loop of henle, distal tubule and collecting tubule. Parathyroid hormone (PTH) promotes absorption of calcium from the bones in 2 ways. the rapid phase bings about a rise in serum calcium within minutes and appears to occur at the level of the osteoblasts and osteocytes. Although it may seem counterintuitive that the cells that promote deposition of bone are involved in resorption, these cells form an interconnected network known as the osteocytic membrane overlying the bone matrix, but with small layer of interposed fluid termed as bone fluid. When parathyroid hormone (PTH) binds to the receptor on these cells, the osteocytic membrane pumps calcium ions from the bone fluid into the extra cellular fluid. The slow phase of bone resorption occurs over several days and has 2 components. First, osteoclasts are activated to digest formed bone, and second , proliferation of osteoclasts occurs. Interestingly, mature osteoclasts lack parathyroid hormone (PTH) membrane receptors; activation and proliferation appears to be stimulated by cytokines released by activated osteoblasts and osteocytes or by differentiation of immature osteoclast precursors that possess parathyroid hormone (PTH) and vitamin D receptors.

The final important function of parathyroid hormone (PTH) is conversion of 25-hydroxyvitamin D to its active metabolite, 1,25-dihydroxyvitamin D-3 [1,25-$(OH)_2$ D3], by activation of enzyme 1-hydroxylase in the proximal tubules of the kidney. Feedback inhibition of parathyroid hormone (PTH) release occurs primarily by direct effect of calcium at the level of the parathyroid gland. Although not well elucidated, 1,25-$(OH)_2$ D3 appears to exert a mild inhibitory effect on the parathyroid gland as well.

B. Vitamin D

Vitamin-D3 (cholecalciferol) is formed in the skin when a cholesterol precursor, 7-dehydroxycholesterol, is exposed to ultraviolet light. Activation occurs when the substance undergoes 25-hydroxylation in the kidneys. The primary action of 1,25-$(OH)_2$ D3 is to promote gut absorption of calcium by stimulating formation of calcium binding protein within the epithelial cells. Vitamin D also promotes intestinal absorption of phosphate ions, although the exact mechanism in unclear. Negatively charged phosphate ion may passively flow through the intestinal cell because of flux of the positively charged calcium ion. In bone, vitamin D may play a synergistic role with parathyroid hormone(PTH) in stimulating osteoclast proliferation and bone resorption. Compared to parathyroid hormone (PTH) vitamin D exerts a much slower effect on calcium balance.

V. OBJECTIVES

A. To develop a calcium rich product using different calcium rich seeds and nuts.
B. To standardize the ingredients of developed product
C. To conduct sensory evaluation of the developed product
D. To estimate the nutritive value of developed product
E. To subject the compiled data to statistical analysis by t- test
F. To assess the knowledge and create awareness of calcium among geriatrics through development of questionnaires
G. To calculate the cost of the developed product.

VI. METHODOLOGY

A. Product development

Product development in a nutritional context means the act of developing a basic product into a new or value added product, which is high in terms of nutrients and other health benefits. Because if quantity and sometimes almost mystical reputation and characteristic of most primary product, their addition to the product usually enhances the nutritive value or quantity of these sensory products. For these reason, the secondary products, with partially or wholly, can be made up of primary product are referred to here as “value added” product or developed products. Hence the product is developed with combination of different calcium rich seeds to increase the consumption of calcium through Non-dairy food sources during old age. Basic recipe selected was oats bar and it is very well known granola bar.

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TABLE I
INGREDIENTS USED IN PREPARATION OF BASIC AND VARIATIONS IN GRAMS.

