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# Effect of Incorporation of Soy Flour on the Quality of Papad

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**Abstract:**
New advances in Food Technology and packaging increased the interest in healthy eating of more nutritious foods, change in meal pattern and existing food habits have increased the demand for creation of new market for value added processed products. Papad is a popular South Indian traditional snack item/side dish. It has a good market potential. Hence considering its demand and nutritional contribution, study was conducted to develop papad by incorporating different levels of soybean flour, to study the shelf life stability of developed products in different packaging materials for a period of three month at room temperature, to analyze the nutrients and microbial counts of the stored products. Sensory evaluation indicated that the overall acceptability scores of Soy papad at 20% were highest 4.4 for both plastic and steel storage containers. However; it was also found that the acceptability was good for all the levels of Soy products, stored for three months at room temperature. Nutrient composition of stored products in steel containers was comparatively better compared to plastic and polyethylene. Total plate counts (microbes) at the end of the storage period were with in the safe limits prescribed by BIS. The study proved that steel and plastic boxes could be used for long storage of value added dry products at domestic levels.
**Key words:** Value addition, Packaging materials, Storage, Nutrient Analysis, Microbial Analysis.

## 1. Introduction:

Plant foods such as cereals and legumes have consistently been considered as the major potential sources of dietary protein for feeding the growing population (Deshpande, 1992). Legumes have played an important role in the traditional diets of many regions throughout the world. Beans tend to have poor image one that stands in stark contrast to the nutritional value they offer. Beans particularly soybean have been called by several names such as the poor man's meat, nuggets of nutrition, the meat that grows on vines, the protein hope of future, golden bean of globe and wonder bean etc indicating its value and importance in human diets in different parts of the world over several hundred years ( Chhabra 1995 and Ali 2008). Beans tend to play only a minor dietary role despite the fact that, they are low in fat and more excellent source of protein, dietary fiber and a variety of micronutrients and photochemical. Indians use variety of pulses in the form of dhal, grams and oil seeds and they have habituated to these traditionally used pulses, though they have characteristics aroma and flavor. Until recently, traditional soy foods were consumed mostly in the east. However, in the last decade, traditional oriental products have been growing popularity in many parts of the world. A wide variety of Indian snack foods can be prepared by replacing traditional ingredients with soy up to 50% are replaced to be quiet acceptable. Full fat soy flour blended with cereals, millets and legume flours are found to result in satisfactory traditional preparations. In addition, variety of soy ingredients are used in manufacturing of processed food stuffs, snack foods, dietetic foods, baby foods, health foods, pharmaceutical and nutraceutical products (Matlani, 2008). Snack foods have long been a part of diets both in developing and developed countries. Properly designed snack foods can make a significant contribution to nutrition status in societies, where social changes are altering traditional patterns of food preparation. Papad is a popular snack food of India. It is indigenous traditional snack food item with

 

thin wafer like product prepared from variety of ingredients. These are made from blend of pulse flour, cereal flour and edible starches with other ingredients. Apart from value addition by processing to traditional products from these grains, development of newer products offers variety, convenience, quality, cost- efficiency and scope for increasing the nutritional value (Sowbhagya and Ali, 2001). This is consumed as roasted / fried product or as an adjunct with vegetable soups and curries. A variety of papads are available in India, which are produced from a great diversity of ingredients. Usually, they are made either using only cereal flour or combination of pulse flour with salt, spices and additives. Supplementation of legume flours with cereal flours have been reported to improve the nutritional value of mixture and products thereof. Hence considering its demand and nutritional contribution and market potential this study was planned with the following objectives, to develop papad by incorporating different levels of soybean flour, to study the shelf life stability of developed products in different packaging materials such as polyethylene covers, plastic and steel containers for a period of 3 months at room temperature, to analyze the nutrients and microbial counts of the stored products.

