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Impact Evaluation Study of Soya Incorporated Traditional Food Items on Health and Nutritional Status of Institutionalized Elderly of Vadodara

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Abstract

Soybeans are high in fat, protein and low in carbohydrate. Its protein reduces risk of heart disease, osteoporosis and cancer. Soy incorporated food items were formulated and assessed for its interventional effect on health of elderly. Traditional recipes were standardized with 25 g soybean and supplemented in meals of Jalram Vridh Ashram residents. Daily supplements provided 17-23 g of soy protein / day for 3 months. 24 hour diet recall, checklist, enzymatic kits used for data collection on dietary information, profile and parameters like haemoglobin, serum total proteins and lipid profile. Paired 't' test for comparison on baseline and post intervention data was applied. Soy based food items scored above 7 on 9 point hedonic rating scale. One serving fulfilled 21-25% RDA of protein. 3 months supplementation showed significant rise in nutrient intake and anthropometric measurements ($P \leq 0.05$), rise in mean haemoglobin (0.05 mg %), reduction in TC, rise in HDL-C levels (37.83 ± 2.67 to 41.56 ± 2.02 mg /dl), reduction in ratio of TC/HDL and LDL/ HDL, decrease in random blood glucose levels ($P \leq 0.05$). Subjects with minor health complaints decreased in level of depression. Thus beneficial effect of soy based food items was seen on health and nutritional status of institutionalized elderly.

Keywords: Soybean Institutionalized Elderly, Hedonic Scale, Diet, Nutrition, Anthropometric Measurements, and RDA.

Introduction

India is the second largest population of the elderly (60+) in the world (Eleventh Five Year Plan 2007-2012). With the increase in life expectancy, the size of the geriatric population in India has gone from 20 million in 1951–100 million (8.3%) in 2014 and the number will rise to approximately 130 million by 2021 (Central Statistics Office (2011).Nutrition is an important factor contributing to their health and functional ability. We see strong evidence that malnutrition is most common in geriatric populations and also therapeutic procedures are underestimated to overcome them (Kimaya Rand R Sharma, 2013). Protein energy malnutrition is associated with increase predisposition to illness, morbidity and mortality which change the quality of life (Yadav et al, 2012). Considering various health benefits of soybean, intervention with soya feeds was planned for three months. The emerging health benefits of soya consumption range from lowering the risk of heart disease (Yang et al, 2005) and certain type of cancers (Branes, 1997) to alleviate menopausal symptoms and enhancing bone strength (Harrison et al, 1998). Hence it was worthwhile to explore the impact of soy feeds on health and nutritional status of institutionalized elderly. Thus the study was aimed to incorporate soybean in the traditional food items of elderly served in institutes, intervene of soy feeds for three months and assess parameters like diet, nutrition and health profile of the residents and evaluate suitable soy feeds in terms of preferences, tolerance, digestibility and ease of preparation in institutional kitchen.

Objective of the Study

Due to massive numerical increase in the elderly population in recent years, elderly face multidimensional problems in various setups that need special consideration. Those in old age homes or such institutions are

usually undernourished with nutritional deficiencies and are prone to psychological problems. These problems in turn reduce their dietary intake. Thus the objective of the study was to overcome their nutritional inadequacies and improve their nutritional status with incorporation of soybean in the commonly consumed traditional Gujarati recipes. Soya feeds would help in overcoming heart diseases, increase in bone strength, fighting cancer, good haemoglobin levels and reduction in blood glucose of the subjects.