S.No	Ingredients	Basic	Variation-1	Variation-2	Variation-3	Variation-4
1	Hand rolled oats	50	40	30	20	-
2	Sesame seeds	-	10	20	30	40
3	Chia seeds	-	5	5	10	10
4	Flax seeds	-	3	2.5	2	1
5	Sunflower seeds	-	5	5	5	5
6	Dried figs	-	10	10	10	10
7	Almond butter	-	5	5	10	10
8	Dates	20	10	10	10	10
9	Honey	20	15	10	5	5
10	Virgin olive oil	5	5	5	5	5

B. Procurement of materials

The raw materials oats, sesame seeds, chia seeds, flax seeds, sunflower seeds, dates, figs, almond butter, honey and olive oil are obtained from local market. The product was standardized by dry roasting 50 grams of oats and then thoroughly mixing it with dates paste, honey and olive oil once done forming into bar shapes by refrigerating it for 20 mins and this was treated as control or reference one. Five samples are prepared using sample one as control or reference containing oats a the primary ingredient, from sample 2-5 they are fortified with sesame seeds at the rate of 10, 20, 30, 40 grams of sesame seeds and different calcium rich seeds.

C. Method of preparation

1) Firstly, dry roast all ingredients except figs, dates, honey and oil.
2) Then put all ingredients in a large bowl and mix together.
3) Press the mixture into logs and smash down in rectangular boxes.
4) Refrigerate these boxes for about 30 mins, so that it sets into bar shapes.
5) Remove these bars from boxes by turning the box upside down, finally cut into bar shapes.

D. Standardization

Sensory quality is a combination of different sense of perception coming into play is choosing and eating a food, appearance, flavour, and mouth fell decide the acceptance of the food. Once the standardization is completed, 20 panellists are selected for both the trials of evaluation of sensory attributes of prepared bars. The panellist in each trial did sensory evaluation of both the basic and variations. The panellist included both working and retired elderly people some procedure and temperature maintained for both the trials, as to minimize any kind of changes in the preparation of the bar might bring difference in taste, colour, texture and odour. The sensory evaluation was done as soon as the bar was set and served to the panellist.

Samples were placed together, in front of each member with a score card to rate the four different recipes. A glass of water was also provided, to drink in between the assessment of four samples, so that it becomes for panellist to get the exact taste of four samples.

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VII. CREATING AWARENESS

A. Product distribution

The study on awareness of calcium foods among geriatrics was done by distributing developed product (calcium rich granola bar). The place of study was Hyderabad. The people who were subjected to the awareness programme were elderly persons.

B. Sample size and selection of the subjects

The sample size consists of a total of 60 subjects. The sample size included the elderly people of around 48yrs and above. The people belonged to different places with different backgrounds.

C. Information collection

The information was collected using a questionnaire method. The questionnaire used to collect the information was developed in English. It consisted of only close ended questions with multiple choices. The content of questionnaires was divided into headings.

1) *General information*: The general information was collected to get the following details like personal information of the respondent viz age, gender, medical history, smoking habits in male and maternal history for female, economic status and contact number.
2) *Awareness information*: It included questions of close ended type. The question was regarding the use of calcium foods, type of calcium foods, preferred calcium weather it's a dairy food source, importance of sesame seeds, functions and importance of calcium foods etc.

3) *Acceptability of the product*: Each subject was provided with a sample of product and was seen whether it was accepted by elderly people through five-point hedonic rating scale.

The product was developed keeping in mind importance of calcium during old age. It consisted of hand rolled gluten free oats, sesame seeds, chia seeds, flax seeds, sunflower seeds, almond butter, dried figs, honey, fresh dates and virgin olive oil. In the basic only oats, dates, honey and olive oil was used where as in the variations different quantity of sesame seeds were added (10, 20, 30, 40) respectively with different calcium rich seeds. The subject was given variation as it was more acceptable than others.

TABLE II
CALCULATED COST OF THE BAR

S.No	Cost (50 gm)
Basic	18.7 rupees
Variation 1	25 rupees
Variation 2	30.2 rupees
Variation 3	37.5 rupees
Variation 4	36.5 rupees

Nutritive value of basic and variation

Nutritive value of basic and variations (Energy, protein, fat, carbohydrates, fibre, iron and calcium) were calculated.

