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Assessment of the Sensory Acceptability of Soy Milk based Sandesh (Traditional Indian Sweet Dairy Dessert) for Elderly People (Aged >60 Years) Living in Kolkata and its Efficacy on the Health Status of Geriatric Population

By Sweata Rani Rai & Sabia Nazmin

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Abstract- Background: Aging is often associated with the incidence of degenerative diseases such as cardiovascular, cerebrovascular diseases, diabetes, osteoporosis, and cancer, which affects dietary eating patterns in older adults. With advancing age, there is a decline in appetite and a reduced affinity to food. However, the eighty million citizens of West Bengal including the older adults have a craving for sweets. Therefore, the present study aims to evaluate the sensory and chemical evaluation of Sandesh prepared from soymilk and dates adhering to nutritional needs and dietary preference towards sweets for older adults.

Method: Sandesh is prepared with the substitution of traditional milk chenna (fresh, unripened curd cheese made from cow milk/ buffalo milk) with soy milk and dates syrup. Sensory evaluation of these two ingredients with graded variations (5gm, 10gm, 15gm, 20gm & 25 gm) of pumpkin seeds and watermelon seeds was carried out by 25 males and 25 females older adults (aged >60 years) at St Joseph's Old Age Home, Kolkata. The standard and the most approved product is further analyzed for physical and chemical parameters.

Result & Discussion: As per the product acceptability, the variation with 20g Soymilk chenna+1.25g cardamom powder+1.25ml rose water+10ml dates syrup+5g watermelon seeds+5g pumpkin seeds was the best sample. One serving (50g) of the product provided 5.1g of protein, 12.5g of carbohydrate, 7.3g of fat, 2.6mg of iron, 93.1mg of calcium, 13mg of phosphorus, and the total antioxidant activity (%) was 30%. These nutrients are of more significance in terms of prevention and retardation of degenerative diseases associated with aging in the elderly.

Conclusion: Sandesh fortified with soya milk chenna, dates, pumpkin seeds, and watermelon seeds can prove beneficial for the overall health of the elderly population and also reduce the risk of morbidity.

Keywords: non-dairy sandesh, geriatrics, degenerative diseases, functional food.

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I. INTRODUCTION

Nutrition acts as an important modifiable determining factor of age-related decline and associated degenerative diseases like obesity, hypertension, and diabetes.^[16] Most importantly, dietary adjustments and alterations not only influence present health but can also determine the quality of life in old age.^[8] People of West Bengal are traditionally sweet lovers and have always been known for their particular weakness for sweets. Even the older adults are no exception to these sweet cravings.^[4]

Sandesh represents the traditional Indian dairy product, which is very common in every household of Eastern India.^[17] The traditional method of Sandesh making involves the preparation of chhana (fresh, unripened curd cheese made from cow/ buffalo milk), mixed with sugar (30-35% of chhana), kneaded and cooked at 70-75°C for 10-15 minutes (Fig. 1). The cooked mass was transferred to moulds for desirable shape. The traditional Sandesh, which is prepared by the addition of cow milk chhana and sugar, was replaced by soymilk chhana and dates, respectively, and for further, enrichment pumpkin seed and watermelon seed were added to enhance the nutritional property of the Sandesh.

II. MATERIALS & METHODOLOGY

a) Study Design

The sensory evaluation of the product with variations is done by 50-panel members comprising of 25 males and 25 females older adults (aged >60 years) residing at St Joseph's Old Age Home, Kolkata. Prior permission is taken from the authorities of the nursing home. The nature, purpose, and objectives of the study is also explained to the inmates and confidentiality was assured. Written informed consent is also taken.

