

SURVEY OF CAFFEINE LEVELS IN HOT BEVERAGES

Key points

- In 2001 the Agency advised pregnant women to limit their intake of caffeine to less than 300 mg per day in light of research that indicated that caffeine intakes above this may be associated with low birth weight and, in some cases, miscarriage.
- This advice included information on the number of beverages that equate to 300 mg of caffeine. The advice was based on caffeine levels in teas and coffees prepared under laboratory conditions according to standard procedures.
- The aim of this survey was to gather data on the level of caffeine in teas and coffees made by consumers following their usual procedures.
- 400 samples of teas and coffees prepared by consumers were collected from family homes, workplaces or purchased in retail settings from 10 areas across the UK.
- All drinks were analysed to determine the concentration of caffeine per serving i.e. per cup or mug.
- A wide variation of caffeine levels (excluding decaffeinated samples) were observed:
 - tea** ranged from less than 1 mg to 90 mg of caffeine per serving (mean 40 mg)
 - instant coffee** ranged from 21 mg to 120 mg of caffeine per serving (mean 54 mg)
 - ground coffee** ranged from 15 mg to 254 mg of caffeine per serving (mean 105 mg)
- Statistical analysis showed that there was a positive trend between the reported perceived strength of samples (weak, medium and strong) and the level of caffeine per serving.
- The mean caffeine levels determined in this survey confirm that the levels quoted in the Agency's previous advice to pregnant women are appropriate. The information gained will also be used to refine future estimates of caffeine intake.

Summary

The main aim of the survey was to collect information on the level of caffeine in tea (loose leaf, bags, vending and instant etc.) and coffee (filter, vending, espresso, cappuccino, latte and instant etc.) as prepared by adults (over 19 years old) in the UK. Green teas, decaffeinated teas and coffees were included in the sampling protocol, but samples of herbal teas were excluded as they are not likely to contain caffeine. General consumption patterns of teas and coffees and information on how the samples were prepared by consumers were also recorded to see if the preparation method affected the level of caffeine in the samples collected.

Previous JFSSG survey work on the level of caffeine in a range of beverages has been published.¹ However, the samples were prepared under standard laboratory conditions and therefore did not take into account the variation between preparation methods used by consumers.

The Agency has advised pregnant women to limit their intake of caffeine to less than 300 mg of caffeine per day in light of research which indicated that caffeine intakes above this level may be associated with low birth weight and, in some cases, miscarriage. When providing this advice the Agency gave an indication of the number of beverages that would equate to 300 mg per day, however, this advice was based on drinks made under laboratory conditions, not as prepared by consumers. The information gained from this current survey will be used to refine estimates of caffeine intake, which in turn helps to inform our advice to pregnant women on caffeine consumption.

Four hundred samples of prepared teas and coffees were collected from 10 regions of the UK from homes, workplaces or purchased from retail settings e.g. cafés and restaurants (Table 1). These samples were collected by Ventress Technical Services (VTS), who were subcontracted to perform this task. Samples were then transferred to the lead contractor, Reading Scientific Services Limited (RSSL), who analysed the level of caffeine in the prepared samples using a validated in-house method.

The results in Table A (Annex 1) showed a wide variation of caffeine levels, with tea samples (excluding decaffeinated teas) ranging from less than 1 mg to 90 mg per serving with a mean of 40 mg per serving. For instant coffee samples (excluding decaffeinated

coffees), the caffeine level ranged from 21 mg to 120 mg per serving with a mean of 54 mg per serving. For ground coffee samples (excluding decaffeinated coffees), the caffeine level ranged from 15 mg to 254 mg per serving with a mean of 105 mg per serving.

Statistical analyses showed that there was a difference in caffeine levels per serving with the reported perceived strength of the samples. In addition, higher levels of caffeine were observed for tea samples where teabags were 'mashed' or squeezed.

Background

Caffeine (1,3,7-trimethylxanthine) is one of a group of chemicals called methylxanthines which occur naturally in a range of plant-derived foodstuffs such as coffee, tea, cocoa/chocolate and cola products. In 2001 the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment looked at the effects of caffeine on reproduction and concluded that caffeine intakes above 300 mg per day may be associated with low birth weight and, in some cases, miscarriage.² As a result of this work, in October 2001, the Food Standards Agency advised pregnant women to limit their intake of caffeine to less than 300 mg of caffeine per day. Information was given on the amount of beverages or confectionery that would equate to 300 mg per day as shown below.

