

# Reducing crude fiber levels in made tea to minimize the failing rates of pre-auction tea samples – A qualitative analysis from Sri Lanka

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## Abstract

Sri Lankan tea known for generations as “Ceylon Tea” is reputed for its’ taste and aroma the world over. On the global export front, the country holds the position of the third-largest exporter of tea. The tea processing factories for exports continually improve and upgrade to meet required technical and hygienic standards to conform to the international food safety requirements. However, it was revealed that more than 2000 pre-auction tea samples get rejected per annum. Therefore, the objective of the current study is to disclose the main factors which lead to failing pre-auction samples (FPAS) at the qualitative analysis by an expert panel of tea tasters within the last five years. Total population sampling was used as the sampling technique (n=1500). Data were analyzed with the use of SPSS. The dependent variable of the research is failing pre-auction samples (FPAS) while six independent variables have been recognized: water extract (WE), alkalinity (A), acid insoluble ash (AIA), crude fibre (CF), the microbiological requirement (MR) and not true to grade (NTG). Correlation tests were performed in order to test the hypothesis. The regression results of measuring relationships between AIA and FPAS, CF and FPAS, MR and FPAS, and NTG and FPAS signify valid regression models ( $p < 0.005$ ) which explains 47.9 %, 59.4%, 51.5%, and 55.7% variance of the outcome variables respectively. It was revealed that AIA, CF, MR, and NTG are significant predictors ( $p < 0.005$ ) of FPAS since beta coefficient values are greater than 0.7. The investigation intends to give helpful bits of alertness to all the stakeholders of the tea industry so that to put efforts into the reduction of failing pre-auction samples. As per the results, the highest cause of failing pre-auction samples is high levels of crude fiber which cannot be completely controlled during tea processing. Therefore, taking sufficient preventive measures at the factory level to reduce the amount of crude fiber in processed tea is vital. It was revealed that there are significant relationships between acid insoluble ash and failing pre-auction samples, crude fiber and failing pre-auction samples, microbiological requirement and failing pre-auction samples, and not true to grade and failing pre-auction samples.

## Introduction

Sri Lankan tea, known for generations as “Ceylon Tea”, is reputed for its’ taste and aroma the world over.

Sri Lanka is the largest producer of orthodox tea in the world. Currently, Sri Lanka ranks as the fourth-largest tea producer in the world. On the global export front, the country holds the position of third-largest exporter of tea. According to the statistics, the Sri Lankan tea industry has recovered during the COVID pandemic, with significant growth in production and exports in the first quarter of 2021 compared to 2019 and 2020 (Forbes & Walker Tea Brokers, 2022). In the first quarter from January to March 21, tea export earnings were Rs. 65 billion in 2020

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(Forbes & Walker Tea Brokers, 2022). It also increased by 49 billion rupees, from 49 billion rupees in the first quarter. Cumulative production in the first quarter has been 74 million kilograms; an increase of 20 million. The price of FOB tea in the first quarter has been Rs. 939/= per kg, an increase of 13%. The price of FOB has been Rs. 867/kg in 2020 and Rs. 823/kg in 2019 (Forbes & Walker Tea Brokers, 2022). Sri Lankan tea depends mostly on the Commonwealth of Independent States, Russian Federation and Middle Eastern countries' markets. About 70 percent of the bulk tea is exported to these markets (Ranaweera, 2007; Hilal, 2020).

As a mandatory requirement, tea samples are tested weekly by the Tea Tasting Division of the Sri Lanka Tea Board prior to each public tea auction. This ensures the quality and safety of the tea, which is tested by a well-trained tea testing panel. These tests enable all stakeholders in the tea industry to enjoy a safe and secure cup of "Ceylon Tea" tea in accordance with the standards. Skilled tea tasters determine the quality of teas by testing the given pre-auction tea samples.

The export-oriented tea processing factories continually improve and upgrade to meet the required technical and hygienic standards to conform to the international food safety requirements. However, it was revealed that more than 2000 pre-auction tea samples are rejected per annum. I.e., 1,200,350 kg of tea are held without being auctioned. Of these failures, only upgradable teas are sent to factories for reprocessing, but the factory owners incur an additional cost to make the tea suitable. The failure of many samples is an economic loss.

Therefore, the objective of the current study is to disclose the main factors that led to failing pre-auction samples (FPAS) in the qualitative analysis by an expert panel of tea tasters within the last five years. Specifications for approving pre-auction samples are based on the ISO 3720 standard (International Organization for Standardization, 2011) and Sri Lanka Tea Board directives for minimum quality standards (Sri Lanka Tea Board, 2011).

Water extract  $\geq 32\%$ , alkalinity 1.0% - max. 3.0%, acid insoluble ash  $\leq 1.0\%$ , and crude fiber  $\leq 16.5\%$  are considered in checking compliance with the ISO 3720 standard. In addition, the microbiological requirement is considered as per the Sri Lanka Tea Board directives, whereas true to grade is another factor considered in the pre-auction sample approval process.

### **Objectives of the Study**

The objective of the study was to disclose the main factors which lead to failing pre-auction samples (FPAS) by the expert panel of tea tasters at the Tea Auction, Sri Lanka.