Review of Literature

The team of research workers from Department of Foods and Nutrition, The Maharaja Sayajirao University of Baroda assessed the diet, nutrition and health profile of the free living as well as institutionalized elderly of urban Baroda city and found gross nutritional inadequacies and thus a need to improve their nutritional status by suitable modifications (Mehta, 1999). Older adults are at great risk for nutritional deficiencies than younger adults (Chernoff, 2005). It was observed that major health problems among inmates were Blood pressure 54%; weakness 44% followed by pain/ tingling in lower limbs 38%, disturbed sleep 36%, and breathlessness 32%, back pain and gastric problem, Thyroid, heart attack, arthritis and hysteria problem (Bhatt.BM et al, 2014). Soy lowers cholesterol, have anticarcinogenic effects and protective effects against obesity, diabetes, and irritants of the digestive tract, bone, and kidney diseases (Friedman. M & Brandon. D L, 2001).Thus the study aimed to formulate and evaluate soy incorporated food items and assess its effect on health of elderly after its intervention. The exploratory study on soybean shows favourable effects on cognitive function in elderly with memory complaints. The study suggests that soybean-derived phosphatidylserine (SB-PS) is safe for human consumption and may serve as a safe alternative to phosphatidylserine extracted from bovine cortex. Improvement in cognitive parameters was detected in the scores of focused attention, sustained attention, visuospatial learning, and spatial short-term memory. A significant reduction in systolic and diastolic blood pressure was observed following 12 weeks of SB-PS supplementation (Richter .Y, et al 2013). The most distinctive aspect of the soybean is its high isoflavone content. Isoflavones are proposed as having a number of health benefits although not surprisingly, the degree to which the evidence supports these claims varies. Evidence indicates soyfoods can be safely consumed by all individuals except those who are allergic to soy protein, which is relatively uncommon in comparison to the number of individuals allergic to many other commonly-consumed foods .When adding soy to the diet it is important to consider the overall nutritional quality of a particular soyfood since many westernized soyfoods include a variety of non-soy ingredients. There are no formal recommendations for soy intake beyond the 25 g/day soy protein established by the US FDA as the threshold intake for cholesterol reduction. However, population and clinical studies involving adults suggest benefits are associated with approximately

two to four servings per day. Ideally, soyfoods are incorporated into the diet by displacing less healthy foods and as part of an overall healthy diet designed to lower risk of chronic disease such as the approach represented by the portfolio diet (Messina.M, 2016). This study was conducted to develop of functional beverages on the basis of cultured aqueous extraction of soya grains with added extracts from Schisandra chinensis. Formulas and technology for production of functional beverages on the basis of aqueous soya extract, extract of Schisandra chinensis berries and probiotic starters (Lactobacillus bulgaricus and Streptococcus thermophilus) have been developed. Shelf life of beverages has been determined. Quality and safety of developed products have been studied. Characterizing the chemical composition and nutritional value of combined soy beverage, we can conclude that they differ balanced protein composition, adjusted for fatty acid composition, have a low calorie, which is very important for the elderly and balanced mineral macronutrients. Soy fermented beverages "Taste of Health" has a high number of viable cells, the optimal pH, allowing lactic acid bacteria remain in the active state during storage. All this makes it possible to call the resulting drink probiotic drinks functionality (Palagina Marina V, 2013)

Research Design

All the subjects (20) were selected from Jalaram Vridh Ashram, Warasia Vadodara. Basic information was obtained using an open ended questionnaire. Information on depression was collected using a "clinical interview for depression questionnaire". Nutritional status was assessed in terms of anthropometric measurements and biochemical parameters. Anthropometric measurements such as height, weight, MUAC and BMI were assessed using bathroom scale and fibre glass tape. Haemoglobin and serum total protein values were estimated using cyanmethaemoglobin method and biuret method respectively. The serum lipid parameters such as TG and TC are estimated by GPO/PAP method and CHOD/ PAP method using the enzymatic kit. The VLDL and LDL fractions were precipitated and supernatant was used by HDL-C estimation by enzymatic kit. LDL and VLDL were then estimated by calculation. Soy feed trials were conducted on ten free living elderly for assessing its acceptability. Based on these findings the recipes were administered in old age home to elderly subjects and their acceptability was studied using hedonic scale. Result of acceptability trials revealed that all the recipes were highly acceptable by the elderly subjects without any digestive or allergic problems. Hence any one of the three soya recipes(each containing 25 grams of soybeans)were supplemented daily in breakfast and soy roti was provided in two major meals for six weeks (total protein content of the diet in respect to soya ranged from 17- 23 grams per day). At the end of six months the above mentioned parameters were reassessed.

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Result and Discussion

The result of the baseline data showed that seventy five percent of the institutionalized elderly were between the age group 70-80 years. The population of unmarried or widow/ widower were 85 %. Thirty percent of the subjects were dependent on their savings, 30% on their children and the rest 40% were dependent on others like relatives, well-wishers and society. Past record of ten years and record of present activity pattern results showed that the percentage of subjects doing exercise declined from 50 to 20%. There was a marked reduction in the overall addiction pattern such as smoking, chewing tabocco, eating pan, supari and alcohol. All the subjects consumed tea twice a day. Eighty percent of the subjects were living sedentary life style while 20% were involved in moderate activity. Results of the disease profile revealed that 95% of the total subjects had oral cavity problems, followed by problems of gastro intestinal tract (80%), central nervous system (65%) and cardio vascular system (60%). With regard to external aids 80% subjects were using spectacles followed by use of stick support for walking (20%) while only 5% were using dentures.

