Eur Arch Psychiatry Clin Neurosci (1996) 246:83–92

ORIGINAL PAPER

Manfred Rihs · Christian Müller · Pierre Baumann

Caffeine consumption in hospitalized psychiatric patients

Received: 6 February 1995 / Accepted: 1 September 1995

Abstract A total of 98 consecutively admitted psychiatric inpatients were asked for their daily consumption of coffee, tea and other products containing caffeine. Calculation of the corresponding daily caffeine intake was performed using data from the literature and from caffeine measurements carried out in different coffee and tea preparations in the hospital. Of the patients 13% presented a high (≥ 750 mg daily) caffeine consumption before hospitalization. The average caffeine consumption per day decreased from 405 mg before to 332 mg during hospitalization ($P < 0.04$), but the before and during hospitalization caffeine consumptions were highly correlated (rho = 0.651; $P < 0.00001$). The decrease in caffeine consumption seems to be influenced by a lower availability of caffeine at hospital. Among the diagnostic groups (DSM-III-R criteria), the caffeine intake was highest in schizophrenia and lowest in anxiety and major depression patients. Patients under a neuroleptic treatment before admission presented a higher caffeine intake. At hospital the high caffeine users showed the highest score on the factor depression (Hopkins Symptom Checklist; HSCL-58). However, the influence of other factors, such as weight and cigarette consumption, which correlated also with the caffeine intake (rho = 0.359; $P < 0.001$; and rho = 0.83; $P < 0.00001$, respectively), have also to be considered. Our data suggest that inquiry into caffeine consumption should be included routinely for psychiatric patients, e.g. at admission, because patients with a psychotic disorder undergo a higher risk for an excessive caffeine consumption.

Key words Caffeine consumption · Smoking · Psychiatric patients · Psychopathology · Psychiatric hospital

Manfred Rihs[1] · Christian Müller[2] · Pierre Baumann (✉)
Unité de biochimie et psychopharmacologie clinique, Département universitaire de psychiatrie adulte (DUPA), Site de Cery, CH-1008 Prilly, Lausanne, Switzerland

Present addresses:
[1] Externer Psychiatrischer Dienst des Kantons Aargau, Königsfelden, CH-5201 Brugg, Switzerland
[2] Herrengasse 23, CH-3011 Berne, Switzerland

Introduction

Caffeine is a widely used psychoactive substance, present in food, but also in pharmaceutical preparations (Dews 1984; Paul and Skolnick 1981; Bruce and Lader 1986). Caffeine is discriminated by humans in doses as low as 10–56 mg (Griffiths et al. 1990). Single doses (100–400 mg) of caffeine may produce slight increases in elation, positive mood and amphetamine-like effects (Goldstein et al. 1965; Oliveto et al. 1990; Bruce et al. 1986), but also aversive effects such as increased anxiety and dysphoria (Stern et al. 1989) in healthy volunteers. Regular caffeine consumers experience less effects after 500 mg, due to tolerance. Furthermore, withdrawal effects are regularly seen in habituated caffeine users (Goldstein and Kaizer 1969). They are characterized by an onset latency of 19 h, peaking on days 1 and 2, and a progressive decrease over the next 5 or 6 days, and they consist of increased headache, sleepiness, laziness and decreased alertness and activeness (Griffith et al. 1986).

Neither the Swiss nor the European average caffeine consumption of the general adult population is exactly known. American investigations based on data obtained in 1977 and 1972 showed a mean daily intake of about 200 mg, or 3 mg/kg body weight, per adult (Gilbert 1976; Graham 1978; Barone and Roberts 1984). Three studies undertaken in the UK showed mean daily caffeine consumption varying between 359 and 621 mg [Galliano 1982 (unpublished; cf Table 5); Bruce et al. 1986; Scott et al. 1989].

Marketing surveys of the per capita consumption of green coffee beans in 1972 (Pan American Coffee Bureau) and of tea leaves in 1970 (International Tea Committee) suggest a similar pattern of consumption of the American (6.3/0.2 kg) and the Swiss (6.2/0.2 kg), but not of the UK, population (2.2/3.8 kg).