TABLE III
NUTRITIVE VALUE OF BASIC AND VARIATIONS OF THE PRODUCT DEVELOPED

Bar	Energy (Kilo .Cal)	Protein(gm)	Fat(gm)	Carbohydrate(g)	Fibre(g)	Calcium(mg)	Iron(Gm)
basic	292.7	7.74	8.5	56.2	6.2	33	2.5
Variation 1	407.3	11.4	20.5	55.4	8.7	252	3.6
Variation 2	405.7	11.6	23.9	48.1	7.7	390	4.1
Variation 3	460.7	13.1	31.8	42.5	6.4	573	5.58
Variation 4	434.3	12.0	34.3	31.3	4.2	705	5.55

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D. T-Test

T test was applied to find out significance of difference between the mean score of sensory properties of basic and variation.

Formula applied

Let x_1 be two independent samples of size N_1 and N_2 respectively, suppose we want to test the hypothesis.

H_O; is the significant difference between the means of basics and variations. Under the null hypothesis, the H have been drawn from the same normal population has a't' distribution as per the statistics.

$$t = (x-y)$$

Where, $x_1 = (xi.y_i)$

$$Y_1 = (y_i-y)$$

VIII. RESULTS AND DISCUSSION

A. Product development

Product development in a nutritional context means the act of developing a basic product into a new or value added product, which is high in terms of nutrients and other health benefits. Because if quantity and sometimes almost mystical reputation and characteristic of most primary product, their product usually enhances the nutritive value or quantity of these sensory products.

For these reason, the secondary products, with partially or wholly, can be made up of primary product are referred to here as "value added" product or developed products. Hence the product is developed with combination of different calcium rich seeds, known to provide dietary calcium and reducing one of the complication of old age. Basic recipe selected was oats granola bar and is very well known granola bar recipe.

Any food gives the person pleasure if it has to be accepted and become a part of being habits. Thus acceptance, colour, taste, texture and flavour which are sensory response of the person to the food. For the measurement of the sensory responses form of estimates of individual dimension of overall quality we have to rely on human panels. Since each variation of product or a formulation could be tested at consumer level becomes necessary to standardize the condition of testing with selected panel under optimal condition, the reason is that if by sensory testing a product will be approved by such panel of layman who is generally less critical or sees it as a whole and non analytically will also approve the product.

B. Prepared sesame seeds bar

Fig-1 Basic oats granola bar and variation-1 fortified with sesame seeds.

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Fig-2 variation-2, variation-3 and variation-4 fortified with sesame seeds

The awareness study conducted among geriatrics from different places 60 samples were selected to know regarding the importance of calcium foods during old age showed the following results.

C. Awareness regarding calcium foods

TABLE IV
AWARENESS OF CALCIUM

Option	Percentage
Yes	55%
no	45%

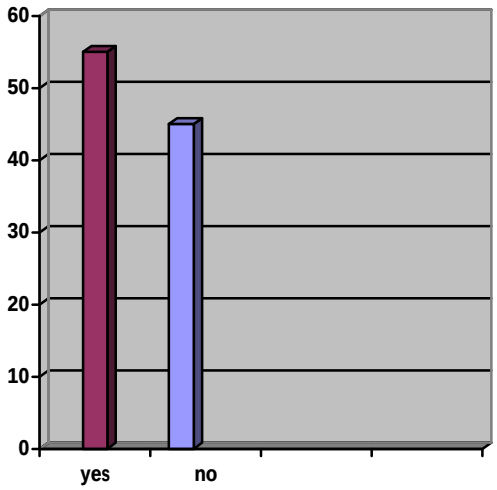

Fig-3 shows that 55% of the subject is aware of the calcium and rest of the 45% are not aware of the calcium.