## 2.Materials and methods

The present study was carried out in the department of Food Science and Nutrition, University of Agricultural Sciences, Bangalore. The study was aimed to develop traditional products of cereals/pulses incorporated by utilizing soybean full fat flour as an entrepreneurial activity. Black gram, sago, white pepper were obtained from local market were cleaned and made free from husk, stones and other foreign matters. They were ground in a flour mill and sieved through standard sieves. Soy variety JS-335 was collected from Tumkur district (Karnataka State) soybean growing farmers. The grains were cleaned manually before dehusked and splitted in to dhal. Dhal was roasted for seven minutes, then ground in a flour mill and sieved (Fig 1). To prepare papad soybean flour was blended with black gram flour in the ratio of 20:80, 30:70, 40:60, 50:50 and 0:100 (control). Different flours like black gram flour, soy flour, sago flour and rice flours were mixed according to above mentioned ratios. This blended cereal and pulse flours was pored to boiling water then stirred well by adding spices. Later divide the dough in to small balls (12g each). This though was placed in oil smeared polyethylene sheets. By applying pressure on roller thin papad sheets were prepared. Papad sheet was cut in to required size and shape. Place these cut sheets (papads) in hot air oven at 50 C for 5Hr. Packaged materials used were polyethylene covers, plastic boxes and steel boxes to store soy papads (Fig-2). Developed products were subjected for shelf life study. These products were stored in separate packages in triplicate and maintained at ambient temperature for a period of 90 days. Profile of sensory characteristics (Organoleptic evaluation) was performed by a panel of 15 experts at every month for a period of three consecutive months. Papad was subjected to sensory evaluation. Product was assessed for appearance, texture, taste, aroma/flavor, colour and overall acceptability using 5 point hedonic scale (*Amerine et al*., 1965). Scoring pattern followed as 5-Highly acceptable, 4-Moderately acceptable, 3-Slightly acceptable, 2-Fairly acceptable and 1-Poorly acceptable. These products were subjected for chemical and microbial analysis after three months of storage. Microbial contamination was estimated by analyzing microbial load in stored papads by using Nutrient Agar (Na) for bacteria and spore, Martin's Rose Bengal Agar (MRBA) for molds/ Fungi and for yeast Davis yeast salt agar. Following the dilution pour plate method. The three dilutions $10^{-2}$ were used for analyzing bacteria, mould, spores and yeast respectively. Chemical analysis was carried out for, protein, fat, ash and crude fiber by using standard procedure (AOAC, 1975 and 1980). Carbohydrate and energy was computed and protein was estimated according to Raghuramulu *et.al.,* 2003 procedure. Micronutrients of the developed products were computed using NIN food tables (Gopalan *et.al.,* 1999).

 

