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RESEARCH PAPER

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# Effect of processing techniques on anti nutritional factors in soybean and soya by products

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## ● ABSTRACT ●

**Soya based products such as soya ladoo,(Bengal dhal flour 50g:soyaflour50g),soyachakali (Bengal gram dhal flour 40g:soyaflour40g: rice flour 10g ) and soyaflakes chiwada (rice flakes 40g:soya flakes40g: groundnuts10g:) were prepared after different processing techniques. The food processing like soaking, germination, degermination, dehullting, drying, roasting, flouring, and flaking were carried out for the preparation of soya products. The soya products were formulated with different combination and standrized with evaluation by organoleptically. All these products were evaluated for anti nutritional factors like phytate phosphorus (PP), trypsin inhibitor activity (TIA), acid detergent fibers, lignin ,cellulose and tannin. These anti nutrients present in the soyabased products a significant decrease was observed after application of different processing techniques. Deep frying in soya oil, flaking, dehulling and roasting reported a significant reduction of anti nutritional factors in soyachakali followed by soyaflakes chiwada and soyaladoo.**

**KEY WORDS :** Soybean, Soyaproducts, Anti nutritional factors

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## ● INTRODUCTION ●

Soyabean (*Glycine max* (L) *Merril*) is leguminous and oil seed cash crop. The high quality content of amino acid profile, excellent source of macro and micro nutrients and other biological properties, soyabean is recommended for supplementary food in different food preparation by many studies (Chandrashaker and Rani, 2004,and Deshpande *et al.,* 2004).

In spite of this soyabean has cultivated at marginal level in agriculture. Moreover, due to its meaty and beany flavour the consumption of soyabased food are not accustomed by Indian population. Soybean also contains anti nutritional factors like trypsin inhibitor, tannin, phytate phosphorus, dietary fiber and haematogglutanin. Without any processing on soyabean its consumption along with these antinutritional factor can be highly risky for human health.

However, most of the studies revealed that the processing techniques such as soaking, roasting, boiling and flaking (Despande, 1990; Sahay and Kacharu,1988) reduces the anti nutritional factors present in soyabean.

Use of proper processing technique and perfect combination of soyabean in the supplementary food can be the better option in the treatment of protein energy mal nutrition. By keeping this view, the present research study bas been designed to evaluate the effect of processing techniques on anti nutritional factors in soyabased food products.

## ● MATERIALS AND METHODS ●

### Preparation of sample:

Local variety of soyabean (MH-CH-58), Bengal gram dhal (Phulepragati), rice (Ratnagiri), and rice flakes were procured in a single lot from local market of Kolhapur city in Maharashtra. The samples were cleaned to remove dust and other foreign materials. These samples were kept in clean airtight glass containers at room temperature with labels.

### Processing of sample:

The processing techniques like soaking, germination, degermination, dehulling, drying, roasting, flouring, frying, and flaking were used. Soyabean was cleaned, washed in plenty of portable water and kept soaking for 8 to 16 hours

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in glass distilled water. Water was drained and soyabean was kept for germination to over night for 8 hours with controlled temperature. Next day germinated soyabean was degerminated by manually and also dehulling process was applied with application of light pressure of rubbing. The degerminated and dehulled soyabean was made into two portion one portion was kept for drying in a shade for a day. Dried soyabean was roasted lightly in oven with controlled temperature till the standard moisture maintained. Dried soyabean was transferred to flouring machine. A fine flouring powder was obtained. This powder was kept in an airtight container. Another half portion of soybean was used for the preparation of soyaflakes. Dehulled soyabean was put under pressure cooker till it done. It was put in pressing machine with controlled pressure. This pressed soyabean was transferred to automatic flaking machine. Soyabean was pressed in roller with controlled temperature. Thin soyaflakes automatically dried. These dried thin soyaflakes were collected in a tray, filled in a polythene bags and sealed airtight.

Bengal gram dhal, rice and rice flakes were sun dried for 6 to 8 hours in a tray separately at clean and non dust place. Bengal gram dhal and rice were grind separately into flour in the laboratory by using labtronic flouring machine. The samples were kept separately in air tight containers with labels.

**Preparation of soya by products:**

Soya by products such as soyaladoo, soyachakali and soyaflakes chiwada was formulated by different combinations. Soyaladoo and soyachakali were prepared by using different soya combination of flours with bengal gram dhal flour and rice flour. Soyflakes chiwada was formulated with different combination of soyflakes and riceflakes. These products were prepared by using standard procedure. The soya by products were judged by panel organoleptically (Amerine *et al.,* 1965). High scored soya by products with its perfect compositions (Tables 1) *i.e.* soyaladoo (50g soyaflour + 50g Bengal gramdhal flour), soyachakali (50g soyaflour + 40 g Bengal gramdhal flour + 10g rice flour) and soyaflakes chiwada (40 g soyaflakes + 40g rice flakes +10 g ground nuts) were taken into consideration for further study.