- 4 average cups or 3 average size mugs of instant coffee
- 3 average cups of brewed coffee
- 6 average cups of tea
- 8 cans of regular cola drinks
- 4 cans of so-called 'energy' drinks
- 400 grams (8 standard 50 g bars) of plain chocolate

The individual intakes are:

- Average cup of instant coffee - 75 mg
- Average mug of coffee - 100 mg
- Average cup of brewed coffee - 100 mg
- Average cup of tea - 50 mg
- Regular cola drink - up to 40 mg

- Regular energy drink - up to 80 mg
- Plain bar of chocolate - up to 50 mg. Caffeine in milk chocolate is about half that of plain chocolate

However, the above information was based on levels reported in literature for samples prepared under laboratory conditions. A previous Canadian study analysed levels of caffeine in tea and coffee samples prepared at home and at a workplace setting.³ However, this work was conducted in 1987 and was based on a limited number of only 70 samples. In addition, no information was collected on tea preparation methods and limited data was collected on coffee preparation. Therefore this survey was commissioned to determine the levels of caffeine in teas and coffees as prepared by UK consumers.

A small number of decaffeinated teas and coffees (14 samples) were also collected. There are no regulations on the level of caffeine in decaffeinated tea products. However, the *Coffee Extracts and Chicory Extracts (England) Regulations 2000*,⁴ which implement European Directive (1999/4/EC),⁵ require that coffee can only be labelled with the term, “decaffeinated”, for coffee which has been subjected to a decaffeination process and in which the residual anhydrous caffeine content does not exceed 0.30 per cent of its coffee-based dry matter content.

Methodology

Samples

Ventress Technical Services (VTS) collected four hundred samples of prepared teas and coffees from family homes, workplaces, or purchased samples in cafés and restaurants etc. The samples were taken from 10 areas over the UK (i.e. twenty teas and twenty coffees per area). Decaffeinated products and green tea were not excluded from the survey, but were not sought specifically. However, herbal teas were outside the scope of this survey as they are unlikely to contain caffeine. A spread of participants within five defined age groups (19 to 24, 25 to 34, 35 to 49, 50 to 64, and over 64 years) was selected.

The participants were asked to provide a sample of a frequently consumed product that was within the remit of this survey, prepared in the usual way in their cup or mug.

Information on the participant's usual consumption patterns of teas and coffees and the perceived strength of such drinks were recorded. The method of preparation and information on the type and brand of drink was also noted by sampling officers. Participants were asked whether the perceived strength of the sample taken for analysis was weak, medium or strong.

In the case of tea samples, to determine whether different preparation methods increased caffeine levels, the sampling officers recorded whether teabags were 'mashed', squeezed or stirred/dunked. Every effort was made not to bias the way the drinks were prepared, for example, questions relating to the participants' preferences were not asked until after the sample had been prepared.

Details of the tea or coffee used to prepare the sample were not collected for every sample as in some cases the tea/coffee had been transferred to another container after purchase and the original packaging had been discarded.

The samples were collected from September 2002 to March 2003. The areas sampled (and their codes) were London and Home Counties (LON), Northern Ireland (NOR), North West England (PRE), Scotland (SCO), Somerset (SOM), South Coast (COA), Suffolk (SUF), Wales (WAL), Worcestershire (WOR) and Yorkshire (YOR). In addition one further sample was taken from Cambridge to replace a sample collected in Worcestershire that was found to be beyond its best before date. Samples were also classified as rural or urban using the definition of rural as being 'settlements of farms, hamlets, villages or small towns of up to a population of 10,000'.

Within each area, samples were taken from family homes (suffix DO), workplaces (suffix WO), family homes sampled via the workplace (suffix WD) and retail establishments such as cafés or restaurants (suffix CA). Five workplace participants from each area were asked to also supply a product prepared by themselves at home (WD samples). Wherever possible, this product was similar to the one submitted as their workplace sample. However, in some instances, participants at work consumed different types of products when at home. For retail samples (suffix CA) that required further preparation before consumption, the sampling officer approached a customer or an employee of the premises to prepare the product to their own tastes. For some retail samples as no preparation was necessary, participant details were not recorded.

Samples were collected from the following establishments:

- 150 Family home samples (15 per area, suffix DO)
- 50 Family home samples who also provided a workplace sample (5 per area, suffix WD)
- 100 Workplace samples (10 per area, suffix WO)
- 100 Retail setting samples (10 per area, suffix CA)

For the retail samples:

- 48 samples from cafés;
- 25 samples from restaurants/public houses;
- 23 samples from coffee shops;
- 4 samples from mobile stalls.