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TABLE V
AWARENESS OF SESAME SEEDS (TIL)

Option	Percentage
Yes	41.6%
no	58.3%

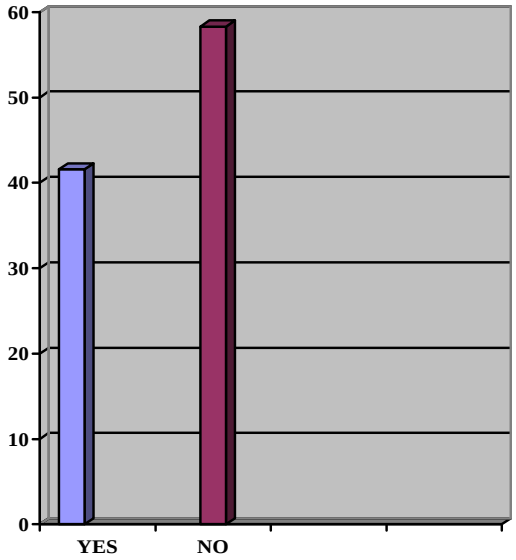

Fig-4 shows that 41.6% of the subject is aware of sesame seeds as a source of calcium and 58.3% is not aware of sesame seeds.

TABLE VI
RESULT OF SENSORY EVALUATION OF BASIC AND VARIATIONS OF DEVELOPED PRODUCT

Sensory Attributes	Basic	Variation-1	Variation-2	Variation-3	Variation-4
Appearance	4.4	4.3	4.4	4.4	4.3
Colour	4.6	4.4	4.5	4.2	4.4
Texture	4.4	4.4	4.6	4.4	4.4
Taste	4.5	4.3	4.2	4.3	4.3
Acceptability	4.7	4.3	4.1	4.2	4.3

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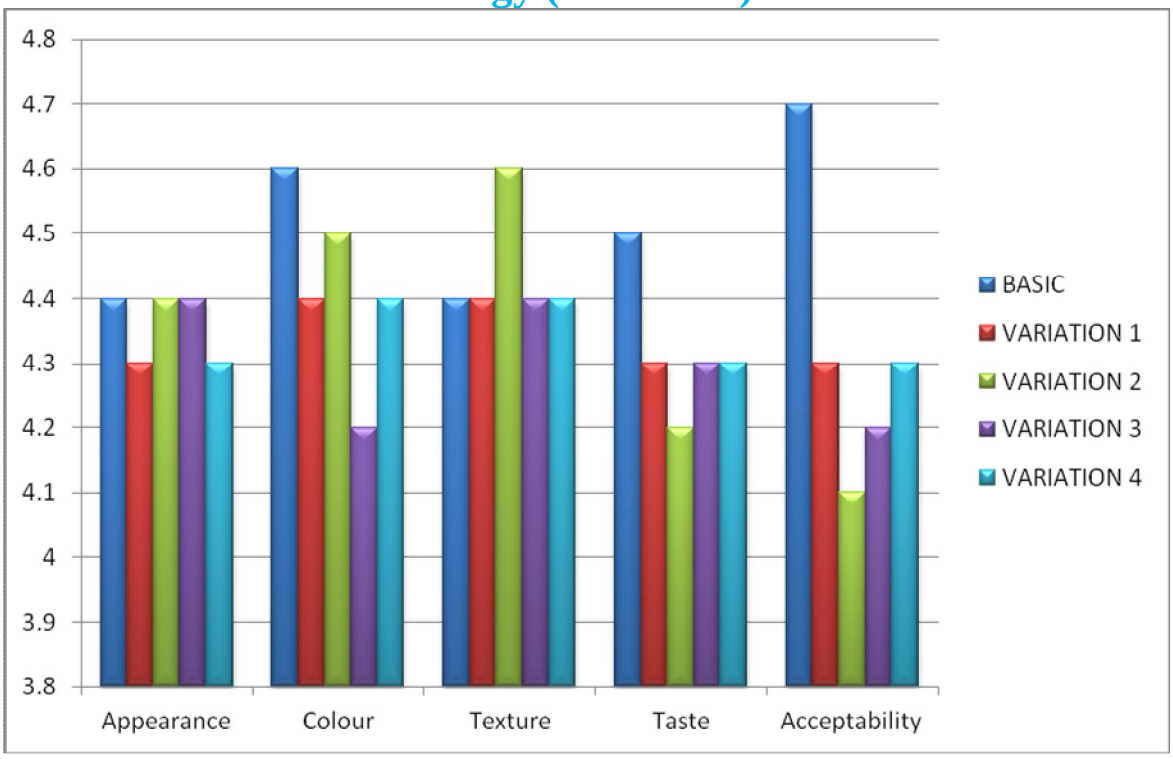