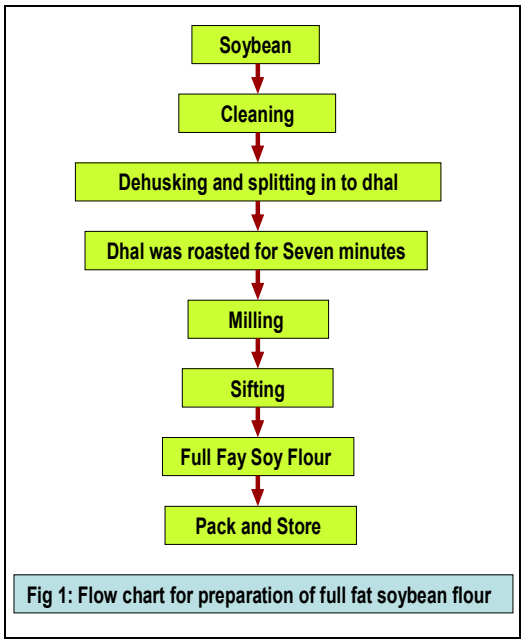


Fig 1: Flow chart for preparation of full fat soybean flour

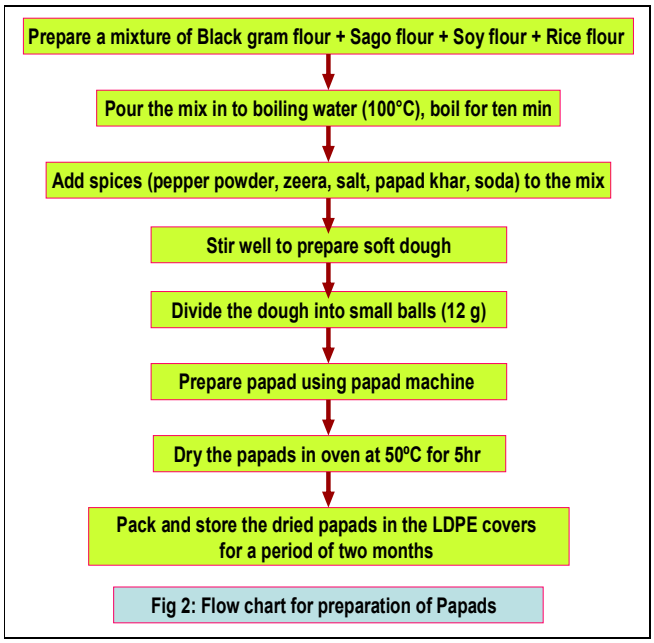


Fig 2: Flow chart for preparation of Papads

**3. Results and Discussion:**

Value addition reduces the perishability of the product, increases its shelf life and makes it available for needy consumption. It also makes it possible to recovery valuable by-products. Thus processing adds value to the commodity. The scores for sensory attributes of papad for different levels of soy incorporation stored in polyethylene covers, plastic and steel boxes was evaluated by the panel of judges during storage study (Table 1). Soy papad of 30% had the highest scores for sensory attributes compared to 40% soy papads during the first month of storage and these scores significantly reduced by second and third month onwards. The interaction effect of packages used to store and duration of storage showed that the papads stored in steel box had slightly higher values of sensory attributes compared to the products in plastic box and polyethylene covers. The papad stored in steel box had slightly higher values of sensory attributes compare to the products in plastic box and polyethylene covers. However the results differed significantly with respect to texture, aroma, taste and colour. Control papads stored in steel box had recorded the highest score for sensory attributes followed by same products in the plastic and polyethylene packages and lowest score was for 40 percent papad in polyethylene covers and plastic box respectively. There was a significant difference at 5 percent level in results of interaction effect of papad of different levels, packages used and storage period with respect to scores of colour.

The papad of different soy levels at different storage periods differed significantly with respect to appearance, aroma, taste and colour. Significant difference in appearance and colour may be due to the golden yellow colour of the seeds/flour. Higher level of incorporations leads to darker coloured products (Deepa *et al.,* 1992). Significant difference of aroma was found due to the presence of beany flavour of soy flour and lowered score for taste may be chalky mouth feel and bitter taste at higher incorporation level compared to control. Papad stored up to 90 days were acceptable due to the presence of spices like salt, pepper, powder, zeera and papad khar which acted as natural preservatives. Storage period was extended up to the three months due to low moisture content of dried papads. Similar study was conducted by Deepa *et.al.,* (1992) by incorporating soy flour to the black gram.