The preparation of the product is carried out in the food and chemistry laboratories of J. D. Birla Institute, Kolkata. All the ingredients are collected from departmental stores in Central Avenue, Kolkata.

b) *Product Development*

The Sandesh is made with substitution of traditional chenna and sugar with soymilk chenna and dates syrup with varying proportions of graded variations (5gm, 10gm, 15gm, 20gm & 25 gm) of

pumpkin seeds and watermelon seeds. The variations are given in (Table 1). The products are then evaluated for sensory and nutritional parameters for production of Sandesh^[3]

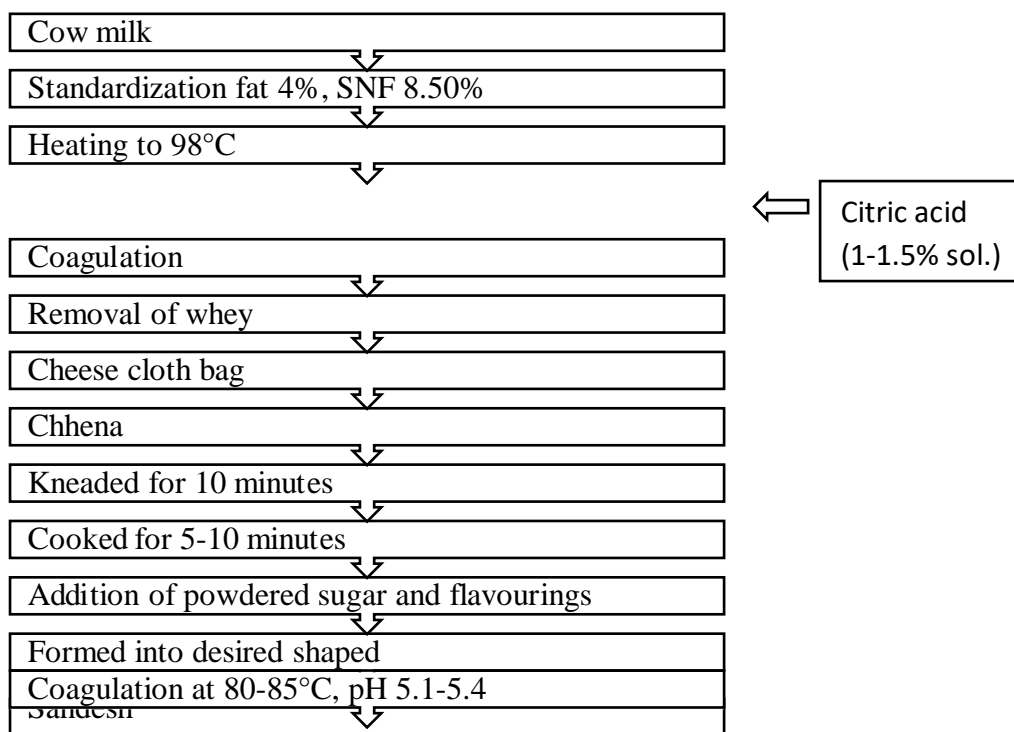


Fig. 1: Flow diagram for production of Sandesh^[3]

Table 1: Variations of Sandesh

Product Code	Additional Ingredients
Product B	20g cow milk chhena+5g powdered sugar+1.25g cardamom powder+5ml rose water
Product S	20g soymilk chhena+5g powdered sugar+ 1.25g cardamom powder+5ml rose water
Product A1	20g soy milk chhena+ 5ml dates syrup+ 1.25g cardamom powder+1.25ml rose water
Product A2	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water
Product A3	20g soy milk chhena+15ml dates syrup+1.25g cardamom powder+1.25ml rose water
Product B1	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+5g watermelon seeds
Product B2	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds
Product B3	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+15g watermelon seeds
Product B4	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+20g watermelon seeds
Product B5	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+25g watermelon seeds
Product C1	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+5g pumpkin seeds
Product C2	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+10g pumpkin seeds

Product C3	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+15g pumpkin seeds
Product C4	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+20g pumpkin seeds
Product C5	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+25g pumpkin seeds

c) *Sensory analysis*

Attributes to be scored were appearance, color, flavor, texture, taste, and overall rating. Each variation of the Sandesh is placed with corresponding codes. A sensory evaluation sheet comprising of a 9-point hedonic scale is also given. The panel members are briefed with the process of evaluation.