Fig-5 comparison of sensory attributes of sesame seeds bar, it shows that variation-3 is the most acceptable in the developed product.

IX. SUMMARY

Sesame seeds add a nutty taste and a delicate, almost invisible, crunchy to many Asians dishes. They are highly valued for their oil which is exceptionally resistant to rancidity. Sesame seeds are an excellent source of copper, a very good source of manganese, and a good source of phosphorous, iron, zinc, molybdenum, and selenium.
In recent studies, calcium has been shown to;

A. Help prevent colon cancer from cancer causing chemicals.
B. Help prevent bone loss that can occur as a result of menopause or certain conditions such as rheumatoid arthritis.
C. Help prevent migraine headaches in those who suffer from them
D. Reduce PMS symptoms during luteal phase (the second half) of the menstrual cycle.

The present study was conducted to assess the knowledge of calcium and to create awareness among geriatrics, study was conducted on a total of 60 subjects. As per the study it was found that the majority of people was in the age group of 48-55 yrs. Later percentage of population were found to be retired people and lesser were working part time.
A questionnaire method was conducted to assess the knowledge of calcium foods among geriatrics and to create awareness about calcium foods. 60 subjects were selected and also provided with a product developed; to test for the acceptability of the product developed 70% accepted the product in terms of appearance, colour, flavour, texture and taste.

X. CONCLUSIONS

It was observed that majority of the subject were aware of the importance of calcium foods during old age and they were aware of different dairy foods rich in calcium and its function in maintaining bone health. It was also observed that majority of the people were not aware of non- dairy calcium rich seeds, and sesame seeds and they were not aware about its inclusion in the daily diet as a source of calcium.
From the finding of the present study investigation it is concluded that the product developed by using different calcium rich seeds contained appreciable amount of calcium, if these are incorporated into the diet, the health status and bone health can be maintained and improved in people with osteoporosis. As it acts by calcium deposition in bones and increase bone mass.
The basic along with the variations were prepared. The basic consists of only oats, dates, honey, and olive oil where as in variations

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oats was replaced with (10, 20, 30, 40g) of sesame seeds. The variation-3 is yhe most acceptable next to basic.

The same method of preparation was followed for preparing both the basic and variations were formulated and standardized by conducting repeated trials.

Panel of twenty judges evaluated the palatability and acceptability of the product. The palatability of the basic and variation were accepted in terms of appearance, flavor, taste, texture and acceptability. Statistical analysis of the palatability trials has shown that't' values at p-0.05 was found to be significant for variations-1, 3 and 4 and insignificant for variation-2. Variation-3 was the most accepted one.

Cost of the developed product was calculated taking into account all the ingredients added. The cost was found to be economical and can be afforded by all the population.

XI. ACKNOWLEDGMENT

My efforts would have not been materialized without the grace of Almighty and the constant encouragement, support and guidance of my family members, not to forget my mentor and guide meena maam. It's a pleasure and a sense of indebtness that i acknowledge here the valuable help of all those who contribute so much to the completion of my project. I am grateful to my late mom without her i would have been nothing, and thankful to my dad for their constant support in all my endeavours besides being a source of inspiration and encouragement tome..

