



## NUTRITIONAL AND PROXIMATE COMPOSITION OF RICE BASED TOMATO POWDER INCORPORATED EXTRUDATES

R. Srivalli, B. Anila Kumari<sup>1</sup>, K. Uma Maheswari<sup>1</sup>, B. Neeraja Prabhakar<sup>2</sup> & Jessie Suneetha, W.<sup>1</sup>

<sup>1</sup>Post Graduate Research Centre, Department of Foods & Nutrition, Professor Jayashankar Telangana State Agricultural University Rajendranagar- Hyderabad, 500030.

<sup>2</sup>Department of Horticulture, College of Agriculture, PJTS Agricultural University, Rajendranagar, Hyderabad – 500 030

### ABSTRACT

Extrudates are highly acceptable snack worldwide. Therefore, the present study developed a cold extruded product with rice and refined wheat flour incorporating tomato powder into it. The pasta Cavatelli control extrudate with rice flour to refined wheat flour in the ratio of 40:60 was selected to which tomato powder at 10% were found to be most accepted. The developed extrudates were undergone nutritional and proximate analysis. The results of study showed significant percentage increase in ash (2.9), protein (1.2), crude fiber (31.11) and dietary fiber (48.27) content. In TP extrudate the potassium content was 25 times greater than sodium. Significant increase in iron content (51.3%) zinc content (50.7%) in TP extrudate compared to control was seen.

**KEYWORDS:** tomato powder, cold extruded, potassium, sodium.

### INTRODUCTION

Tomato being a popular fruit, find numerous uses, both in fresh and processed forms. Processed products include ketchup, sauces, pastes and juice. Tomato ranks 13<sup>th</sup> in vitamin C, with significant amount of lycopene, beta-carotene, magnesium, niacin, iron, phosphorus, potassium, riboflavin, sodium and thiamine. Many studies confirm that people who eat large amounts of tomatoes experience a reduced risk of cancer. (Famurewa and Raji, 2011). The proximate composition showed that the raw tomato contained fat 1.75%, ash 27.97%, crude fiber 0.18%, protein 28.95% and carbohydrate 41.15% while the sun dried sample contained fat 1.25%, Ash 42.71%, Crude fiber 0.19%, protein 15.74% and carbohydrate 40.11% (Famurewa and Raji, 2011). Rice contains approximately 7.3% protein, 2.2% fat, 64.3% available carbohydrate, 0.8% fiber and 1.4% ash content (Zhou *et al.*, 2002). Due to its hypoallergenic properties and absence of gliadin, rice is considered as good source for making gluten free food products. Rice flour has become an attractive ingredient in the extrusion industry due to its bland taste, attractive white colour, hypoallergenicity and ease of digestion (Kadan *et al.*, 2003). Rice requires the highest temperature during extrusion to cook a snack. Selection of the rice starch in the snack foods formulation will depend upon the amylose content of the common rice varieties. The difference in amylose to amylopectin ratio greatly affects the gelatinization temperature of rice flour and texture of multigrain snack foods (Riaz, 2006).

### MATERIAL & METHODS

#### Selection of tomato cultivars

Tomato (*Solanum lycopersicum*) fruits from three commercial tomato cultivars namely *viz.* Pusa Ruby, Lakshmi and US440, were grown in Dept of Horticulture

farm, college of Agriculture PJTSAU, Rajendranagar, Hyderabad.

#### Preparation of rice flour

The polished MTU 1001 rice was soaked in water for 4 hrs and drained, sun dried for 1.0 hr, milled to fine powder, sieved to particular size of 2 mm then packed in polythene bag.

#### Preparation of tomato powder (TP)

Three selected cultivars of tomatoes were screened for lycopene content (Ranganna, 2003) and the cultivar Pusa ruby which is having highest lycopene content among the three was selected and processed for further making of tomato powder (Nagamani, 2014).