Sensory evaluation results showed acceptability score similar to the control up to 40% of soy flour and decreased with the increase in the level of soy flour in the papad. Deshpande *et.al.,* (2005) indicated that the papads prepared using pulses with 30 percent of soy flour were liked by the panelists. Those products were devoid of off flavor and possess acceptability characteristics. /yellow to dark brown colour of the papad diminished pliability and poor rolling property of papad was observed at higher levels of soy flour. Taste was acceptable with out any acceptable flavor of soy flour (Deepa *et.al.*, 1992). Appearance and colour of the raw papad improved with increased

 

in the level in the level of mung flour. Darkening of papad increased by the addition of sodium carbonate due to caramalization, starch oxidation and millard reaction (Singh *et.al.,* 1996a). Further, papads stored up to three months at room temperatures did not showed significant differences in the quality attributes of papads. Singh *et al.,* (1996a) reported that blends of mung flour with wheat and rice flours at different levels increased the gelatinization temperature but reduced the viscosity and expansion ratio of papad.

Chemical analysis is a method used to measure nutrient density in the products. Chemical analysis of stored products in different packaging materials was done. Nutrient analysis revealed that (Table 2) soy papad stored in polyethylene covers showed higher moisture gain followed by plastic and steel boxes. Moisture content of control papads showed slight decrease in samples stored in all the packaging materials. Storage period was extended due to the low moisture content of the dried papads. Storage period was extended due to the low moisture content of the dried papads. Soy dry papads were found to be rich in protein (31g), low in fat (6.5g), high in minerals, crude fiber (2.2g), calcium (231mg), iron (8mg) and energy (374kcal/100g) lower values is compared to control papads, however carbohydrate content (49g) was less than control papads. A similar type of work was carried out by Pattan *et.al.,* (2001). They had developed ready- to-eat madeli from wheat. Storage stability was observed by storing the product in aluminium box and polyethylene pouch at ambient condition. Further the end product was observed for changes in proximate composition. Slightly higher moisture and protein contents were observed in stored madeli. Madeli in polyethylene pouch had higher moisture content than aluminum box. There was slight decrease in crude fiber and fluctuations in the values of fat and ash contents. Ready-to -eat foods for elderly were developed by Uma (1998).Chemical analysis of the stored products showed variations in nutrients. The increasing moisture levels of all the RTE foods during storage might be attributed to the hygroscopic nature of LDPE bags when stored for longer duration and the prevailing environment condition and high relative humidity. Thus soy papads appear for suitable for all age population including protein-calorie malnourished children, pregnant mothers, lactating mothers and adolescents.