In order to prevent any microbial degradation of the samples between collection and analysis, a preservative (sodium benzoate) was added. Citric acid was used to lower the pH of samples to the range where benzoate is effective as a preservative. Pre-prepared sample collection containers were filled with 0.15 g of sodium benzoate (equivalent to 600 milligrams per litre in 250 ml of drink) and 1 g citric acid (equivalent to 0.4 per cent w/v in 250 ml of drink) which is sufficient to lower the pH to less than 4. These concentrations were determined during the validation of the analytical method.

The total sample weight of each prepared sample was recorded and samples were stored refrigerated (ca. 4°C) at Ventress until despatch to RSSL for analysis. The drinks were despatched to RSSL in batches corresponding to each geographical area, and again were stored refrigerated (ca. 4°C) at RSSL until required for analysis. A storage stability trial was set up to ensure that the protocol was adequate for a ten-week storage period between sampling and analysis. A sub-sample was not taken due to the potential lack of homogeneity after precipitation of milk. It should also be noted that this survey has no enforcement implications. After analysis, original sample pots were resealed and were stored deep-frozen at -18°C to prevent sample deterioration.

The levels of caffeine were analysed in the prepared drinks.

Standard Solution

A stock caffeine standard of concentration 1000 mg/l was prepared fresh each week. A working calibration standard (50 mg/l) was made up fresh daily by diluting the stock caffeine standard with 1:20 in aqueous 0.06 per cent perchloric acid (mobile phase A).

Quality Control (QC) sample

The QC stock solution contained 2.2 g of Nescafe Original granules (Batch code HS2267M), dissolved in 250 ml of water. Prior to use the coffee granules were finely ground to ensure homogeneity. This stock solution was diluted at 1:10 with 50 per cent acetonitrile/water (v/v) to make the QC working standard. The stock and working standard solutions were prepared fresh each day.

Analytical Methodology

The method used for analysis was a variant of the RSSL in-house UKAS accredited method BR2 using reverse-phase gradient HPLC. The method was modified to ensure adequate separation of caffeine from the added benzoic acid by the use of 0.06 per cent perchloric acid (pH 2.5) as the aqueous mobile phase. Samples were brought to room temperature, agitated and 5 ml diluted to 50 ml by volume with 50 per cent acetonitrile/water (v/v). The flask was inverted to mix the contents and to encourage precipitation of any protein and fat. After settling, an aliquot was filtered through a glass fibre membrane (0.7 micron) and loaded into the HPLC autosampler. Decaffeinated samples were not diluted with 50 per cent acetonitrile/water (v/v), but were injected directly after filtration. Samples were run in analytical batches as received from Ventress e.g. 25-30 samples per batch, and also included a calibration standard (50 mg/l) of caffeine and a QC sample of instant coffee.

All samples were stored refrigerated and analysed within 10 weeks of collection. This timescale was validated during the stability trials where the level of caffeine was found to vary by less than 5.2 per cent over 30 weeks in prepared drinks, except for a decaffeinated sample where the variation was 7.8 per cent. No trend was seen in the data over this timescale. The method was validated to demonstrate that it was applicable to the direct analysis of tea and coffee samples containing milk.

HPLC Analysis

The HPLC system used was a Hewlett-Packard (Agilent) HP1100 diode array system operated under the following conditions:

Column:	Phenomenex Columbus 5 micrometres C8 4.6 × 150mm
Temperature:	45°C
Flow rate:	0.8 ml per minute
Injection Volume:	5 microlitres
Detection wavelength:	275 nm, bandwidth 4 nm
Reference wavelength:	550 nm, bandwidth 10 nm
Mobile phase A:	0.06 per cent perchloric acid in water
Mobile phase B:	Acetonitrile

Gradient programme:

<i>Time (mins)</i>	<i>Percentage Mobile phase A</i>	<i>Percentage Mobile phase B</i>
0	85	15
7	74	27
13	50	50
15	85	15
20	85	15

Samples were run in analytical batches of up to 30 samples. Every tenth analytical sample was prepared and run in duplicate.

The caffeine peak was identified by a retention time of ca. 4.5 minutes (typical response factor 5.3×10^{-2}) and was confirmed by diode-array spectral match (benzoic acid elutes at ca. 11 minutes under the conditions given). Caffeine was quantified with respect to the external standard calibration peak. Linearity has been demonstrated (r^2 greater than 0.999) between 10 and 100 mg/l caffeine as injected. Therefore this equates to 100 - 1000 mg/l for 'regular' samples which are diluted tenfold prior to analysis and 10 - 100 mg/l for decaffeinated samples. Samples of coffee with caffeine levels above 1000 mg/l were further diluted and re-analysed.

Quality Assurance

Each batch of samples included a mixed calibration standard and a Quality Control (QC) sample. A statistical analysis of the data for the replicates (Table B, Annex 1) showed a correlation coefficient of 0.9997.