**Estimation of antinutritional factors:**

Antinutritional factors in soyabean and soyaproducts were estimated by using standards methods as phytate phosphorus by Hauq and Lantzsch (1983), tryspin inhibitor activity by Kakade *et al.*(1974), tannin by AOAC(1975) and acid detergent fiber by Vansoet (1970). The cellulose content of the samples was calculated from the determined values of acid detergent fiber and lignin.

**Table 1 : Major composition of soya by products**

| Sr. No. | Major composition | Soya by products | | |
|---|---|---|---|---|
| | | Soyaladoo | Soyachakali | Soyaflakes chiwada |
| 1. | Bengalgramdhal flour(g) | 50.0 | 40.0 | ------ |
| 2. | Ground nut(g) | --- | ----- | 10.0 |
| 3. | Oil/Ghee (g) | 50.0 | 30.0 | 30.0 |
| 4. | Rice flakes (g) | ----- | ------ | 40.0 |
| 5. | Rice flour (g) | ------- | 10.0 | ----- |
| 6. | Soyaflakes (g) | ------ | ------- | 40.0 |
| 7. | Soyaflour (g) | 50.0 | 40.0 | ----- |
| 8. | Sugar (g) | 50.0 | ----- | ----- |

**Statistical analysis:**

A relevant statistical applications such as 't' test and 'z' test were used to observe the significance difference between different processing techniques on antinutritional factors in soyabean and the soya by-products, respectively (Gomez and Gonez, 1984).

## ● RESULTS AND DISCUSSION ●

Anti nutritional factors like phytate phosphorus, tryspin inhibitor activity, tannin, acid detergent fibers, lignin and cellulose in soyabean with different processing techniques like germination, degermination, dehulling, roasting, flouring, paraboiling, flaking, soaking, roasting in ghee/ oil were determined. The different preparaed soyaproducts like soyaladoo, soyachakali and soyaflkaes chiwada were also analyzed for the content of antinutritional factors. The relevant data are presented in Table 2, 3 and 4.

Table 2 revealed the antinutritional factors present in soyabean after the application of different processing techniques. It clearly shows that phytate phosphorus was reduced from 460 to 195 mg/100g in flaking processing. Tryspin inhibitory activity was noticed drastically reduce after processing technique in soyabean. Similar effects were noticed on trypsin inhibitor activity after heat treatments in soybean stated by Monodrama and Sarojini (1982). More significant reductions were noted in TIA per ml due to dehulling (46.6), roasting (28.7), flouring (28.2), paraboiling (24.9) and flaking (17.3). Tannin content in soyabean was also minimized from 0.64 to 0.15 mg/100g after different processing techniques. Reduction in tannin was observed higher in descending order 23.4 as per cent due to flaking, 29.7 per cent in flouring,32.8 per

**Table 2 : Effect of different processing techniques on antinutritional factors in soybean**

| Sr. No. | Processing techniques | Antinutritional factors | | | | | |
|---|---|---|---|---|---|---|---|
| | | Phytate phosphorus (mg) | Tryspin inhibitor activity (ml) | Tannin (mg) | Acid detergent fiber (g) | Lignin (g) | Cellulose (g) |
| 1. | Baseline | 460(100.0) | 36.9(100.0) | 0.64(100.0) | 2.95(100.0) | 1.10(100.0) | 1.85(100.0) |
| 2. | Soaking | 390(84.8) | 30.1(85.9) | 0.55(85.9) | 2.91(98.6) | 1.08(98.2) | 1.83(98.9) |
| 3. | Germination | 305(66.3) | 26.5(71.8) | 0.49(76.6) | 2.88(97.6) | 1.06(96.4) | 1.82(98.4) |
| 4. | Degermination | 299(65.0) | 19.8(53.7) | 0.38(59.3) | 2.76(93.6) | 0.96(87.3) | 1.80(97.3) |
| 5. | Dehulling | 287(62.4) | 17.2(46.6) | 0.31(48.4) | 2.58(87.4) | 0.81(73.6) | 1.77(95.7) |
| 6. | Roasting | 281(61.1) | 10.6(28.7) | 0.28(43.8) | 2.51(85.0) | 0.79(71.8) | 1.72(93.0) |
| 7. | Paraboiling | 274(59.6) | 9.2(24.9) | 0.21(32.8) | 2.48(84.1) | 0.76(69.1) | 1.69(91.3) |
| 8. | Flaking | 195(42.4) | 6.4(17.3) | 0.15(23.4) | 1.57(53.2) | 0.38(34.5) | 1.19(64.3) |
| 9. | Flouring | 279(60.7) | 10.4(28.2) | 0.19(29.7) | 2.37(80.3) | 0.71(64.5) | 1.66(93.0) |
| 't' Value | | | | | | | |
| a vs h | | (6.88)** | (9.24)** | (8.05)** | (4.92)** | (5.33)** | (3.69)** |
| a vs i | | (2.81)* | (6.71)** | (6.30)** | (2.15)* | (2.61)* | (1.99)* |

* and ** indicate significance of values at P=0.05 and 0.01, respectively

cent paraboiling, 43.8 per cent in roasting and 48.4per cent in dehulling. The content of acid detergent fiber in soyabean was shown drastically decreased in flaking process. 2.95 g of acid detergent fiber in soybean reduced to 1.57 g in soyaflakes. The processing techniques like soaking, germination, degermination, dehulling, and roasting were not found effective in the reduction of acid detergent fiber in soyabean. The per cent of reduction in lignin content of soyabean was shown maximum due to flaking (34.5), where as 64.3 per cent reduction was recorded in cellulose content in soyabean after flaking.