Table 3 shows micro nutrient composition of soy papads. Results revealed that 40% of soy papads had 528mg of phosphorous, 509mg of potassium, 231mg of calcium, 169mg of magnesium, 28mg of sodium and 8mg of iron per 100gm samples. Bacteria, Moulds, yeasts may infect food after harvesting during its handling, processing and storage. Temperature, oxygen, light and duration of storage are the important factors that influence the type of microbial growth and spoilage of food during storage.

Table 4 shows maximum number of bacteria and yeast counts stored in polyethylene covers followed by plastic and steel boxes. This could be because of higher water vapor and gas transmission rate, poor tensile strength and sun light/rays causing spoilage of food products. Incorporation of soy flour not only improves the nutritional quality of the sorghum flour but also improved its keeping quality (Jayalakshmi and Neelakanthan, 1987). The result of the present study is supported by the microbial analysis carried out by Chethana (2008) and Devaraju *et al* (2006).

**Conclusion:**

The study revealed that soy flour can be successfully incorporated in soy papad up to 50% level. The study proved that steel and plastic containers could be used as a better storage material for value added dry products at domestic level. Soy incorporated papad found to be superior than traditionally prepared with respect to nutritional, microbial, storage quality and ultimately the acceptability.

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**Table 1: Effect of storage period on sensory quality of soy papad in different packaging materials**

| | Mean sensory scores | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Appearance** | | | **Texture** | | | **Aroma** | | | **Taste** | | | **Colour** | | | **Over All Acceptability** | | |
| **Storage Months** | | | | | | | | | | | | | | | | | | |
| 1 | 4.60 | | | 3.84 | | | 3.57 | | | 3.57 | | | 3.37 | | | 3.62 | | |
| 2 | 4.13 | | | 3.57 | | | 3.02 | | | 3.55 | | | 3.11 | | | 3.68 | | |
| 3 | 3.62 | | | 3.62 | | | 3.08 | | | 3.13 | | | 2.91 | | | 3.57 | | |
| F-ratio | 25.5553** | | | 2.1864 NS | | | 11.7861** | | | 7.2869** | | | 7.5437** | | | 0.3584 NS | | |
| $SE_M \pm$ | 0.0967 | | | 0.0966 | | | 0.0884 | | | 0.0928 | | | 0.0852 | | | 0.0934 | | |
| CD (5%) | 0.2681 | | | 0.2678 | | | 0.2449 | | | 0.2571 | | | 0.2362 | | | 0.2589 | | |
| **Packages** | | | | | | | | | | | | | | | | | | |
| Polyethylene | 3.97 | | | 3.17 | | | 2.60 | | | 2.97 | | | 2.37 | | | 3.53 | | |
| Plastic | 4.08 | | | 3.93 | | | 3.64 | | | 3.66 | | | 3.64 | | | 3.64 | | |
| Steel | 4.28 | | | 3.93 | | | 3.44 | | | 3.62 | | | 3.37 | | | 3.71 | | |
| F-ratio | 2.6558 NS | | | 20.3829** | | | 39.3644** | | | 17.2705** | | | 61.3689** | | | 0.9245 NS | | |
| $SE_M \pm$ | 0.0967 | | | 0.0966 | | | 0.0884 | | | 0.0928 | | | 0.0852 | | | 0.0934 | | |
| CD (5%) | 0.2681 | | | 0.2678 | | | 0.2449 | | | 0.2571 | | | 0.2362 | | | 0.2589 | | |
| **Month x Package** | | | | | | | | | | | | | | | | | | |
| M1 Poly1 | 4.40 | | | 3.20 | | | 3.13 | | | 3.20 | | | 2.73 | | | 3.53 | | |
| M2 Poly2 | 4.13 | | | 3.20 | | | 2.33 | | | 3.40 | | | 2.20 | | | 3.53 | | |
| M3 Poly3 | 3.40 | | | 3.13 | | | 2.33 | | | 2.33 | | | 2.20 | | | 3.53 | | |
| M1 Pla1 | 4.60 | | | 4.40 | | | 3.80 | | | 3.73 | | | 3.80 | | | 3.73 | | |
| M2 Pla2 | 4.13 | | | 3.60 | | | 3.53 | | | 3.73 | | | 3.80 | | | 3.60 | | |
| M3 Pla3 | 3.53 | | | 3.80 | | | 3.60 | | | 3.53 | | | 3.33 | | | 3.60 | | |
| M1 Stl1 | 4.80 | | | 3.93 | | | 3.80 | | | 3.80 | | | 3.60 | | | 3.60 | | |
| M2 Stl2 | 4.13 | | | 3.93 | | | 3.20 | | | 3.53 | | | 3.33 | | | 3.93 | | |
| M3 Stl3 | 3.93 | | | 3.93 | | | 3.33 | | | 3.53 | | | 3.20 | | | 3.60 | | |
| F-ratio | 0.7562 NS | | | 2.0277 NS | | | 1.1913 NS | | | 3.2992* | | | 1.0194 NS | | | 0.6415 NS | | |
| $SE_M \pm$ | 0.1676 | | | 0.1674 | | | 0.1530 | | | 0.1607 | | | 0.1476 | | | 0.1618 | | |
| CD (5%) | 0.4644 | | | 0.4638 | | | 0.4241 | | | 0.4453 | | | 0.4092 | | | 0.4484 | | |
| | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III |
| Polyethylene control | 4.7 | 4.4 | 4.3 | 4.6 | 4.1 | 4.0 | 4.2 | 4.1 | 4.1 | 4.3 | 4.2 | 3.5 | 4.4 | 4.1 | 4.1 | 4.6 | 4.2 | 3.2 |
| Plastic control | 4.6 | 4.5 | 4.2 | 4.8 | 4.3 | 4.1 | 4.4 | 4.2 | 4.0 | 4.2 | 4.4 | 3.8 | 4.5 | 4.3 | 4.2 | 4.6 | 4.2 | 3.7 |
| Steel control | 4.8 | 4.6 | 4.3 | 4.8 | 4.3 | 4.3 | 4.4 | 4.4 | 4.2 | 4.5 | 4.5 | 4.1 | 4.5 | 4.4 | 4.4 | 4.7 | 4.3 | 4.3 |