#### Addition of TP to rice extrudates

Two different types of pasta control extrudates Tagliatelle and Cavatelli were prepared in three different compositions 40:60, 50:50 and 60:40 of rice flour to refined wheat flour. Among the variations, the variation pasta Cavatelli control extrudate 40:60 rice flour and refined wheat flour got the highest sensory scores are best accepted by the panel members. Thus it was taken for further study by incorporated with tomato powder (TP) at 4 different levels *i.e.* 5, 10, 15 and 20% levels by the process of folding and passing through rollers of pasta presto making machine several times. Sheeted dough was extruded through a suitable die (width, 2.0 mm), cut to have desired size of extrudates and shade dried for 16 hrs. Now these standardized cold extrudates were steamed for 20 min at 102 – 105°C, spread over tray drier and dried for 1 hr at 60 °C. The dried products were boiled for 6 min and the sensory evaluation was conducted using 9 point hedonic scale by 15 semi trained panelists.

#### Selection of best extrudates

The pasta Cavatelli control extrudate with rice flour to refined wheat flour in the ratio of 40:60 was selected to which tomato powder at 10% were found to be most

accepted. Proximate analysis was carried to these extrudates as per the procedures followed by standard AOAC methods. Moisture, ash and protein (AOAC, 2005), fat (AOAC, 1997), carbohydrate and energy (AOAC, 1980), crude fiber (AOAC, 1990) and total dietary fiber (AOAC 2000) were used. Minerals like sodium and potassium in flame photometer (AOAC, 1990) along with zinc and iron in AAS (AOAC, 1990) were estimated for the extrudates.

**RESULT & DISCUSSION**

**Proximate composition of extrudates**

Proximate composition was done for the accepted TP extrudates and the results are reported in the Table 1

**Moisture**

The results indicated that the moisture content was high in control sample than the TP extrudate. The moisture content varied from 7.18 to 7.22% (Table 1). Low moisture content in TP extrudates may be due to addition of tomato powder. The loss of water occurred in the extrudate made with tomato powder which may have been associated with the faster hydration dynamics and weaker water holding capacity of insoluble fibre present in the tomato skin, compared to starch in control extrudates. These findings were conformity with the results (5.63% to 12.33%) reported by Dehghan-Shoar *et al.* (2010) in tomato pomace incorporated extrudates.

**TABLE 1.** Proximate composition of standardized extrudates

Extrudates	Moisture (g/100g)	Ash (g/100g)	Fat (g/100g)	Protein (g/100g)	Carbohydrate (g/100g)	Energy (kcal)
Control	7.22 ±0.01	2.34 <sup>a</sup> ±0.07	1.00 <sup>a</sup> ±0.08	22.99 <sup>a</sup> ±0.31	66.13 ±0.37	365.50 <sup>a</sup> ±0.64
TP	7.18 ±0.01	2.41 <sup>a</sup> ±0.02	0.92 <sup>b</sup> ±0.07	23.27 <sup>a</sup> ±0.10	65.78 ±0.08	364.46 <sup>b</sup> ±0.48
Mean	7.2	2.377	0.967	23.130	65.92	364.98
CD value	0.0525	0.114	0.062	0.954	1.049	0.852
SE	0.0122	0.0267	0.0145	0.2218	0.2437	0.1979
CV	0.207	1.374	1.850	1.175	0.453	0.066

**Note:** Values are expressed as mean ± standard deviation of three determinations. Means within the same column followed by a common letter do not differ significantly at p≤ 0.05  
 Control: Rice flour + refined wheat flour  
 TP - Tomato powder incorporated extrudate

**Ash:** The ash content of extrudates varied from 2.34 to 2.41 g/100 g (Table 1). However, statistically significant difference was observed between the control extrudate and TP extrudate. The percent increase in ash content was 2.9% when compared with control (Figure 1).