Chemical analysis of the standard (S) and most approved variation (C2) chosen by the panel members are performed.

d) *Estimation of Proteins*

The protein content of the samples was measured using the Biuret method. Bovine serum albumin (BSA) at a concentration of 1mg/dl is used as the standard protein solution. The standard protein solutions of 0.2ml, 0.4 ml, 0.6 ml, 0.8 ml were taken in test tubes, and the volume was made up 1ml by addition of distilled water. For the test samples, 1ml of the test sample is taken in separate test tubes, and 4ml of the Biuret reagent was added and incubated at room temperatures for 30 minutes. The optical density is then measured at 550 nm. The concentration of the protein sample was determined using a standard curve.^[9]

e) *Estimation of Fat*

The determination of fat is done by Rose Gottlieb method. 10gm of the sample was weighed and transferred to the extraction tube and 1.25ml of ammonia was added and mixed. Further, 25ml of diethyl ether (peroxide free) is added, stoppered and shaken vigorously for a minute. 25 ml of petroleum ether was also added and shaken for about half a minute and was allowed to stand still followed by decantation. The extraction process is repeated twice, and drying was carried out in hot air oven at 102 °C for two hours, cooled in a desiccator, and weighed. Fat calculation:

$$\text{Fat (gms)} = \frac{\text{Weight of extracted fat}}{\text{weight of the sample}}^{[10]}$$

f) *Estimation of Total carbohydrates*

The determination of the total carbohydrate is done by the Anthrone method. 1gm of the sample was taken in a boiling tube and hydrolyzed by keeping it in a boiling water bath for three hours with 10 ml of 2.5 N HCL. Afterward, the sample was cooled to room temperature and neutralized with sodium carbonate until the effervescence ceases. The volume of the test sample was made up to 100 ml and centrifuged at 3000-4000g. The supernatant was collected, and 1 ml of the aliquot is used for analysis. 4ml of anthrone reagent

was added to it and is heated for 10 minutes in a boiling water bath. The absorbance was measured at 630nm using a spectrophotometer. D-glucose at a concentration of 1mg/dl is used as the standard for the estimation. The amount of total carbohydrate present in the sample is calculated using the standard curve.^[26]

g) *Estimation of Calcium*

The estimation of calcium was carried out by O-Cresolphthalein Complexone (OCPC) method. OCPC combined with calcium at alkaline pH to form a purple colored complex, the absorbance which was measured at 578nm. The recommended volumes of kit agents (Coral Clinical System, India) are added to the test tubes labeled as blank, standard, and test samples. The reaction mixtures are incubated at room temperatures for 5 minutes, followed by measurement of absorbance of the samples at 578 nm.

Calcium concentration calculation:

$$\text{Calcium (mg/dl)} = \left[\frac{\text{Absorbance of test}}{\text{Absorbance of standard}} \right] \times 10^{[23]}$$

h) *Estimation of Iron*

The estimation of iron is done by the Ferrozine method, where Fe II ions reacted with Ferrozine to form a violet colored complex. The recommended values of kit reagents (Coral Clinical Systems, India), buffer solution, color reagent, and standard solutions are added to the test tubes labeled as blank, standard, and test. The mixtures are then incubated at room temperature for 5 minutes, and the absorbance is measured at 578nm. The concentration of iron is determined by the following formula:

$$\text{Iron } (\mu\text{M}) = \left[\frac{\text{Absorbance of test}}{\text{Absorbance of standard}} \right] \times 35.8^{[6]}$$

i) *Estimation of Phosphorus*

Estimation of phosphorus is done by the Molybdate UV method, where the phosphate ions in an acidic medium react with ammonium molybdate to form a phosphomolybdate complex. The absorbance was then measured at 340 nm. The intensity of the complex formed is directly proportional to the amount of inorganic phosphorus present in the sample. The ash solution is dissolved in 10ml of 6N HCL, warmed over a water bath, and filtered through Whatman filter paper. 1ml of the working reagent is added to the blank, standard and test. The concentration of phosphorus is determined by the following formula:

$$\text{Phosphorus (mg/dl)} = \left[\frac{\text{Absorbance of test}}{\text{Absorbance of standard}} \right] \times 5^{[15]}$$

j) *Estimation of total antioxidant capacity*

The free radical scavenging activity of the samples was determined using a 2, 2-diphenyl-1-2-picrylhydrazyl (DPPH) method. An aliquot of 2ml of 0.15mM DPPH in ethanol is added to the test tube with 1ml of the sample extract. The reaction mixture was vortex mixed and left to stand at room temperature in the dark for 20 minutes. The absorbance is then measured at 517nm with the help of a spectrophotometer. The control sample is prepared without adding extract.

$$\%TAA = [1 - (\text{Absorbance of the sample} / \text{Absorbance of control})] \times 100^{[12]}$$

k) *Statistical Analysis*

The standard deviation and student t- test are done of all the sensory attributes of the standard variation and most approved variation. The mean score is also estimated for the most approved variation with the standard recipe.

$$\text{Calculation: } t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{(s_1)^2 / n_1 + (s_2)^2 / n_2}}$$

Where,

\bar{x}_1 = is the mean of the standard

s_1 = is the standard deviation of the standard

n_1 = is the no. of individuals in standard

\bar{x}_2 = is the mean of the most approved

s_2 = is the standard deviation of the most approved

n_2 = is the no. of individuals in most approved

III. RESULTS AND DISCUSSION

a) *Sensory evaluation of basic and standard*

Acceptability of products is evaluated from the ratings obtained through the scorecard using 9 points hedonic scale during the sensory evaluation. When the mean score of the sensory attributes of the standard (S) is compared with the most approved variation (C2), there was no significant difference observed which can lead to higher acceptability of the product.

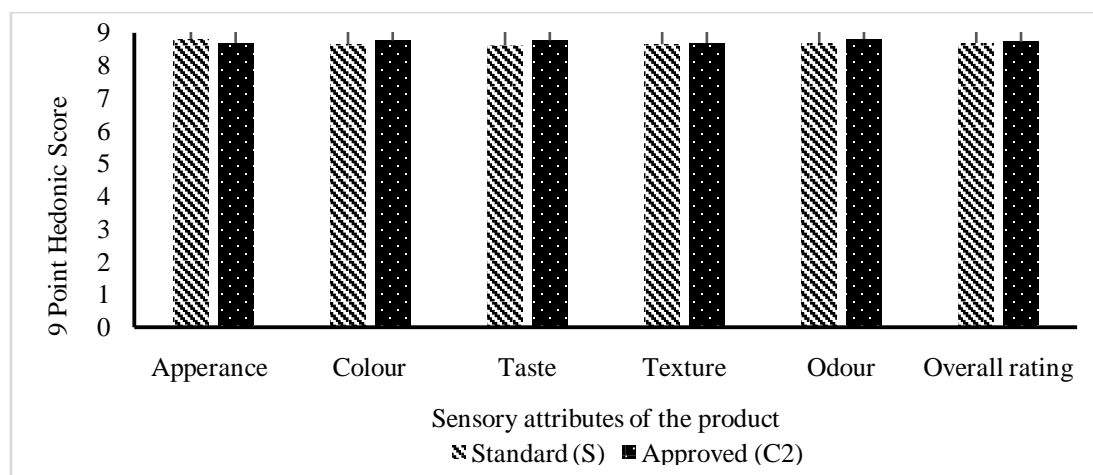


Figure 2: Comparison of student t-test of sensory attributes of standard(S) and most approved variation (C2)