The figure 1 of the hedonic score test revealed that the scores for the soya incorporated food items(soy usal, dhokli and roti) were near to seven out of nine showing moderate acceptability whereas other soyfood items (soy sambhar and stuff parantha) were above seven showing high acceptability by the institutionalized elderly. None of the subjects reported any complaints of digestion related to allergic problems. The table 1 reveals that one serving of all the soy based traditional cooked items (analysed values) were fulfilling 21-25 % of RDA of protein, calcium and iron whereas only one serving of soy roti was fulfilling 12% of RDA.

The results of the post intervention data in table 2 and 3, showed a significant rise in the mean nutrient intake of the elderly female and male subjects in terms of energy, protein, fat, fibre, calcium, iron, beta- carotene and vitamin C ($P \le 0.05$). Majority of the subjects (77%) met 100% RDA for beta- carotene and fibre. Calcium intake was found 100% of RDA in all subjects whereas 72% and 16.7% of the elderly met 76-100% of the RDA of iron and vitamin C respectively. Thus improvement in the dietary intake of the institutionalized elderly was clearly observed.

The result of table 4 shows that there was a significant change in the anthropometric measurement, which included weight, BMI and MUAC of the male after a period of three months ($P \le 0.05$). In case of females, rise has been seen but not significant. Haemoglobin values also increased after intervention, which were statistically significant for male ($P \le 0.05$) compared to female.

The results of figure 2 shows that after intervention number of subjects having haemoglobin in the range of 7-9.9 gm % was none against six subjects before intervention, haemoglobin in the range 10-11.9 gm% has increased to 76% against 70% subjects before intervention and subjects with ≥

12gm% haemoglobin before and after intervention shows no significant change respectively.

From table 5 it was found that there was a significant difference in the level of total cholesterol and LDL-C with significant increase in HDL-C ($P<0.05$, initial 37.8 mg % rose to 41.8 mg %) and decrease in TC/HDL were observed. Percentage of subjects with normal lipid profile increased after intervention. Also a significant difference was seen in the mean values of serum total protein of the institutionalized elderly after 6 weeks of soya feed supplementation ($P<0.05$).

The percentage of the subjects reporting minor illnesses such as body ache, constipation, indigestion and pain in joints decreased considerably indicating general well-being of the subjects taking soya feeds. The feeling of sadness, solitude, irritation, sleeplessness, low self-esteem, thoughts of suicide decreased among the elderly after intervention, projecting decrease in level of depression. A very good impact of soy feeds was found on general appetite of the subjects.

