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Effect of Time and Temperature on Infusion of Tannins from Commercial Brands of Tea

SALIM-UR-REHMAN, KAUSAR ALMAS†, NAUREEN SHAHZADI, NIGHAT BHATTI† AND ASIMA SALEEM
Departments of Food Technology and †Home Economics, University of Agriculture, Faisalabad–38040, Pakistan

ABSTRACT

Effect of various times (2, 4, 6, 8, 10 min), temperatures (90, 95, 100°C) on tannin extraction from commercial brands of tea i.e. Lipton Danedar, Lipton Taza and Lipton Yellow Label and its effect on egg protein solubility was investigated. A significant increase in tannin contents and significant decrease in KoH solubility of protein with increase in time and temperature were recorded. Moisture, ash and water soluble ash contents of Lipton Danedar were significantly highest among brands, where as alkalinity of water soluble ash, crude protein, crude fat and crude fibre of Lipton Yellow Label were found higher than that of Lipton Taza and Lipton Danedar. The data of sensory evaluation revealed that Lipton Yellow Label exhibited a highly significant differences in colour, taste, flavor and overall acceptability as compared to Lipton Taza and Lipton Danedar.

Key Words: Tea; Tannins; Commercial brands; Protein solubility

INTRODUCTION

Tea (*Camelia sinensis*) is one of the most widely consumed beverages due to its health giving dietetic and therapeutic qualities. Tannins are water soluble polyphenol compounds having wide prevalence in plants. It is a powerful stringent and to some extent an irritant. Its properties depends on the formation of insoluble compounds but as the process of digestion progress the stomach contents become more acidic. The protein tannate break up and some of the combined tannins pass into intestine and decrease secretion of small intestine which produced constipation (Bhat *et al*., 1998; Reed, 1995). Excessive intake of tannins may cause insomnia, nausea, vomiting, palpitation of heart and a cup of tea after meal may cause dyspepsia (Chung *et al*., 1998). Tea during meals significantly inhibits the absorption of both food iron and medicinal iron (Disler *et al*., 1975). Protein digestibility was greatly reduced when tanniferous was the part of diet (Giner-Charved, 1996). Small quantities of tannins in diet caused adverse effect in poultry (Haslan, 1989). It has been observed at public places and road-side tea shops, in Pakistan that the procedure for tea making generally consists of repeatedly and prolong boiling of tea for maximum extraction of colour and taste which otherwise may be harmful.

Taking in view the above facts, this project was designed to assess the effect of time and temperature on the extract of tannins and its effect on protein solubility.

MATERIALS AND METHODS

These studies were carried out at University of Agriculture, Faisalabad, during 1999-2000. Commonly used commercial brands of tea, Lipton Danedar, Lipton Taza and Lipton Yellow Label were purchased from local market.

Tea extracts were prepared using various cooking times (2, 4, 6, 8 and 10 min) and temperatures (90, 95 and 100°C).

Chemical analysis. Moisture, ash, alkalinity of water soluble ash, crude protein, crude fat and crude fiber of each brand of tea were determined according to the standard methods (Harold *et al*., 1981).

Sensory evaluation. Tea infusions were evaluated for color, taste, flavor and overall acceptability by panel of Judges on nine points hedonic score (Land & Shephered, 1988).

Preparation of tea infusion. Each tea infusion was prepared by taking 3 g of tea in 400 mL distilled water from each brand of tea (AOAC, 1990). The solubility of egg protein was determined by method of AOAC (1990). The data were analyzed statistically by using Analysis of Variance Technique (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

The results showed a significant increase in tannin contents and significant decrease in KoH solubility of protein with increase in time and temperature.

On two minutes cooking, the tea brand Lipton Taza showed a highly significant negative correlation between tannin extraction and protein solubility with increase of temperature ($r = -0.097$, $P<0.0001$) as compared to Lipton Danedar as shown in Fig. 1. The effect of temperature on rate of extraction of tannins of all the brands was non-significant. These results were found in accordance with the findings of Savolainen (1992) who found that the tea

Tannin extraction and protein solubility of three commercial brands of tea cooked for two (Fig. 1), four (Fig. 2) and six (Fig. 3) minutes at 90, 95 and 100°C. LD= Lipton Danedar; LT= Lipton Taza; LY= Lipton Yellow