The limits of detection and quantification were dependent on matrix interference and were typically in the region of 1 and 5 mg/l respectively.

Calculation of caffeine levels per serving

The caffeine levels were recorded as mg/l in the beverage as analysed. This was then multiplied by the mass of the sample in kg (Ventress data, corrected for nominal pot tare weight of 71.5 g) to give the absolute amount of caffeine (in milligrams) in that particular sample. One error arises from the relative density of the drink, but this is unlikely to exceed 1.030 for a sugar-sweetened drink or one made entirely from milk. Therefore the error from this source is likely to be an overestimate of caffeine concentration in a few cases by no more than 3 per cent. A second error arises from the variable tare weight of the sample pots. This was estimated by Ventress as 71.5 g (tare) plus or minus 4 g in a typical net mass of 250 g (ca. $\pm 1.6\%$). A very few samples weighed as little as 46 g net mass and so the maximum error here would be plus or minus 8.7%.

In some cases the calculated 'absolute amount of caffeine' was divided by two if the sample related to 2 cups e.g. a retail sample that included a free refill.

Reporting

Brand names have been reported as this survey was carried out in accordance with guidelines for reporting survey results published in the Food Safety Information Bulletin in September 1997. The absence of a particular brand from Table C (Annex 1) means only that the brand was not sampled in the survey e.g. it was not offered to the sampling officers in the family homes, workplaces or retail establishments where samples were taken. No further meaning should be read into its absence from this report.

Statistical analysis

An analysis of variance (ANOVA) of the data was used to explore the relationship between caffeine levels per serving (excluding decaffeinated samples) and the variables listed as follows:

- the type of sample e.g. instant tea, vending machine tea, teabags and loose leaf tea or instant coffee, ground coffee (i.e. espresso, cappuccino, filter) and vending machine coffee.
- the perceived strength of the sample.
- the age of the participant.
- the gender of the participant.
- the preparation method e.g. mashing or squeezing teabags.
- if prepared at home or work.

When performing multiple statistical significance tests on the same data, the more significance tests carried out, the more likely that one will be significant 'by chance'. Therefore, a Bonferroni correction was used which adjusts the level of significance of the individual tests to account for this, keeping the overall significance level the same (0.05).

For the purposes of the statistical analysis, tea and coffee products that were classed under two sample types (vending and teabag, or vending and ground coffee respectively) were classed as vending only. In some cases there were not sufficient numbers of samples in selected categories to perform statistical analysis.

Results and interpretation

In total 201 samples of teas and 199 samples of coffees were collected. The split over age and gender are shown in Table 1. The results of individual analyses are listed in Table A (Annex 1) and the distributions of caffeine levels in teas and coffees are illustrated in Figures 1-4. From the method of analysis, the measure of uncertainty in the caffeine level per serving was calculated as plus or minus 7.4 per cent. Information on the typical daily/weekly consumption of teas and coffees are not listed in this Information Sheet, but can be found in the contractor's report held in the Agency's library.

The sampling officers experienced difficulty in collecting equal numbers of ground and instant coffee samples from family homes and workplaces, and so the majority of ground coffee samples have been purchased from retail settings. Additionally, more women than men were willing to participate in the survey.

Caffeine ranges (mg per serving) for decaffeinated samples are shown in Table 2, and demonstrates that caffeine levels were less than 10 mg per serving. Tables 3 and 4 show the range and mean caffeine level per serving respectively for 'regular' samples (i.e. excluding decaffeinated samples). As expected, there is a significant difference (p less than 0.001) between the mean caffeine level per serving for ground (105 mg) and instant coffee (54 mg). Table 5 shows the mean serving size in grams for teas and coffees.

The results obtained from this survey were compared with the caffeine levels quoted for tea and coffee in the Agency's advice to pregnant women issued in 2001 (Table 6). This advice included information on the amount of cups (or mugs) of tea/coffee that equates to an intake of caffeine of 300 mg per day.

Statistical analyses were performed to see if there was a variation in the caffeine level with the perceived strength of 'regular' samples and with the preparation of tea samples (Table 7). A statistically significant difference was observed between the caffeine level per serving and the perceived strength of tea samples (p less than 0.001). As expected the caffeine level increased with perceived strength. As there was a low number of 'weak' coffee samples only the difference between medium and strong samples was tested. This showed a statistically significant difference ($p = 0.015$) between these two perceived strengths. Table 7 also shows that mashing or squeezing teabags produced tea containing more caffeine (p less than 0.001).

