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Levels of the Cholesterol-Elevating Diterpenes Cafestol and Kahweol in Various Coffee Brews

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The coffee diterpenes cafestol and kahweol raise serum cholesterol in humans. Each 10 mg of cafestol consumed per day elevates cholesterol by 5 mg/dL (0.13 mmol/L). Diterpene levels in various coffee brews were examined. Scandinavian boiled coffee contained (mean $\pm$ SD) 3.0 ± 2.8 mg, French press coffee 3.5 ± 1.2 mg, and Turkish/Greek coffee 3.9 ± 3.2 mg of cafestol per cup. Consumption of five cups per day of any of these coffee types could thus elevate serum cholesterol by 8–10 mg/dL. Italian espresso coffee contained 1.5 ± 1.0 mg of cafestol per cup, five cups theoretically raising cholesterol by 4 mg/dL. Brewing time had little effect of diterpenes. Brewing strength increased diterpenes in boiled, French press, and espresso coffee but not in Turkish/Greek coffee. Diterpenes in instant, drip filtered, and percolated brews were negligible. Regular and decaffeinated coffees had similar diterpene contents. High chronic intake of French press coffee or Turkish/Greek coffee could increase serum cholesterol and thus coronary risk similar to that reported previously for Scandinavian boiled coffee.

Keywords: Coffee; cafestol; kahweol; brewing method; serum cholesterol; coronary disease

INTRODUCTION

Scandinavian-type boiled coffee raises serum cholesterol in man (Aro, 1993; Thelle et al., 1987). The diterpenes cafestol and, possibly, kahweol are responsible for this effect (Heckers et al., 1994; Weusten-van der Wouw et al., 1994). Additionally, cafestol and kahweol affect liver function; they increased the activity of alanine aminotransferase and depressed that of γ -glutamyltransferase in serum. In controlled trials, serum cholesterol rose by about 1 mg/dL (0.03 mmol/L) and alanine aminotransferase by about 1 unit/L for each extra 2 mg of cafestol ingested (Weusten-van der Wouw et al., 1994). Levels of cafestol and kahweol in various coffee brews could be used to predict their capacity to affect lipoprotein metabolism and liver function and are thus an important health issue.

Cafestol and kahweol represent the major part of the unsaponifiable lipid fraction in coffee beans. They are mainly present as fatty acid esters, but small amounts of free alcohols also occur. The total diterpene content is 1.3% w/w in green beans of *Coffea arabica* (commonly called Arabica beans) and 0.2% in beans of *Coffea canephora* (commonly called Robusta beans) (IARC Working Group, 1991). Robusta beans are almost devoid of kahweol (Viani, 1988) but contain a third diterpene—16-O-methylcafestol—which is absent in Arabica beans (Speer and Mischnick, 1989). Other diterpenes, such as decomposition products of cafestol and kahweol, are present in very low quantities and are therefore unlikely to affect serum lipids and liver enzymes substantially.

Brewing releases oil droplets containing diterpenes from ground coffee beans. They are retained by a paper filter (Ratnayake et al., 1993), which explains why paper-filtered coffee shows no (Ahola et al., 1991; van

Figure 1. Brewing principles for percolated, French press (cafetiere or plunger), and mocha coffees.

Dusseldorp et al., 1991) or only little (Fried et al., 1992) effect on serum cholesterol. With espresso and mocha coffee, and with French press coffee, also known as plunger or cafetiere coffee, lipids readily pass the metal filter (Ratnayake et al., 1993) and the hypercholesterolemic diterpenes may thus be removed less efficiently from the brew. Other brews, such as Scandinavian boiled coffee and Middle Eastern coffee types, are decanted directly from the boiling state into the cup without applying a filter at all (IARC Working Group, 1991).

We report diterpene contents of various coffee brews and their potential impact on serum cholesterol levels.

EXPERIMENTAL METHODS

Collection of Field Samples. Boiled coffee was collected from regular consumers in Norway and Finland ($n = 14$); Turkish/Greek coffee was collected from Turkish and Greek restaurants operated by immigrants in the Netherlands ($n = 7$) and from retail outlets in Greece and Egypt ($n = 4$). Espresso was from bars and restaurants in Italy ($n = 10$), Spain ($n = 2$), Switzerland ($n = 4$), and the Netherlands ($n = 15$). French press coffee (Figure 1) was obtained from consumers in the Netherlands ($n = 5$). Brews were poured into plastic containers so as to mimic the amount of the brew that is consumed from the cup and frozen at -20 °C. Cup size was defined as the amount poured into the container.

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