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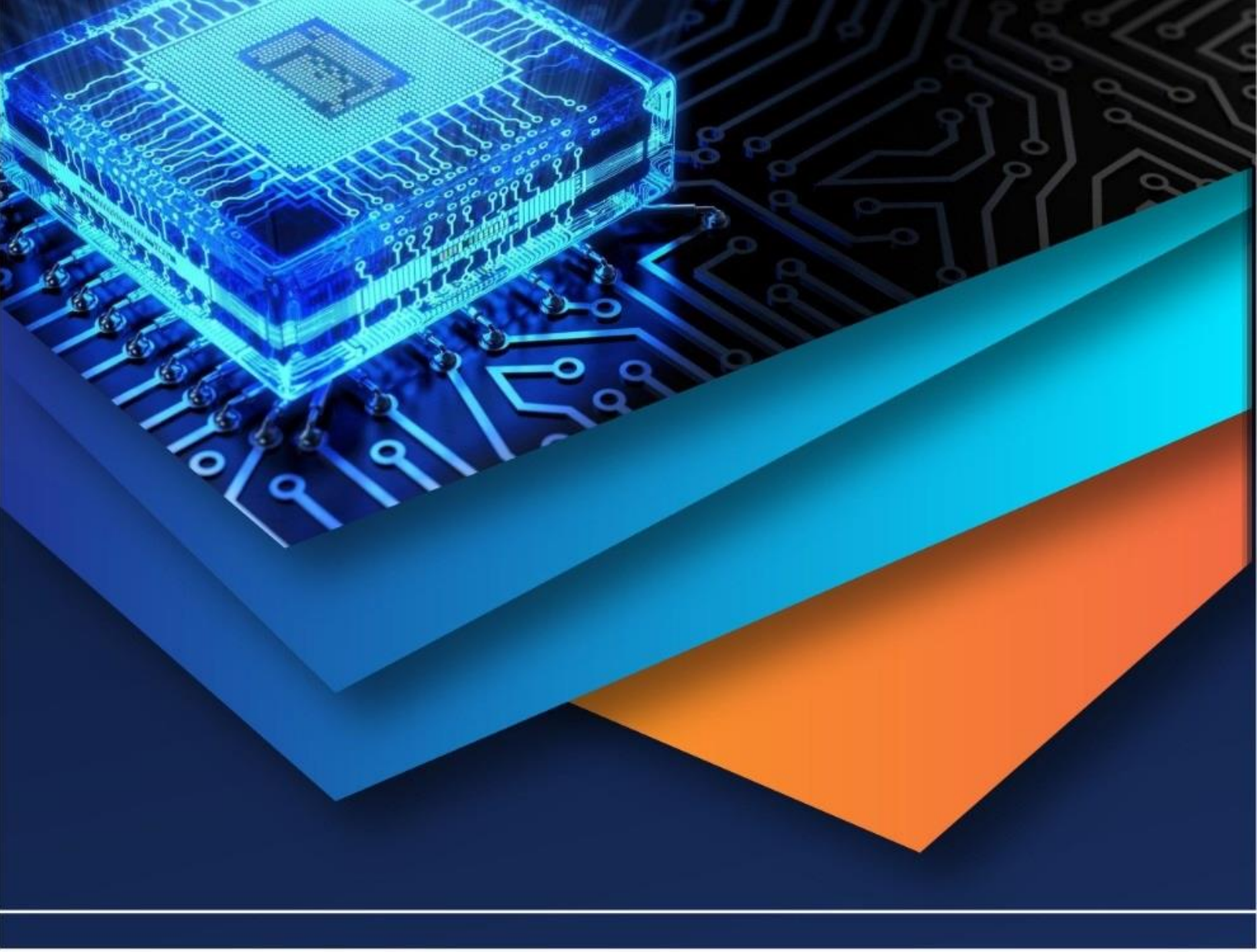

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