The studies conducted on product formulation for elderly showed good results with regard to improvement in health and nutritional status. As per study by Satusap P et al (2014), carbohydrate sources rice flour, brown rice flour, moong bean starch, along with protein and fat sources soybean flour, black sesame seed, and rice bran oil can be effectively incorporated to develop products flake snack, instant beverage, and instant soup .Such products showed balanced energy distribution, good quality protein, and energy from saturated fat<8 kcal/100 kcal and free sugar<10 kcal/100 kcal. Results from sensory evaluation indicated the significant acceptance of the products.
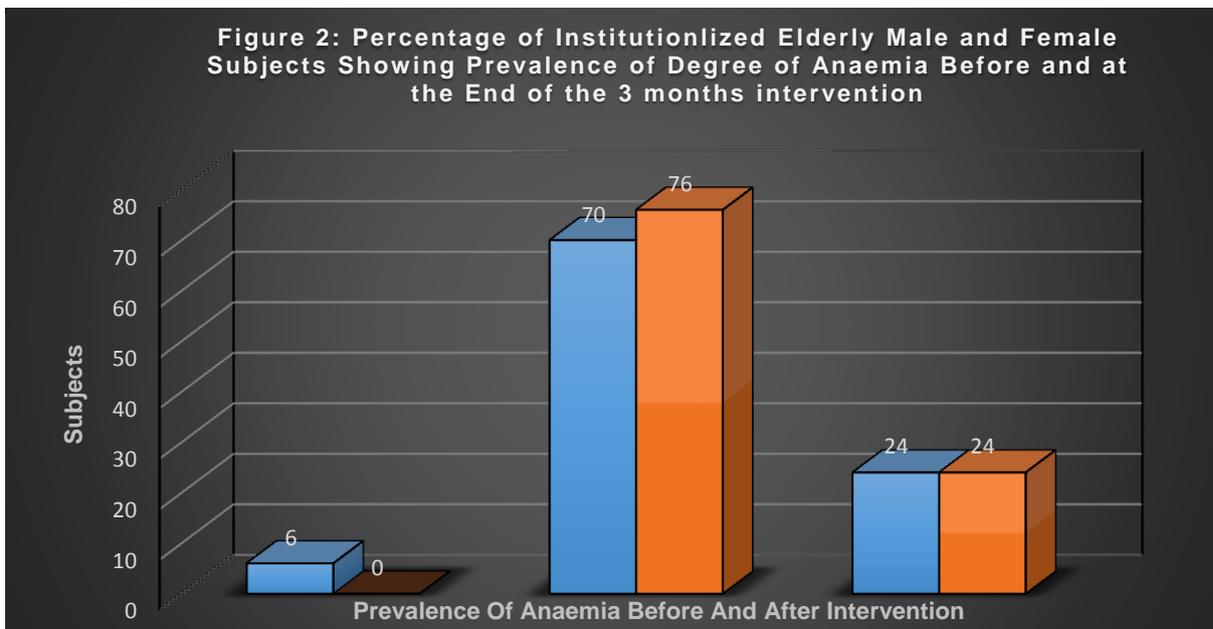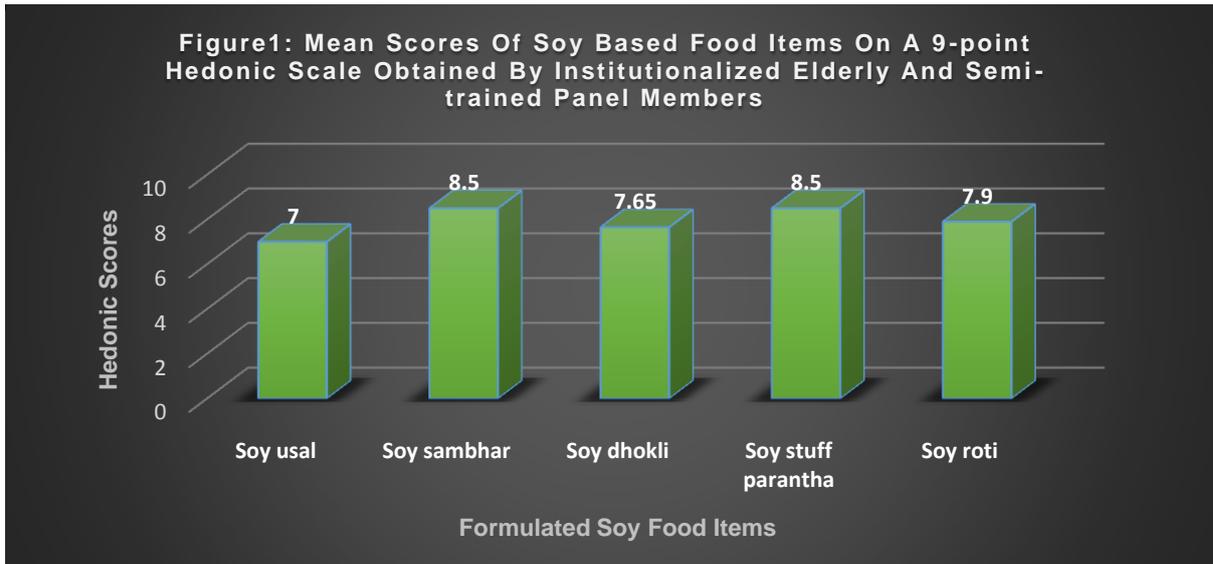
Conclusion

The developed soy incorporated food products in our study on basis of sensory evaluation and nutritive composition showed that soy as sambhar ranked highest followed by stuffed parantha, usal and dhokli. The products supplied 21-25% RDA of protein, calcium and iron. The obtained data predicts that consumption of soybean incorporated items helped in meeting the RDAs for majority of nutrients in both male and female elderly subjects. The subjects showed increased in haemoglobin, normal lipid profile and decrease in level of depression. Thus a positive effect of soy on general health of the elderly has been seen and this further indicates feasibility of including soy in the diets of malnourished elderly.