Fig. 1

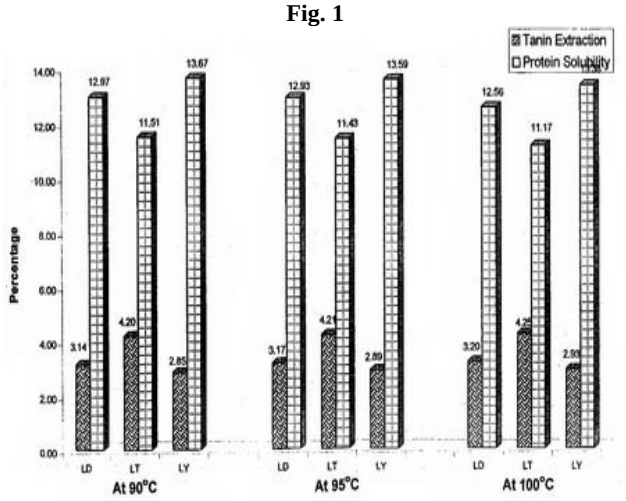


Fig. 2

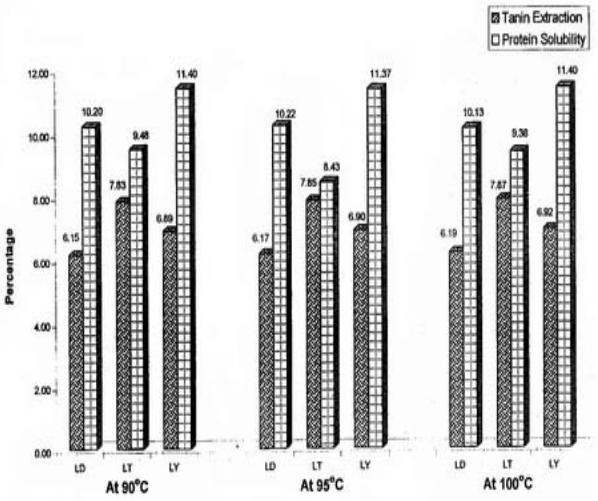
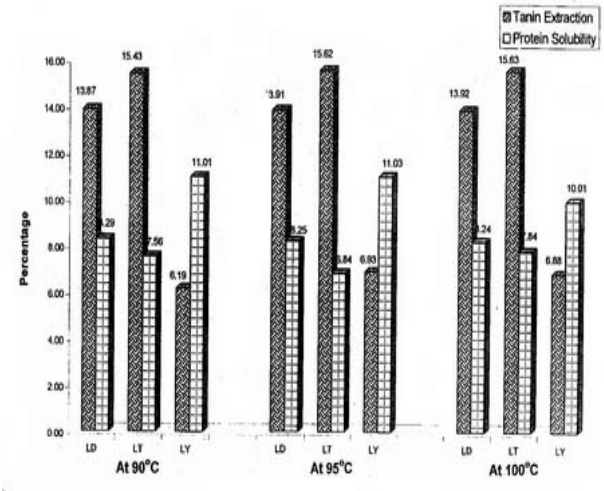


Fig. 3



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spectrophotometry. Heating for 2 min at three temperatures revealed a significantly higher amount of soluble protein in Lipton Yellow Label followed by Lipton Danedar. Heating for 4 minutes at three temperatures revealed significantly the highest amounts of tannin extraction in Lipton Taza which were 7.83, 7.85 and 7.87% at 90, 95 and 100°C, respectively (Fig. 2). Lipton Yellow label showed increase in tannin contents and decrease in protein solubility which is highly significantly correlated ($r = -0.602$; $P<0.08$) as compared to Lipton Taza and Lipton Danedar ($r = -0.44$; $P<0.23$) ($r = -0.35$; $P<0.36$). Effect of all temperatures on tannin extraction on three brands of tea was found non-significant. Panda *et al.* (1981) has estimated tannin from tea dust by boiling and direct infusion from 4-6 min to be 122-128 mg and 150-165 mg/100 mL, respectively. The deception in the results obtained in the present investigation from that of panda *et al*. (1981) may be due to difference in boiling periods and varieties of the tea. On 6 min cooking, Lipton Taza showed a higher extraction of tannin while Lipton Danedar exhibited higher protein solubility as compared to other brands. Lipton Taza showed the lowest significant negative correlation ($r = -0.28$; $P<0.46$) as compared to correlation of Lipton Danedar and Lipton Yellow Label (Fig. 3).