Conclusion

The results of this survey showed that there is a wide range of caffeine levels in teas and coffees prepared by consumers. Tea samples (excluding decaffeinated teas) ranged from less than 1 mg to 90 mg per serving with a mean of 40 mg per serving. For instant coffee samples (excluding decaffeinated coffees), the caffeine level ranged from 21 mg to 120 mg per serving with a mean of 54 mg per serving. For ground coffee samples (excluding

decaffeinated coffees), the caffeine level ranged from 15 mg to 254 mg per serving with a mean of 105 mg per serving. The caffeine levels in beverages also increased with perceived strength of the samples.

The survey shows that the levels of caffeine quoted in the Agency's advice to pregnant women are appropriate. Although the mean caffeine levels for instant coffee and tea are slightly lower than the caffeine levels used by the Agency to formulate the advice, due to the wide ranges of caffeine levels in teas and coffees this advice will not be revised. However, if pregnant women prefer stronger tea or coffee, or larger servings then they should drink fewer cups or mugs to make sure their caffeine intake does not exceed the recommended caffeine level.

References

1. Survey of caffeine and other methylxanthines in energy drinks and other caffeine-containing products. Food Surveillance Information Sheet Number 144, March 1998.
2. COT statement on the reproductive effects of caffeine. Available at <http://www.food.gov.uk/science/ouradvisors/toxicity/statements/cotstatements2001/caffeine>
3. Stavric B., Klassen R., Watkinson B., Karpinski K., Stapley R. and Fried P. Variability in caffeine consumption from coffee and tea: Possible significance for epidemiological studies. *Food and Chemical Toxicology*, 1988, 26(2), 111-118.
4. *The Coffee Extracts and Chicory Extracts (England) Regulations 2000* (S.I. [2000] No. 3323). HMSO.
5. European Community (1999). Commission Directive 1999/4/EC relating to coffee extracts and chicory extracts. Official Journal of the European Communities L66/26.
6. MAFF (2nd edition). *Food Portion Sizes*. London: HMSO, 1993.

Further Information

Units

mg/l = milligrams per litre

Further information on this survey can be obtained from:

Dr Wendy Dixon

Food Standards Agency

Chemical Safety and Toxicology Division

Room 515c, Aviation House

125 Kingsway

WC2B 6NH

Tel: +44 (0) 20 7276 8587

Fax: +44 (0) 20 7276 8514

Email: wendy.dixon@foodstandards.gsi.gov.uk

Further copies of this Information Sheet can be obtained from:

Library

Food Standards Agency

Ground Floor, Aviation House

125 Kingsway

WC2B 6NH

Tel: +44 (0) 20 7276 8181/8182

Fax: +44 (0) 20 7276 8193

E-mail: library&info@foodstandards.gsi.gov.uk.

A copy of the full report of this survey has been placed in the Library, Aviation House, 125 Kingsway, London, WC2B 6NH Tel. No. + 44 (0) 20 7276 8181/8182. If you wish to consult it please contact the library for an appointment giving at least 24 hours notice or alternatively copies can be obtained from the library: a charge will be made to cover photocopying and postage.