Product code

S	20g Soymilk chenna+1.25g cardamom powder+1.25ml rose water+10ml dates syrup
C2	20g Soymilk chenna+1.25g cardamom powder+1.25ml rose water+10ml dates syrup+5g watermelon seeds+5g pumpkin seed

b) *Macronutrient analysis of standard (S) and most approved product (C2)*

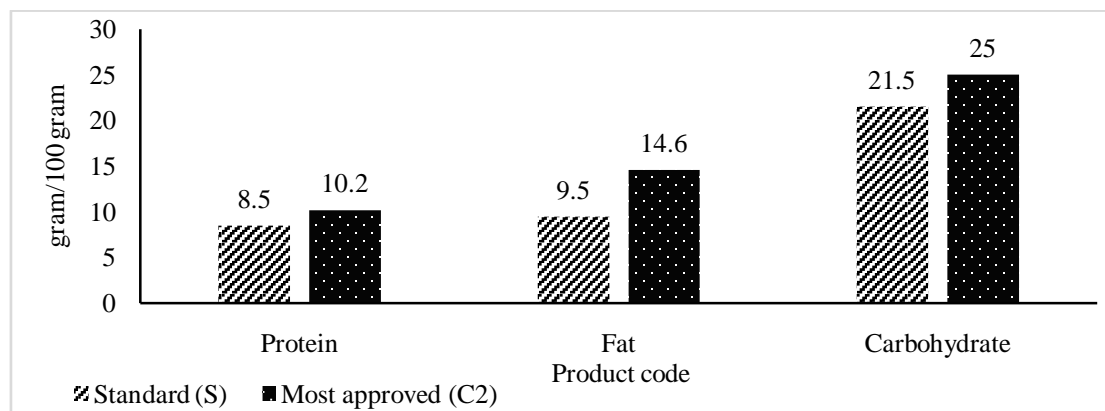


Figure 3: Comparison of protein, fat and carbohydrate content of standard (S) and most approved product (C2)

From fig 3, it is seen that the protein content of the standard (S) was 8.5gram, and the most approved product (C2) was 10.2 gram, respectively. Product S is the standard recipe having soybean chenna as the only source of protein. In the most approved product, C2, apart from soybean chenna (43.2gm/100gm), watermelon seeds (34.1gm/100gm), pumpkin seeds (24.3gm/100gm) and dates are added to improve the protein content of the approved product.^[11]Soybean protein contains all amino acids essential to human nutrition, which makes soy products almost equivalent to animal sources in protein quality but with less saturated fat and no cholesterol.^[19] Furthermore, watermelon seed is high in citrulline, and arginine, and pumpkin seeds are a good source of L- tryptophan, which reduces depression and also aids in sleeping by conversion to serotonin, thereby beneficial for geriatrics^[18] In old age, there is a substantial reduction in physiologic proteins such as organ tissue, blood components, and immune bodies, which contributes to impaired wound healing, loss of skin elasticity, and also inability to fight infection. Therefore, improvising the protein content in the product is beneficial for the elderly.

The total carbohydrate content of product standard (S) and the most approved product was 21.5gram and 25 grams, respectively. The carbohydrate content of the most approved product was more as the sugar in the standard product is replaced with dates syrup. Dates are ideal fruits to substitute added sugar in foods as the sugar in dates is easily digested and metabolized to release energy for various cellular activities. Dates are also rich in dietary fiber (8.1-12.7%/100gm), phenolic compounds, minerals, vitamins, and antioxidant compounds.^[2] The presence of insoluble fibers such as cellulose, hemicellulose, pectin, and lignins in dates further reduces the chances of bowel cancer and regulates bowel movement in older people.^[21]

The standard (S) and most approved (C2) have 9.5 grams and 14.6 grams of fat content per 100gms. Fat percentage is an imperative constituent of the sweets as it gives a better texture to the finished product and also improves the flavor and taste. The fat content of the most approved was more when compared to the standard due to the addition of watermelon seed and pumpkin seeds. Soybean has low saturated fat content with a high amount of polyunsaturated fat and is a readily available source of essential fatty acids.^[19] Pumpkin seeds are one of the best sources of plant-based omega-3 (alpha-linolenic acid) fatty acids, which helps to lower total as well as LDL-c and increase HDL-c levels in the blood.^[5] Fat provides energy and assists the absorption of essential nutrients such as vitamins A, D, E, K, and carotenoids. The ingredient added in Sandesh contains monounsaturated and polyunsaturated fats, which reduce the risk of heart diseases owing to the anti-inflammatory property and cholesterol-lowering effect, which is beneficial for the elderly population.