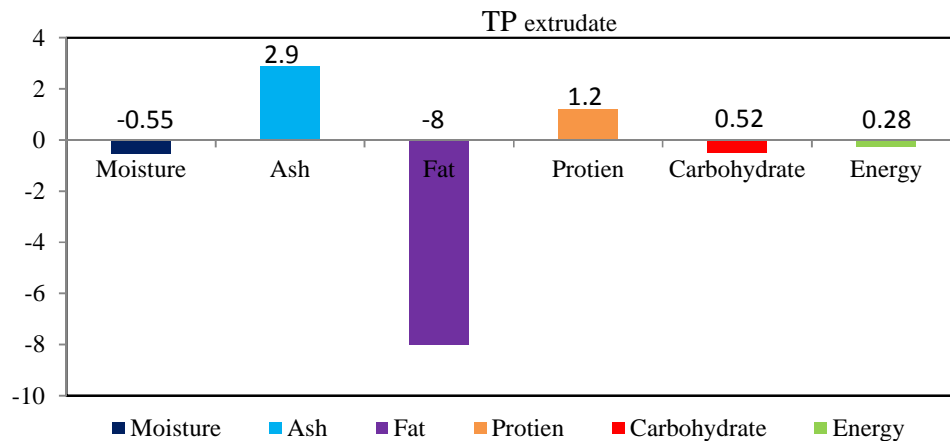
**Fat:** The fat content in control was 1.00 g/100 g (Table 1) where as 8% decrease in fat was observed in TP extrudates (Figure 1). However, statistically significant difference (p<0.05) was observed between the control extrudate sample and TP extrudate. Similar results were reported by Hazarika *et al.*, (2013) in ready to eat extruded products prepared with rice flour, sweet potato flour, tomato powder and chilli powder combination.

**Protein:** Statistically no significant difference was observed in the protein content of control and TP

extrudate. But there was 1.2 % increase in protein content of TP extrudate compared with control.

**Carbohydrate:** The carbohydrate content varied from 65.78 g/100 g to 66.13 g/100g in the extrudates. TP extrudate showed a decrease of 0.52% (Figure 1) in the carbohydrate content. The purpose of adding tomato powder and rice flour was to improve the total dietary fiber content in the extrudates by replacing refined wheat flour which has high amounts of gluten.

**Energy:** The energy values ranged from 364 to 366 k/cal in extrudate. Control extrudate had high energy value due to high amount of carbohydrate than the TP extrudates (Table 1).



Nutritional quality characteristics of extrudates

**Crude fiber and total dietary fiber (TDF) in extrudates**

Crude fiber is the residual part remaining after treatment with acid, alkali and alcohol. Dietary fiber is the portion that is resistant to digestion to enzymes secreted by human body consisting of hemi cellulose, cellulose, lignins, oligosaccharides, pectin, gums and waxes. Crude fiber is a part of dietary fiber. The consumption of diets with high dietary fiber lower the risk of cardiovascular diseases by reducing the plasma and LDL cholesterol levels but do not

alter the concentration of HDL cholesterol or triglycerides (Schneeman, 1999). The dietary fiber and crude fiber content was analysed in standardized extrudates and the results are presented in Table 2. The results showed that the dietary fiber in TP extrudate increased by 48.27% in comparison with control extrudate. Significant increase of dietary fiber was observed ( $p < 0.05$ ) in the extrudates after incorporation of tomato powder (Figure 2).

**TABLE 2.** Fiber content of extrudates

S. No	Extrudates	Crude fiber (mg/100 g)	Dietary fiber (mg/100 g)
1.	Control	0.310 <sup>a</sup> ±0.03	2.183 <sup>b</sup> ±0.09
2.	TP	0.450 <sup>a</sup> ±0.04	4.22 <sup>a</sup> ±0.12
3.	Mean	0.38	3.19
4.	CD value	0.162	0.143
5.	S.E	0.0378	0.0339
6.	CV (%)	1.27	12.20

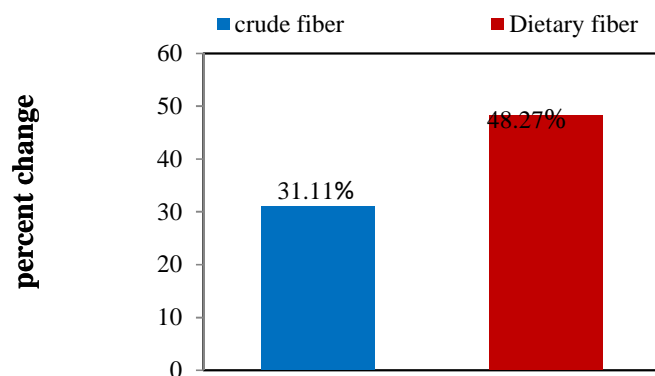
**Note:** Values are expressed as mean ± standard deviation of three determinations. Means within the same column followed by a common letter do not differ significantly at  $p \leq 0.05$

Control: Rice flour + refined wheat flour

TP - Tomato powder incorporated extrudates

The crude fiber content ranged from 0.31 mg/100 g to 0.45 mg/100 g (Table 2). The crude fiber content increased to 31.11% in TP extrudates (Figure 2) due to tomato powder incorporation when compared with control. Hazarika *et al.*

(2013) reported higher crude fiber content (1.35%) in ready to eat extruded products prepared with rice flour, sweet potato flour, tomato powder and chilli powder combination.



