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Roasted Barley Addition to Coffee: Detection of the Adulterant Barley Using Trained Panelists

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The objective of this research was to detect the adulterant roasted barley at different concentrations (5 to 20 % w/w) in roasted and ground Harar coffee using trained panelists. The samples used were medium roasted coffee and barley mixtures (5 to 20% w/w barley) trained panelists Quantitative Descriptive Analysis sensory evaluation indicated that, there was no significant ($p \geq 0.05$) difference among the adulterated coffee 5% to 20% w/ w barley using pure Harar coffee as a reference with respect to aroma, acidity, bitterness and body sensory notes. Sensory evaluation resulted in not discriminating the adulterated coffee samples 5%, 10% and 20% w/ w barley despite pure coffee was presented as a reference.

Key words: Adulterant, barley,Harar coffee, Panelists, Quantitative Descriptive Analysis

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INTRODUCTION

Arabica coffee originated from Ethiopia and discovered by a goat herder named Kaldhi around 850 A.D. (Butt and Sultan, 2011). Coffee is the most traded next to petroleum in the world market, about 10 billion US dollar per year (Cordella et al, 2002). Annually, about 500 billion cups of coffee are consumed by about one third of the population of the world (Butt and Sultan, 2011). Economic adulteration of food affects the nature, quality, originality and nutritional value of food and thereby influences consumers' expectations (Dennis, 1998).

Roasted coffee can be liable to adulteration by mixing it with cereals, coffee twigs, Robusta coffee, brown sugar (Jham et al., 2007). Higher cost of coffee and its physical characteristics resemblance to roasted and ground cereals, seeds, roots and parchments could be the reasons for its adulteration (Fontes et al., 2006; Varvolgyi et al., 2013). Moreover, the increase in coffee prices plays a role in economic adulteration of roasted coffee (Briandet et.al., 1996).

Regulatory bodies, quality personnel and food chemists require fast, more reliable, low cost and less or no sample treatment analytical method for routine detection of adulterants in foods though most analytical methods are expensive, time taking and tired some (ALPDOĞAN et al, 2002).

Oliveira et al. (2009) described that detecting the different concentration of the adulterant roasted and ground barley in roasted and ground coffee by trained panelists can be troublesome at low concentration of barley addition. Varvolgyi et al. (2013) compared electronic tongue, near infrared and untrained sensory panelists' techniques to detect barley in Robusta coffee

and found that untrained panelists were unable to discriminate the adulterated coffee in comparison to electronic tongue and near infrared analysis among the different concentrations of barley. As to the author's knowledge, there is literature gap on adulteration detection of coffee using trained panelists to verify the amount of barley present in roasted coffee describing the changes in sensory attributes. Thus, the aim of this study was to discriminate the roasted barley addition to roasted coffee at different concentration (5 to 20 % w/w) using trained panelists, well experienced coffee experts so as to enable coffee consumers describe brewed adulterated coffee barley mixture organoleptic characteristics and to discriminate barley adulterated coffee, roast and ground.

MATERIALS AND METHODS

Study site

The study was conducted at Ministry of Agriculture and Natural Resources coffee quality inspection center laboratory, Addis Ababa, Ethiopia.

Sample preparation

Pure Harar coffee was provided from Ethiopian Ministry of Agriculture and Natural Resources coffee quality inspection center and the six rowed barley was purchased from the local market (Addis Ababa, Ethiopia).

The pure Harar coffee and pure barley were roasted at medium roast in Probat® roaster separately and finely ground in Mahlkonig® coffee grinder for 60 seconds, 0.15 $<D<$ 0.5 mm. The coffee and barley roasting, grinding, packaging and sensory evaluation were carried out at coffee quality inspection center laboratory (Addis Ababa, Ethiopia). For the study purpose, proportions of 5 to 20 % w/w barley to coffee mixtures were prepared intentionally by mixing 95% coffee with 5% barley, 90% coffee with 10% barley and 80% coffee with 20% barley then for the homogeneity of the samples, each of the proportions were mixed thoroughly by a Stuart® electronic mixer (homogenizer), the stirrer wheel and containers were cleaned properly before and after each mixing. Then the roasted and ground pure coffee, pure barley and their mixtures were put into polyethylene bags for the analysis.