c) Mineral estimation of standard (S) and most approved product (C2)

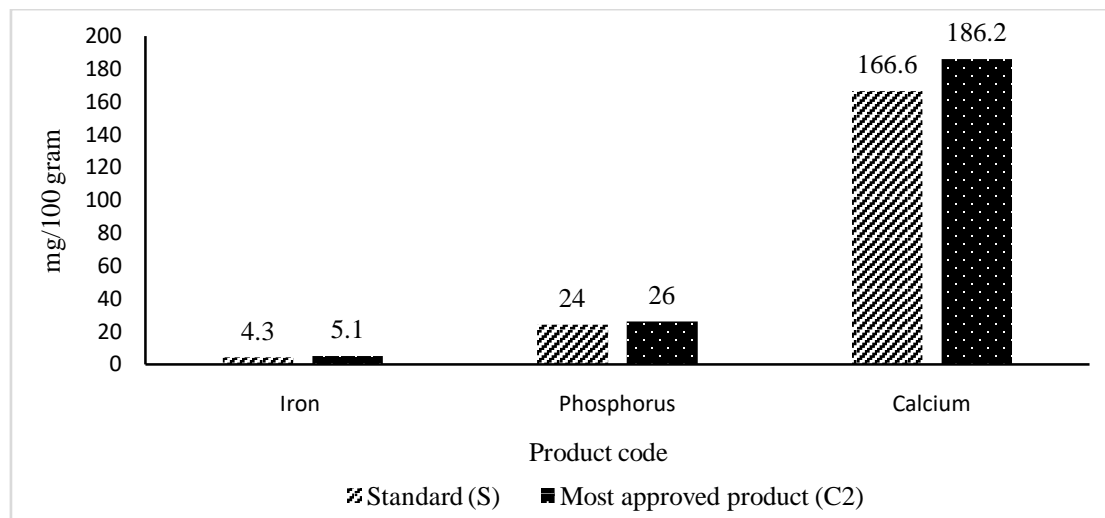


Figure 4: Comparison of iron, phosphorus and calcium content of the standard (S) and most approved product (C2)

Fig 4 denotes that the iron content of standard (S) and most approved (C2) was 4.3 mg and 5.1 mg per 100 grams, respectively. An increase in the iron content can be due to the addition of dates (1mg/100mg), pumpkin seed (5.5mg/100mg), and watermelon seed (7.4mg/100mg). Iron deficiency anemia is prevalent in old age, particularly after the age of 80. [11] There is also a decline in serum ferritin concentrations observed in the elderly. The iron from soybean ferritin helps to prevent the risk of anemia in old age and prevention of undesirable health outcomes, including increased susceptibility to fall and depression. [1] Dates also contain thiamine, riboflavin, niacin, and pantothenic acid, which help the body in haemoglobinsynthesis. [24]

The calcium content of standard (S) and most approved (C2) was 166.6mg and 186.2mg, respectively. The calcium content of the most approved (C2) was more due to the addition of functional ingredients such as dates, pumpkin seeds, and watermelon seed. 100g of dates, pumpkin seed, and watermelon seed contains 22mg, 50mg, and 100mg of calcium, respectively. [11] Calcium helps to ease insomnia and also helps regulate the passage of nutrients through cell walls. Diet deficient in calcium can result in the uptake of calcium from the bones leading to bone resorption. To absorb calcium, nutrients such as magnesium and copper is required, which aids in bone formation. Soymilk contains 12 times the amount of copper and 42 times the amount of manganese as compared to cow milk, which is essential for bone formation. The soy isoflavones, daidzein and genistein, directly hinder bone resorption thereby, reducing the risk of osteoporosis in the elderly population. [20] Furthermore, watermelon seed contains substantial amounts of lysine, which plays a vital role in calcium absorption and the formation of collagen and

connective tissue in the body. Moreover, pumpkin seeds contain a considerable amount of zinc, which acts as a natural protector against osteoporosis since zinc deficiencies can lead to higher rates of osteoporosis development. [7]