**FIGURE 2:** Percentage change in Fiber content in TP extrudates

### Mineral content in extrudates

Mineral content in extrudates were analysed and reported in Table 3. Significant increase in all the minerals except zinc was observed after incorporation of tomato powder in extrudates (Figure 3). The potassium content was 35 times greater than sodium in control extrudate and in TP extrudate the potassium content was 25 times greater than

sodium. Tomatoes and tomato products are important sources of potassium and they also contribute substantially to the magnesium and iron intake. The TP extrudates could be considered as good food supplement because of their high content of potassium and low content of sodium. Due to its low Na/K ratio, it could be used as protective agent of cardiovascular disease.

**TABLE 3:** Mineral content in standardized extrudates

S. No	Extrudates	Sodium (mg/100g)	Potassium (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)
1.	Control	1.08 <sup>b</sup> ±0.04	37.66 <sup>b</sup> ±0.3	0.93 <sup>b</sup> ±0.05	0.67 <sup>a</sup> ±0.02
2.	TP	2.23 <sup>a</sup> ±0.04	56.53 <sup>a</sup> ±0.3	1.91 <sup>a</sup> ±0.01	1.36 <sup>a</sup> ±0.03
3.	Mean	1.65	47.10	1.42	1.01
4.	CD value	0.0895	1.0039	0.0887	0.1148
5.	S.E	0.0208	0.2333	0.0206	0.026
6.	CV (%)	1.540	0.607	1.78	3.22

**Note:** Values are expressed as mean ± standard deviation of three determinations. Means within the same column followed by a common letter do not differ significantly at  $p \leq 0.05$ .

Control: Rice flour + wheat flour

TP - Tomato powder incorporated extrudate

It is worth mentioning that the relatively high ascorbic acid level in tomatoes maintained iron in its reduced form, increasing its potential for being taken up by the body. The

percent increase in iron content in TP extrudate was 51.3% (Figure 3). Increase in zinc content in TP extrudate was 50.7% when compared to the control.

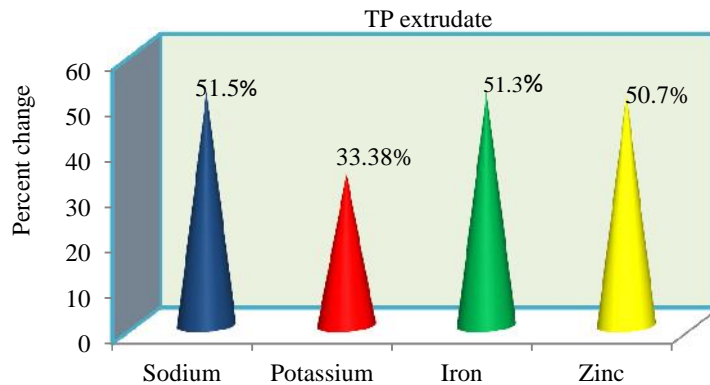


FIGURE 3: Percentage change in mineral content in extrudates

### CONCLUSION

The results of proximate analysis concluded that TP extrudates showed that the moisture content was high in control sample than the TP extrudate. The percent increase in ash content was 2.9%. The fat content in control was 1.00 g/100 g where as 8% decrease in fat was observed in TP extrudates. In protein statistically no significant difference was observed. Control extrudate had high energy value due to high amount of carbohydrate than the TP extrudates. The dietary fiber in TP extrudate increased by 48.27% in comparison with control extrudate. Significant increase in dietary fiber and crude fiber was observed ( $p < 0.05$ ) in the TP extrudate. The TP extrudates could be considered as good food supplement because of their high content of potassium and low content of sodium. Due to its low Na/K ratio, it could be used as protective food for cardiovascular disease. Significant increase in all the minerals except zinc was observed after incorporation of tomato powder in extrudates.

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