Table 1 – Summary of sample details for each area

Area Code	Sample Code	Product Category						Age						Gender			Location		Type of Premises			
		Tea			Coffee			19-24	25-34	35-49	50-64	>64	Male	Female	Urban	Rural	Cafés (including In-Store)	Coffee Shops	Restaurants / Public Houses	Mobile Stalls		
		Teabag/ Loose/ Instant	Vending	Instant Coffee	Ground Coffee	Vending																
LON	DO	11	0	3	1	0	2	2	3	3	5	6	9	15	0							
	WO	5	0	4	1	1	3	4	2	0	3	7	9	1								
	WD	1	0	3	1	0	1	3	1	0	2	3	4	1								
	CA	3	0	2	5	0	0	2	2	0	4	0	0	10	0	2	3	3	2	2		
	TOTAL	20	0	12	8	1	3	6	12	8	5	15	19	38	2	2	3	3	2	2		
NOR	DO	9	0	6	0	0	1	6	4	3	1	3	12	2	13							
	WO	4	0	4	0	2	0	4	6	0	0	1	9	7	3							
	WD	5	0	0	0	2	0	2	3	0	0	0	5	3	2							
	CA	2	0	1	7	0	1	1	2	0	0	1	3	8	2	6	1	3	0	0		
	TOTAL	20	0	11	7	2	2	13	15	3	1	5	29	20	20	6	1	3	0	0		
PRE	DO	7	0	7	1	0	1	3	3	4	4	5	10	8	7							
	WO	6	0	3	0	2	4	2	2	0	0	5	5	5	5							
	WD	4	0	1	0	3	2	0	2	0	0	1	4	2	3							
	CA	3	0	1	6	0	1	0	1	0	0	0	2	5	3	6	1	3	0	0		
	TOTAL	20	0	12	7	2	4	10	8	6	4	11	21	20	20	6	1	3	0	0		
SCO	DO	7	0	6	2	0	2	2	5	3	3	5	10	13	2							
	WO	4	1	4	0	2	1	1	7	1	0	5	5	10	0							
	WD	4	0	1	0	0	0	0	4	1	0	3	2	5	0							
	CA	5	0	0	5	0	2	6	0	0	0	3	5	8	2	1	5	4	0	0		
	TOTAL	20	1	11	7	2	5	9	16	5	3	16	22	36	4	1	5	4	0	0		
COA	DO	10	0	4	1	0	2	1	4	3	5	4	11	15	0							
	WO	4	1	5	0	1	3	3	3	0	0	4	6	8	2							
	WD	3	0	1	1	0	1	0	1	3	0	1	4	4	1							
	CA	2	0	3	5	3	1	1	1	0	0	0	3	9	1	5	2	2	1	1		
	TOTAL	19	1	13	7	3	5	5	9	9	5	9	24	36	4	5	2	2	2	1		
SOM	DO	8	0	7	0	0	3	2	4	0	6	2	13	14	1							
	WO	4	1	2	1	2	0	1	3	6	0	2	8	10	0							
	WD	3	0	1	1	0	0	0	2	3	0	0	5	5	0							
	CA	5	0	1	4	0	0	2	2	1	0	1	4	8	2	7	1	1	1	1		
	TOTAL	20	1	11	6	2	3	5	11	10	6	5	30	37	3	7	1	1	1	1		
SUF	DO	11	0	0	5	0	2	1	3	10	0	7	9	4	12							
	WO	5	1	2	1	3	0	0	4	6	0	4	6	10	0							
	WD	2	0	2	1	0	0	0	1	4	0	0	5	3	2							
	CA	4	0	0	6	0	0	0	0	5	0	1	4	10	0	5	3	2	0	0		
	TOTAL	22	1	4	13	3	2	1	8	25	0	12	24	27	14	5	3	2	2	0		
WAL	DO	8	0	4	3	0	2	4	2	4	3	8	7	15	0							
	WO	4	2	1	1	4	1	3	3	0	0	6	4	10	0							
	WD	2	0	2	1	0	0	1	2	2	0	4	1	5	0							
	CA	5	0	0	5	0	3	0	1	2	0	0	6	10	0	4	2	4	0	0		
	TOTAL	19	2	7	10	4	6	8	8	11	3	18	18	40	0	4	2	4	0	0		

Area Code	Sample Code	Product Category						Age				Gender		Location		Type of Premises				
		Tea			Coffee			19-24	25-34	35-49	50-64	>64	Male	Female	Urban	Rural	Cafés (including In-Store)	Coffee Shops	Restaurants / Public Houses	Mobile Stalls
		Teabag/ Loose/ Instant	Vending	Instant Coffee	Ground Coffee	Vending														
WOR	DO	6	0	5	3	0	1	1	1	5	6	3	11	3	11					
	WD	5	0	2	2	3	0	2	4	4	0	3	7	10	0					
	WO	3	0	2	0	0	0	1	2	2	0	2	3	4	1					
	CA	5	0	0	5	0	2	0	1	4	1	3	5	8	2	7	1	2	2	0
	TOTAL	19	0	9	10	3	3	4	8	15	7	11	26	25	14	7	1	2	2	0
YOR	DO	9	0	4	2	0	2	4	5	1	3	4	11	12	3					
	WO	4	0	5	0	2	2	2	4	2	0	3	7	8	2					
	WD	3	0	2	0	0	1	1	1	2	0	0	5	4	1					
	CA	2	0	2	6	0	1	1	0	2	1	1	4	9	1	5	4	1	1	0
	TOTAL	18	0	13	8	2	6	8	10	7	4	8	27	33	7	5	4	1	1	0
TOTALS	DO	86	0	46	18	0	18	26	34	36	36	47	103	101	49					
	WO	45	6	32	6	20	8	23	40	29	0	36	64	87	13					
	WD	30	0	15	5	0	2	9	21	18	0	13	37	39	11					
	CA	36	0	10	54	3	11	11	10	16	2	14	36	85	15					
	GRAND TOTAL	197	6	103	83	23	39	69	105	99	38	110	240	312	88	48	23	25	4	4

If the vending/tea trolley product was described as instant tea or as instant or ground coffee, the sample has been placed in all relevant columns.