### **Methodology**

The attempt of the current study is hypothesis testing, which is the track of building up a comprehensive theoretical framework for the study. Hypotheses were inferred and subjected to tests to check their acceptance or rejection. In view of that, it is intended to identify the relationships between each specification tested and failing pre-auction samples (FPAS). This investigation focused on the correlation analysis as it makes sense of whether there are relationships between each specification tested and failing pre-auction samples (FPAS). As the research is based on secondary data, in a non-contrived setting, quantitative in nature, and correlational, there was minimum interference. The study particularly analyzed the factors which affect failing pre-auction samples (FPAS). Simple random sampling was used as the sampling technique. The data required for the study was obtained by the Sri Lanka Tea Board. The study area is Sri Lanka. The data were analyzed with the use of SPSS. The dependent variable of the research is failing pre-auction samples (FPAS), while six independent variables have been recognized, namely, water extract (WE), alkalinity (A), acid insoluble ash (AIA), crude fiber (CF), the microbiological requirement (MR), and not true to grade (NTG).

The alternative hypothesis driven were  $H_1$  - there is a relationship between water extract

(WE) and failing pre-auction samples (FPAS), H<sub>2</sub> - there is a relationship between alkalinity (A) and failing pre-auction samples (FPAS), H<sub>3</sub> - there is a relationship between acid insoluble ash (AIA) and failing pre-auction samples (FPAS), H<sub>4</sub> - there is a relationship between crude fiber (CF) and failing pre-auction samples (FPAS), H<sub>5</sub> - there is a relationship between microbiological requirements (MR) and failing pre-auction samples (FPAS), and H<sub>6</sub> -there is a relationship between not true to grade (NTG) and failing pre-auction samples (FPAS)

## Results

The P values of the Shapiro-Wilk test are 0.487, 0.114, 0.319, 0.689, 0.444, 0.229, and 0.102 for the seven main constructs, indicating a higher value than 0.05. The calculated Z values of skewness and kurtosis values also confirm that the figures are in the standard range. All the KMO estimations are greater than 0.50. In addition, the BTS is significant at 0.001 (i.e.,  $p < 0.001$ ). Henceforth, it is affirmed that the convergent validity is met. To check the reliability, Cronbach's coefficient alpha values were obtained, whereas all the values were greater than 0.7, which suggests that the scale is internally reliable. The mean values obtained were 42.4700 (SD = 0.34563), 3.9565 (SD = 0.23571), 0.1304 (SD = 0.47421), 4.3478 (SD = 0.60963), 26.3043 (SD = 0.77342), 4.6956 (SD = 0.41630), and 4.5652 (SD = 0.45421) for failing pre-auction samples (FPAS), water extract (WE), alkalinity (A), acid insoluble ash (AIA), crude fibre (CF), microbiological requirement (MR) and not true to grade (NTG) respectively. Correlation tests were performed in order to test the above-mentioned hypothesis, and it was revealed that there are significant relationships between AIA and FPAS, CF and FPAS, MR and FPAS, and NTG and FPAS.

The correlation coefficient values were 0.722, 0.801, 0.752, and 0.708, respectively, showing which are significant at the 0.01 level. The regression results of measuring relationships between AIA and FPAS, CF and FPAS, MR and FPAS, and NTG and

FPAS signify valid regression models ( $p < 0.005$ ) that explain 47.9%, 59.4%, 51.5%, and 55.7% of the variance of the outcome variables, respectively. It was revealed that AIA, CF, MR, and NTG are significant predictors ( $p < 0.005$ ) of FPAS, and since beta coefficient values are greater than 0.7, it can be concluded that H<sub>3</sub>, H<sub>4</sub>, H<sub>5</sub>, and H<sub>6</sub> are supported. I.e., there are significant relationships between AIA and FPAS, CF and FPAS, MR and FPAS, and NTG and FPAS.

## Discussion

Sri Lanka has established a reputation as a leading producer of tea in the world. There has been increasing disagreement between performance and reputation for the last few years. Therefore, the export-oriented industry is under increasing threats due to a range of domestic issues and international competition. These domestic issues have seriously affected the Sri Lankan tea industry's productivity and efficiency (Wickramasinghe & Cameron, 2003; Hilal, 2020). The study concentrates on contributing to the knowledge pool of productivity and efficiency of tea, by bringing up the facts which create tea that accords with the applicable standards. Convincingly, the investigation intends to give helpful bits of alertness to all the stakeholders in the tea industry so that they can put efforts into the reduction of failing pre-auction samples. It is important to meet all the stakeholders in the tea industry to improve the tea sector. As per the results, the highest cause of failing pre-auction samples is high levels of crude fiber, whereas the maximum possible crude fiber content of black tea is 16.5% as per the ISO 3720 standard (International Organization for Standardization, 2011). Although this cannot be completely controlled during tea processing taking sufficient preventive measures at the field level to reduce the amount of crude fiber in processed tea is vital. It is possible to reduce the number of rejected pre-auction tea samples and contribute to increasing the country's GDP if awareness is created among the stakeholders of the tea industry. Increasing the awareness programs among all the

stakeholders in the tea industry is a necessity to uplift the approving tea quantity for consumption.

### Conclusions

There are significant relationships between acid insoluble ash and failing pre-auction samples, crude fiber and failing pre-auction samples, microbiological requirements and failing pre-auction samples, and not true to grade and failing pre-auction samples. The greatest cause of failing pre-auction samples is high levels of crude fiber.

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