Greden et al. (1981) defined three groups of coffee drinkers: low (0–249 mg per day), moderate (250–749 mg) and high caffeine consumers (750 mg or more). Of 83 psychiatric inpatients 22% were found to be high caffeine

consumers who had comparatively high scores on the State and Trait Anxiety Scale (STAI) and on Beck's depression rating scale (BDI; Greden et al. 1978). European psychiatric populations have been the subject of only two studies, those of Galliano (1982 unpublished) and of Winstead (1976), the latter undertaken in a U.S. Army Hospital in Germany (no indications of the nationality of the patients, but probably mostly Americans). The percentage of high caffeine consumers (> 750 mg daily) seems to be remarkably higher in the studies investigating psychiatric patients compared with normal adults. DSM-III-R (1987) defines a disorder called 'caffeine intoxication' (305.90), and the chapter V (F) of the ICD-10 (1990) includes effects due to caffeine in the category F15.

There were mainly two reasons based on personal observations which prompted us to undertake a study on the caffeine consumption of psychiatric inpatients. We have frequently observed that a major part of the chronic patients (with long-term hospitalizations, mostly schizophrenics) consume many cups of coffee per day. This behaviour may be motivated by the social aspects of coffee drinking (e.g. the coffee house or the coffee break), by psychological reasons such as habituation, ritualization, boredom, or by psychopharmacological reasons to increase alertness, to avoid caffeine withdrawal states or search for relief of uncomfortable medication effects, e.g. sedation. On the other hand, anxiety patients show an increased sensibility to caffeine especially concerning its anxiogenic properties. These patients seem to present a lower mean caffeine consumption indicating a caffeine-avoiding behaviour.

Therefore, in this investigation the caffeine, cigarette and alcohol consumption before and during hospitalization of psychiatric inpatients was studied, taking into account their diagnosis, medication and scores in the Hopkins Symptom Checklist (HSCL-58; Derogatis et al. 1974) and the Somatic Symptom List (SL-29; Boulenger 1986, personal communication). Preliminary results of this study have been published previously (Rihs and Baumann 1989).

Patients and methods

From 172 patients admitted to a general acute psychiatric section with one open and one closed ward of similar size, 107 fulfilled the selection criteria 'hospitalization since 14 days at least' within a 9 month period (from October 1986 to June 1987). Moreover, 3 patients (two alcoholics and one schizoaffective) did not consent to participate, 3 were unable to participate for medical reasons (2 with severe dementia; one suffered from a persistent confusional state) and 2 for organizational reasons (one major depression and one schizophrenia patient). The only patient with alcoholism as DSM-III-R axis-I diagnosis was excluded for the final evaluation.

The diagnoses of the finally included 98 psychiatric inpatients, 48 women and 50 men, with a mean age of 41.3 years (SD ± 13.1 years; range: 20–68 years) are presented in Table 1. All patients were examined by one of us (M. R.), generally within the third week of hospitalization or as early as their mental state allowed for examination (Mean ± SD 28.0 ± 19.5 days; range 14–150 days). The study was explained to the patients as a general investigation about nutritional habits, focusing on beverages and food such as chocolate.

A total of 96 patients completed the HSCL-58 (Derogatis et al. 1974) with 58 items and the SL-29 (Boulenger 1986), a rating scale which questions about known symptoms occurring during caffeine intoxication (29 items, e.g. tremulousness and increased urination, with possible answers to range in five degrees). Both scales focused on the actual symptomatology (past 24–48 h).

Furthermore, the caffeine, cigarette (none, 1–10, 11–20,... 71–80 cigarettes/day) and alcohol consumption (none, < 2, 2–5, 5–10, > 10 dl of wine-equivalents/day; beer × 0.5; strong liquor × 4) was explored in a semistructured interview focusing on the habitual (before hospitalization) and the actual (during hospitalization) consumption. For the habitual consumption the final 'healthy' peroid lasting several months before psychiatric decompensation was taken into account, whereas the present consumption concerned the last 48-h period before the interview. The patients were split into caffeine subgroups, using the criteria of Greden et al. (1981), into low (0–249 mg/day), moderate (250–749 mg/day) and high (≥ 750 mg/day) consumers.