Sample codes: samples taken from family homes (DO), workplaces (WO), family homes sampled via the workplace (WD) and retail establishments such as cafés or restaurants (CA).

Area codes: London and Home Counties (LON), Northern Ireland (NOR), North West England (PRE), Scotland (SCO), Somerset (SOM), South Coast (COA), Suffolk (SUF), Wales (WAL), Worcestershire (WOR) and Yorkshire (YOR).

Table 2 – Summary of caffeine levels in decaffeinated samples

	Mean serving size (g)	Caffeine level range (mg per serving)	Mean caffeine level per serving (mg) Number of samples in brackets
Teabag	223	0.6 - 2	1 (5)
Instant coffee	197	1 - 4	2 (7)
Ground coffee	145	4 - 8	6 (2)

Table 3 – Summary of caffeine level ranges (excluding decaffeinated samples)

	Caffeine level range (mg per serving)			
	Tea	Coffee		
		Instant	Ground	All [‡]
Family home samples (DO)	3 - 71	21 -116	47 - 159	21 -159
Workplace samples (WO)	7 - 90	23 -120	62 - 137	23 - 137
Family home samples who also provided a workplace sample (WD)	<1 - 73	24 - 85	91 - 218	24 - 218
Retail samples (CA)	8 - 71	23 - 98	15 - 254	15 - 254
All samples	<1 - 90	21- 120	15 - 254	15 - 254

[‡] includes vending samples

Table 4 – Summary of mean caffeine levels (excluding decaffeinated samples)

	Mean caffeine level per serving (mg)			
	Number of samples in brackets			
	Tea	Coffee		
		Instant	Ground	All[‡]
Family home samples (DO)	43 (81)	50 (43)	93 (18)	63 (61)
Workplace samples (WO)	37 (49)	59 (27)	100 (2)	59 (49)
Family home samples who also provided a workplace sample (WD)	42 (30)	57 (13)	150 (5)	83 (18)
Retail samples (CA)	36 (36)	54 (8)	105 (51)	98 (62)
All samples	40 (196)	54 (91)	105 (76)	75 (190)

[‡] includes vending samples

Table 5 – Summary of mean serving sizes (excluding decaffeinated samples)

	Mean serving size (g)			
	Tea	Coffee		
		Instant	Ground	All[‡]
Family home samples (DO)	236	231	230	273
Workplace samples (WO)	224	232	206	208
Family home samples who also provided a workplace sample (WD)	248	269	264	268
Retail samples (CA)	208	196	204	203
All samples	230	234	215	219

[‡] includes vending samples

Table 6 – Comparison of mean caffeine levels in previous Agency advice and levels determined in this survey.

	Caffeine level in FSA advice (mg)	Mean caffeine level determined in survey (mg)*
Average cup of instant coffee	75	45
Average mug of coffee	100	61
Average cup of brewed coffee	100	111
Average cup of tea	50	33

* calculated from average caffeine concentration (mg/l), assuming a cup is 190 g and a mug is 260 g.⁶ Does not include decaffeinated samples.

Table 7 – Caffeine level per serving with strength of samples or preparation method (excludes decaffeinated samples)

Perceived strength of sample or preparation method	Caffeine level range (mg per serving)		Mean caffeine level per serving (mg) Number of samples in brackets	
	Tea	Coffee	Tea	Coffee
Weak	<1 - 71	30 - 105	25 ± 2 (42)	53 ± 10 (7)
Medium	9 - 90	21 - 218	42 ± 1 (115)	61 ± 3 (97)
Strong	25 - 71	22 - 189	51 ± 2 (33)	78 ± 5 (45)
Mash/squeeze teabag	15 - 71	N/A	46 ± 2 (79)	N/A
Not mash/squeeze teabag	<1 - 90	N/A	36 ± 2 (107)	N/A