The result obtained in the study shows the phosphorus content of the standard (S) and most approved variations (C2) as 24mg and 26mg, respectively. The phosphorus content of the most approved was more due to the addition of pumpkin seed and watermelon seed. 100 g of pumpkin seed and watermelon seed contains 830mg and 937mg of phosphorus. [11] Soybean contains phosphorus, which help to strengthen teeth and prevent nerve disorder. It was reported that soybean consumption on a regular basis delays the aging process. [14]



d) Total antioxidant analysis by DPPH method

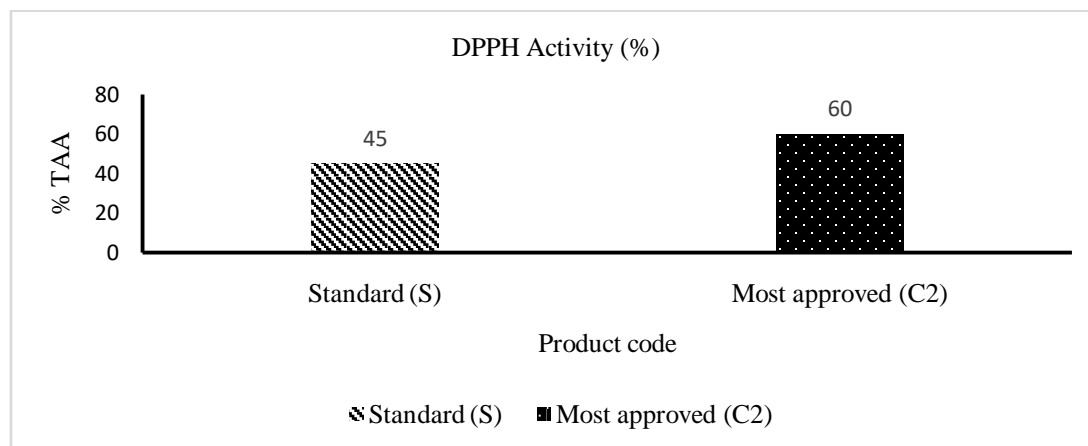


Figure 5: Comparison of total antioxidant activity of standard (S) and most approved (C2)

From figure no 5, it is seen that the total antioxidant activity of the standard and most approved one was 45% and 60%, respectively. In old age, inflammation is predominant, which in turn increases the formation of free radical in the body leading to several chronic and life-threatening diseases and health problems including heart disease, cancer, immune dysfunction, diabetes, and degenerative brain disorders (including dementia and Alzheimer's disease). Antioxidants are known to quench free radicals, thus are essential components of the anti-aging formulation.^[13] Consumption of the pumpkin seed and watermelon seed reduces the risk of getting cardiovascular diseases and cancers due to the substantial amount of total phenols and vitamin E present.^[22] Dates have the highest concentration of polyphenols (3942 mg/100g) among dried fruits.^[25] The antioxidant activity of phenolic compounds is a result of their redox properties, which play an essential role in absorbing and neutralizing free radicals.

IV. CONCLUSION

Sandesh is a very famous dessert in eastern parts of India and forms part and parcel of social life, ceremonies, and festivals and is enjoyed by all. Soybean protein is considered to be a good dietary protein alternative compared to animal protein in terms of quality of amino acid profile and cost effectiveness. Dates are also considered as an ideal food for the elderly because it provides a wide range of essential nutrients with many potential health benefits. Furthermore, pumpkin seeds and watermelon seeds are a powerhouse of a concentrated sources of iron, zinc, magnesium, B-vitamins, and other phytochemicals. Therefore, the substitution of the traditional cow's milk chenna with soy milk chenna and fortification with pumpkin seeds and watermelon seeds can prove beneficial for the overall health of the elderly population

and also reduce the risk of morbidity and improve quality of life.

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