Table 3 highlights the antinutritional factors present in the other ingredients *i.e.* rice flour, rice flakes and bengal gram dhal flour used in the preparation of soya byproducts. It indicated that, phytate phosphorus (mg/100g) was higher in Bengal gram dhal flour *i.e.* 121.2 than that of rice flour (63.0) and rice flakes (48.3). Trypsin inhibitory activity (ml) was found lower in rice flakes *i.e.*1.08 than rice flour 2.6 and Bengal gram dhal flour (8.4). Rice flakes was shown lowest content of acid detergent fiber (0.86g), lignin (0.22g) and cellulose(0.64g). Where as highest score of acid detergent fiber and cellulose was observed in Bengal

**Table 3 : Antinutritional factors in other ingredients used for preparation of soya-by-products**

| Other ingredients | Antinutritional factors | | | | | |
|---|---|---|---|---|---|---|
| | Phytate phosphorus (mg) | Tryspin inhibitor activity (ml) | Tannin (mg) | Acid detergent fiber(g) | Lignin (g) | Cellulose (g) |
| 1. Bengalgram dhal flour | 121.2 | 8.4 | 0.14 | 1.40 | 0.35 | 1.05 |
| 2. Rice flakes | 48.3 | 1.08 | 0.09 | 0.86 | 0.22 | 0.64 |
| 3. Rice flours | 63.0 | 2.6 | 0.17 | 1.28 | 0.41 | 0.87 |

**Table 4 : Antinutritional factors in soya-by-products**

| Sr. No. | Antinutritional factors | Soya by products | | | | | |
|---|---|---|---|---|---|---|---|
| | | (A) Soyaladoo | (B) Soyachakali | (C) Soya flakes chiwada | 'Z' values | | |
| | | | | | A vs B | B vs C | A vs C |
| 1. | Phytate phosphorus (mg) | 183.2 | 151.8 | 168.4 | (3.48)** | (2.97)* | (2.11)* |
| 2. | Tryspinin in hibitor activity(ml) | 8.3 | 5.5 | 7.1 | (2.05)* | (2.08)* | (0.87)Ns |
| 3. | Tannin(mg) | 0.15 | 0.07 | 0.13 | (2.35)* | (2.00)* | (0.09)Ns |
| 4. | Acid detergent fiber(g) | 1.31 | 1.08 | 1.22 | (2.19)* | (2.02)* | (0.81)Ns |
| 5. | Lignin(g) | 0.31 | 0.29 | 0.38 | (0.05)Ns | (0.08)Ns | (0.10) Ns |
| 6. | Cellulose(g) | 1.00 | 0.79 | 0.84 | (1.98)* | (0.06)Ns | (0.43)Ns |

* and ** indicate significance of values at P=0.05 and 0.01, respectively
NS = Non-significant

gram dhal flour *i.e.* 1.40g and 1.05g, respectively.

A data regading antinutritional factor present in soyabyproduct are presented in Table 4. It reveals that, more antinutritional factors such as phytate phosphorus (183.2 mg), TIA (8.3 ml), tannin (0.15 mg), ADF (1.31g), lignin. (0.31 g) and cellulose (1.0 g) were found in soyaladoo. Where as in soyachiwada 168.4 mg, 7.1 ml, 0.13 mg, 1.22 g, 0.38 g and 0.84 were found as of phytate phosphorus, TIA, Tannin, ADF, lignin and cellulose, respectively. Among these soyabyproducts soyachakali, scored minimum antinutritional factors. A significant reduction of phytate phosphorus (151.8 mg) was noticed in soyachakali.Decrease of Tannin (0.07 mg), TIA (5.5ml), ADF (1.08 g) and cellulose (0.79 g) content were found significantly in soyachakali. Processing techniques reduced TIA in soyabean. However, the antinutritional factors between soyaladoo and soyaflakes chiwada were not observed significantly reduced after processing technigues.

**Conclusion:**

In a nut shell it can be concluded that processing techniques has positive effect in the reduction of antinutritional factors in soyabean and its by products. Flouring and flaking has been shown a significant impact for the decreasing level of antinutritional factors. Whereas frying *i.e.* soyachakali found minimum antinutritional factors as compared with shallow fried soyaflakes chiwada and soyaladoo prepared by roasting method of cooking. Hence, soyachakali may be suggested for the further research intervention in relation with dietary supplementation to combat the malnutrition among vulnerable segments of population.

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