 

**Table 2:Effect of storage period (90 days) on nutrients in soy value added papad stored in different packaging materials**

| Type of package | Products | Moisture (g) | Protein (g) | Fat (g) | Ash (g) | Crude Fibre (g) | CHO (g) | Energy (Kcal) |
|---|---|---|---|---|---|---|---|---|
| **Polyethylene covers** | Soy papad | 4.60 | 30.37 | 6.40 | 8.40 | 2.20 | 48.03 | 371.20 |
| | Control | 3.20 | 24.68 | 4.00 | 7.10 | 1.28 | 59.74 | 373.68 |
| **Plastic box** | Soy papad | 3.85 | 31.42 | 6.50 | 8.60 | 1.94 | 47.69 | 374.94 |
| | Control | 2.85 | 24.86 | 4.20 | 7.40 | 1.20 | 59.49 | 375.20 |
| **Steel box** | Soy papad | 3.35 | 30.89 | 4.90 | 9.10 | 2.27 | 49.49 | 365.62 |
| | Control | 2.90 | 25.99 | 4.30 | 7.90 | 1.21 | 57.70 | 373.46 |

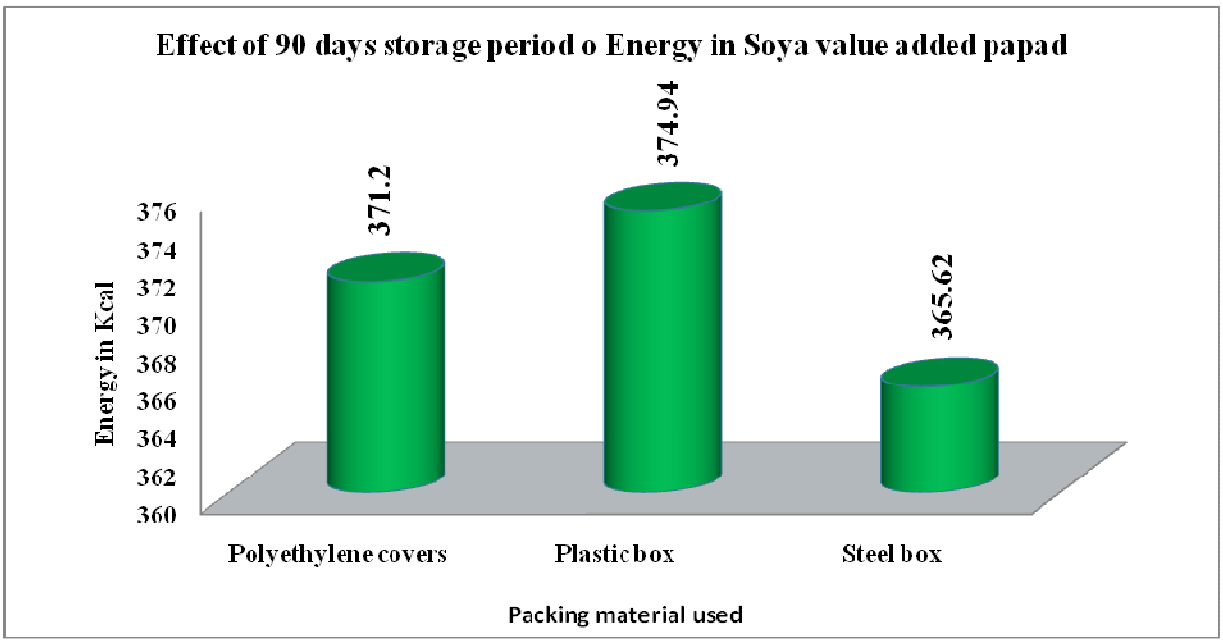

 

**Table 3: Micronutrient composition of soy value added papad**

| Name of the Nutrients (mg/100g) | Soy papad (40%) |
|---|---|
| 1.Calcium | 231 |
| 2. Phosphorous | 528 |
| 3. Iron | 8 |
| 4. Magnesium | 169 |
| 5. Sodium | 28 |
| 6. Potassium | 509 |

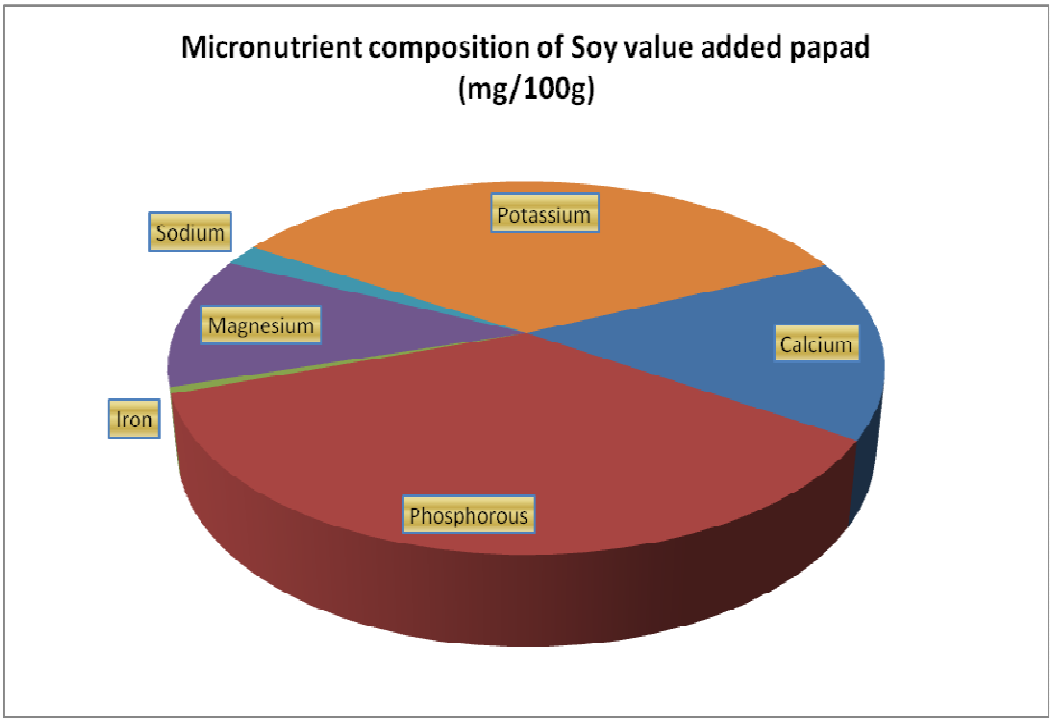

 

**Table 4: Microbial counts ($10^{-2}$cfu/g) of different Soy value added papad stored for a period of 90 days in different packaging materials**

| Soy value added Papad | Polyethylene cover | Plastic box | Steel box |
|---|---|---|---|
| Mould | 0.05 | 0.05 | 0.00 |
| Yeast | 1.15 | 0.35 | 0.25 |
| Bacterial counts | 9.15 | 5.75 | 2.95 |
| Spores | 0.20 | 0.10 | 0.05 |