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Figure1: Mean Scores Of Soy Based Food Items On A 9-point Hedonic Scale Obtained By Institutionalized Elderly And Semi-trained Panel Members

Figure 2: Percentage of Institutionlized Elderly Male and Female Subjects Showing Prevalence of Degree of Anaemia Before and at the End of the 3 months intervention

Table 1: Comparison of the Soya Incorporated Traditional Food Items Based on their Nutrient Composition

Food Items	Protein (g)		Fat (g)		Calcium (mg)		Iron (mg)	
Soy Incorpo-rated	CV *	AV**	CV	AV	CV	AV	CV	AV
Soy Usal	15.17	12.70±0.14	17.02	17.00±0.94	80.69	76.03±3.7	3.78	4.46±0.36
Soy Sambhar	12.57	10.73±0.89	10.50	8.35±0.38	78.60	75.03±7.51	3.64	3.83±0.30
Soy Dhokli	12.72	10.43±0.86	15.15	14.41±3.86	76.00	81.76±1.52	3.50	3.65±0.43
Soy Parantha	14.15	11.78±0.3	10.33	7.08±0.5	74.00	117.2±24.31	3.93	6.73±0.97
Soy Roti	6.08	5.90±0.07	5.45	5.26±0.28	27.40	29.50±0.4	1.77	2.23±0.14

*Calculated Values   ** Analysed Values

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Table 2: Mean Nutrient Intake of Institutionalized Elderly Female Subjects before and after intervention of 3 months

Sr. No	Nutrients	Before Intervention Mean±SD	After 3 Months Intervention Mean±SD	' t ' Value (3 Months)
1.	Energy (Kcal)	1420±302	1854±452	-5.46*
2.	Protein (g)	44.96±11.39	68.00±11.94	-37.82*
3.	Fat (g)	66.93± 20.29	81.33±14.43	-5.78*
4.	Fibre (g)	3.74±0.80	9.19±1.30	-14.08*
5.	Calcium (mg)	383±45	626±186	-3.07*
6.	Iron (mg)	17.54±3.48	24.22±3.11	-22.36*
7.	β-carotene (µg)	618±107	908±183	-6.40*
8.	Vitamin-C (mg)	26.11±12.76	32.47±12.50	-9.88*

∗   **Significant at P ≤ 0.05**

Table 3: Mean Nutrient Intake of Institutionalized Elderly Male Subjects before and after intervention of 3 months

Sr. No	Nutrients	Before Intervention Mean±SD	After 3 Months Intervention Mean±SD	' t ' Value (3 Months)
1.	Energy (Kcal)	1711±515	2047±499	-9.72*
2.	Protein (g)	47.89±11.20	68.64±16.80	-5.76*
3.	Fat (g)	70.86± 21.74	86.34±17.74	-5.18*
4.	Fibre (g)	4.44±2.16	10.40±3.80	-8.46*
5.	Calcium (mg)	472±160	627±131	-3.89*
6.	Iron (mg)	20.63±4.47	28.49±4.56	-8.45*
7.	β-carotene (µg)	581±102	874±155	-7.96*
8.	Vitamin-C (µg)	28.83±18.26	37.19±18.92	-7.35*

∗   **Significant at P ≤ 0.05**

Table 4: Mean anthropometric measurements of Institutionalized Elderly Subjects before and after intervention of 3 months

Sr. No	Indices	Males (N=12) Mean±SD (Initial)	Females (N=6) Mean±SD (Initial)	Males (N=12) Mean±SD (After 3 months)	Females (N=6) Mean±SD (After 3 months)	't' Value (3 months)	
						Male	Female
1.	Height (m)	1.60±0.06	1.46±0.04	1.60±0.06	1.46±0.04	-	-
2.	Weight (kg)	53.08±13.79	44.83±9.26	54.93±14.63	46.98±10.00	-4.01**	-4.86**
3.	MUAC (cm)	25.83±4.78	24.50±3.61	26.66±5.05	24.75±3.63	-2.06**	-0.62**
4.	BMI (Kg/m^2)	20.62±5.60	20.41±3.63	21.35±5.99	21.38±3.86	-4.15**	-5.60**

**Significant at p <0.05 between initial and 3 months

Table 5: Mean Value of the Lipid Profile of Institutionalized Elderly Male and Females Subjects before and after Intervention of three Months (n=18)

Sr. No	Parameters	Initial Mean ± SD	3 Months Intervention Mean ± SD	't' Value (3 months)
1.	TC (mg/dl)	173.05±23.68	170.94±17.32	0.78
2.	TG (mg/dl)	125.88±11.69	127.77±10.27	-1.72
3.	HDL (mg/dl)	37.83±2.79	41.83±2.20	-6.73**
4.	VLDL(mg/dl)	25.11±2.34	24.88±2.47	0.51
5.	LDL (mg/dl)	108.44±24.11	104.66±18.16	1.70**
6.	TC/HDL	4.54±0.62	4.12±0.42	4.41**
7.	LDL/HDL	2.83±0.63	2.52±0.44	3.42*

*Significant at p≤ 0.05