Procedure

Six expert tasters, three males and three females aged 30 to 55, who are very experienced on coffee quality control were recruited from coffee quality inspection center and trained. The training was short to measure each assessor is consistent in their own score (Kemp et al. 2011). The sensory evaluation was carried out in coffee quality inspection center cupping and liquoring unit laboratory, sensitivity of the panelists was trained by profile testing for five sessions for profile analysis and used the terms that best describe the samples described by Varvolgyi et al. (2013) then agreement protocol on descriptive terms was reached and then the intensity scale test was discussed and also reference sample 100% w/w Harar coffee was presented. Quantitative Descriptive Analysis (QDA) of the coffee barley mixture was assessed by using unstructured scale in triplicate (Varvolgyi et al., 2013) and the reference sample was presented along with test samples. The QDA method was adopted anchored at 1.25 cm as low and 13.75 cm as high in intensity of respective attributes, the perceived intensities of each of the attributes was indicated by cutting the scale by a vertical line on a score card of a particular code number, the length of the line from left end and up to the point of cutting indicated the intensity of the attribute (Prakash et al., 1998).

For each sample of coffee barley mixture brew was prepared by putting 5.5 g coffee or coffee barley mixture in 100 ml water just off the boil (Oeistreich-Janzen, 2010), stirred for 5 minutes and then filtered and cooled to a temperature of 55^{o}c as serving temperature and three digit coded samples were presented monadically in triplicate to the panelists with 15 ml in 100 ml white porcelain vessel (Varvolgyi et al., 2013). The order of presentation of the samples was 20% barley, 5% barley and then 10% barley w/w mixed with Ethiopian Harar coffee with three digit coded samples (Stone and Sidel, 1993) as 734,568 and 216 respectively. Pure Ethiopian Harar coffee roast and ground brew was used as a reference sample and served with the samples to the trained panelists. Room temperature drinking water was presented with expectoration cup. The sensory evaluation room was also quite an illuminated with natural light through the window. The scale is 15 cm long and anchored scale 1(detectable) to scale 10 (very intense) (Varvolgyi et al., 2013).

DATA ANALYSIS

Data obtained from sensory attributes were evaluated using one way ANOVA considering main effect and blocking judge effect. SPSS software version 20 was used for the statistical analysis and significance of means were declared at $p<0.05$ and mean separation was carried out with Duncan multiple comparison procedures of the SPSS.

RESULTS AND DISCUSSION

As one way ANOVA indicated, the trained panelists

Table 1. Mean sensory scores of the adulterated coffee Attributes Coffee barley mixtures

	5% barley	10% barley	20% barley
Aroma	4.05±0.48[a]	4.25±0.58[a]	5.48±0.81[a]
Acidity	5.23±0.75[a]	5.78±0.42[a]	5.62±0.45[a]
Bitterness	5.25±0.52[a]	3.8±0.43[a]	3.72±0.40[a]
Body	5.25±0.52[a]	5.93±0.29[a]	6.22±0.53[a]

Means followed by same letters in the same row were not significantly different $p \geq 0.05$

sensory analysis using QDA of the four attributes of the Ethiopian Hararcoffee barley mixturerevealed there was no significant difference ($p \geq 5$) among the adulterated 5% barley,10% barley and 20% barley interms of aroma, acidity, bitterness and body (table 1).

The study result is in agreement with Varvolgyi et al. (2013) which not succeeded using untrained sensory panel through Quantitative descriptive analysis. Oliveira et al. (2009) in their study stated that detecting the adulterant barley at low concentration is challenging. Souto et al. (2015) described that expert tasters coffee quality analysis does not provide reliable information regarding the adulterants present in roasted coffee, which is in agreement with the result of this study.

CONCLUSION

Sensory evaluation resulted in not discriminating the adulterated Harar coffee samples 5 %, 10 % and 20 % w/w barley despite pure coffee was presented as a reference.

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