Figure 1 – Distribution of caffeine level in ground coffee samples

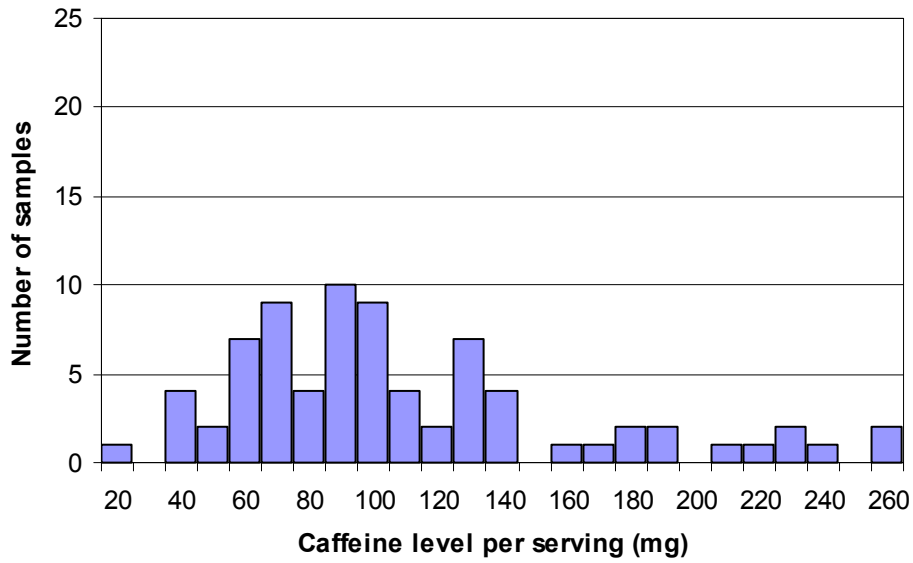


Figure 2 – Distribution of caffeine level in instant coffee samples

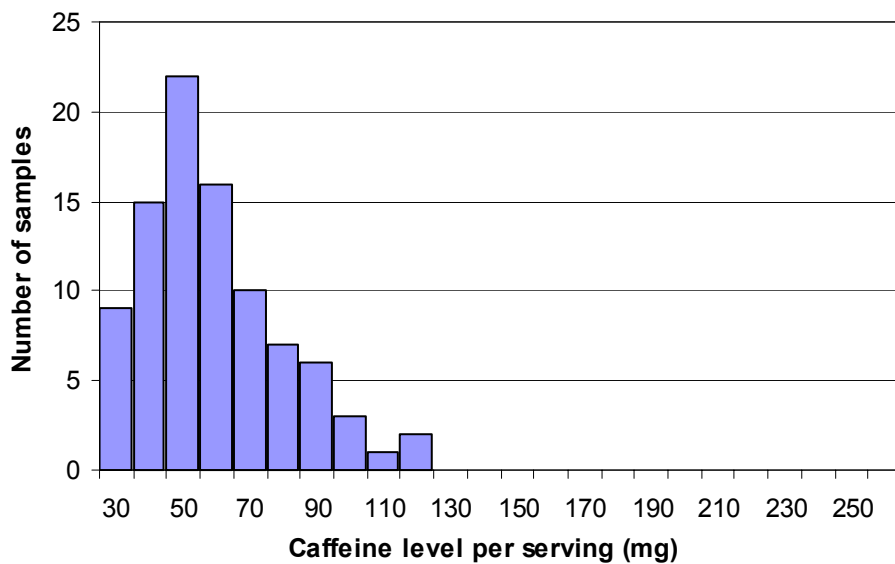


Figure 3 – Distribution of caffeine level in vending coffee samples

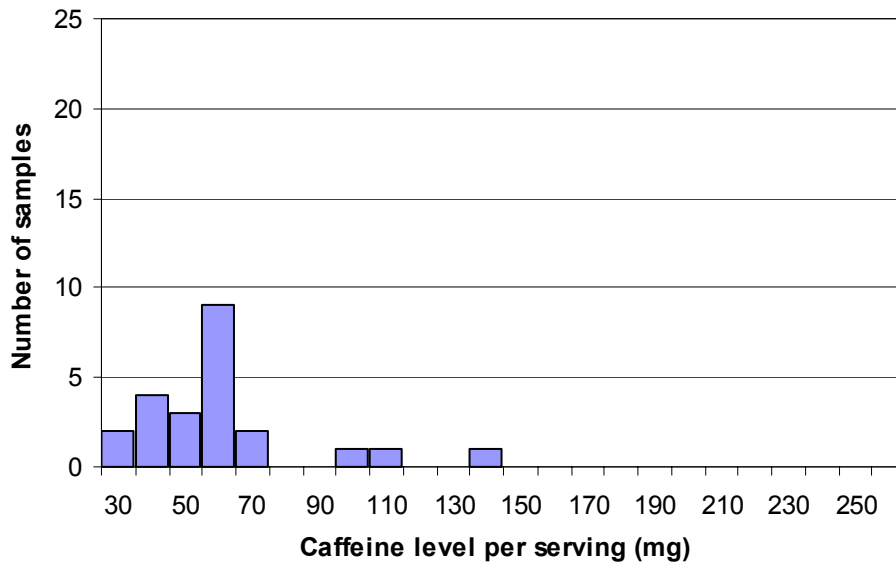


Figure 4 – Distribution of caffeine level in all tea samples