Similar trend was observed in case of 8 and 10 minutes cooking with respect to tannin extraction and protein solubility (Fig. 4, 5). Proximate analysis showed that moisture, ash and water soluble ash of Danedar were significantly highest among Lipton Taza and Lipton Yellow Label, whereas alkalinity of soluble ash, crude protein, crude fat and crude fibre of Lipton Yellow label were highly significantly highest than the Lipton Taza

Fig. 4. Tannin extraction and protein solubility of three commercial brands of tea cooked for eight minutes at 90, 95 and 100°C. LD= Lipton Danedar; LT= Lipton Taza; LY= Lipton Yellow

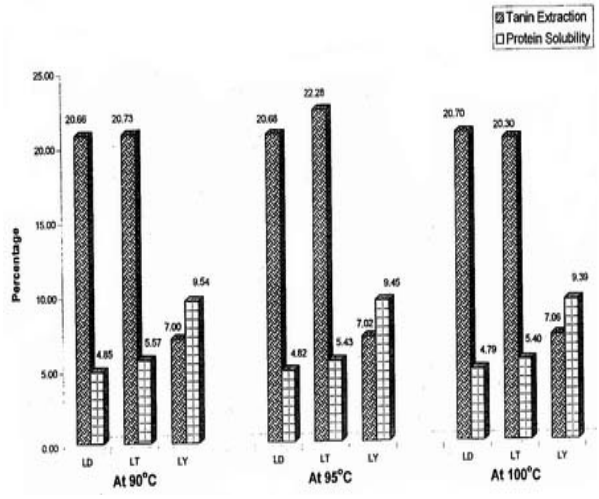
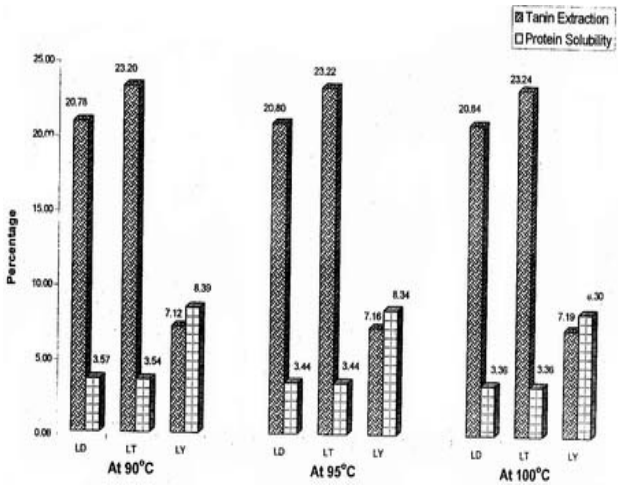


Fig. 5. Percentage of tannin extraction and protein solubility of three commercial brands of tea cooked for 10 minutes at 90, 95 and 100°C. LD= Lipton Danedar; LT= Lipton Taza; LY= Lipton Yellow



and Lipton Danedar as shown in Table I.

Table I. Proximate analysis of common commercial brand of tea

	Lipton Danedar	Lipton Taza	Lipton Yellow Label
Moisture (%)	4.01±0.011	3.21±0.011	3.66±0.005
Ash (%)	5.52±0.011	5.40±0.011	5.11±0.011
Water soluble ash (%)	3.97±0.011	3.61±0.015	3.45±0.011
Alkalinity soluble ash (%)	1.20±0.011	1.24±0.005	1.46±0.011
Crude protein (%)	3.94±0.011	4.08±0.005	4.09±0.051
Crude fat (%)	1.62±0.005	0.99±0.011	1.99±0.005
Crude fibre (%)	14.60±0.011	14.04±0.005	14.98±0.011

When the data of sensory evaluation were analyzed, Lipton Yellow Label exhibited highly significant difference for color, taste, flavor and overall acceptability as compared to Lipton Taza and Lipton Danedar as shown in Table II.

Table II. Sensory evaluation of commercial brands of tea

	Lipton Danedar	Lipton Taza	Lipton Yellow Label
Colour	5.00±1.00B	6.33±0.57AB	8.00±1.00B
Taste	6.00±1B	6.33±0.57B	8.00±0.577A
Flavour	6.33±0.57B	6.66±0.57B	8.66±0.57A
Overall acceptability	6.66±0.57B	8.00±1.00AB	8.66±0.57A

CONCLUSIONS

These studies revealed that the tannin contents increased with an increase in boiling time and protein solubility was decreased with an increase in tannin concentration. Since it is harmful in large doses, it is necessary to avoid the prolong boiling as commonly practiced in hotels and road side tea shops in Pakistan in order to get the maximum extraction of color and briskness which is not suitable. Prolong boiling causes decrease in sensory properties i.e essential oils responsible for aroma of tea are also lost on boiling due to their volatility. Two minutes boiling is sufficient for tea making in order to get a good ratio of tannins.

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