Table 1 Diagnostic data in 98 psychiatric inpatients and their daily caffeine consumption (mg)

Caffeine groups	*N*	Before hospitalization (all)	During hospitalization (all)	Before hospitalization (*n*)			During hospitalization (*n*)		
		Mean ± SD	Mean ± SD	Low	Mod	High	Low	Mod	High
Schizophrenia	21	545 ± 321[a]	428 ± 238[c]	4	11	6	5	15	1
Psychosis NEC, delusions	20	483 ± 571	303 ± 196	6	11	3	9	11	–
Major depression	17	268 ± 208[b]	234 ± 143[d]	8	8	1	9	8	–
Other mood disorders	12	489 ± 430	494 ± 261[e]	4	5	3	2	6	4
Adjustment disorder	17	276 ± 155	277 ± 146	5	12	–	8	9	–
Anxiety disorders	5	222 ± 274	315 ± 235	4	1	–	3	2	–
Organic Mental disorder	6	388 ± 154	217 ± 138	1	5	–	4	2	–
All diagnostic groups	98	405 ± 368*	332 ± 213**	32	53	13	40	53	5

Caffeine consumption of all diagnostic groups
* $p < 0.05$, H = 13.1 $df = 6$, Kruskal-Wallis; multiple comparisons: $p < 0.05$, Schizophrenia > major depression;
** $p < 0.02$, H = 15.3, $df = 6$, Kruskal-Wallis; multiple comparisons: $p < 0.05$, Schizophrenia > major depression; $p < 0.05$, Other mood disorders > major depression

Caffeine consumption of one diagnostic group compared with the other patients
Before hospitalization: [a] $p < 0.01$: Schizophrenia vs other patients; [b] $p < 0.05$: Major depression vs other patients;
During hospitalization: [c] $p < 0.02$: Schizophrenia vs other patients; [d] $p < 0.03$; Major depression vs other patients;
[e] $p < 0.01$: Other mood disorders vs other patients.

Table 2 Average caffeine content of drinks (in mg caffeine per cup) and of food, as indicated by the literature and measurements at the hospital

Author	Coffee				Tea	Cola beverage	Chocolate	
	Dripped	Espresso	Instant	Decaffeinated			Drinks	Bar
Burg 1975	83	–	59	3	41	–	–	–
	64–124	–	40–108	2–8	30–48	–	–	–
Gilbert 1981	112[a]	74	66	2	27	–	6	20/30 g
Boulenger 1985	75–150	75–150	60–100	3–6	40–60	35–55	15–30	–
Scott et al. 1989[b]	133		64		55	14	14	
Milon 1980[c]	90–165	60	80	0.2–3.2	–	–	–	–
Caffeine sources at the Psychiatric Clinic of Lausanne, Switzerland:								
Milon (unpublished)[d]	53	73–121	–	–	23–41	–	–	–

[a] The FDA (1980) cites a range of 75–155 mg of caffeine per cup of coffee, indicating that percolated coffee is in the lower part of this range and dripped coffee in the upper

[b] UK data (mg/200 ml)

[c] Swiss data (all other concern American data): Milon H, Gutknecht AM (1980) How much caffeine do we ingest with coffee? Biological Experimentation Services, Labior Nestlé, Orbe, Switzerland (unpublished)

[d] Milon H (1987) Measurement of the caffeine content of the beverages of the Psychiatric Clinic of the University of Lausanne, Switzerland (personal communication)

To calculate the habitual daily caffeine consumption before hospitalization, the patients were asked about their consumption of the following beverages or foods [approximate caffeine content per cup according to mean figures of the literature (Table 2)]: dripped (110 mg), espresso or soluble coffee (70 mg), black tea (40 mg), hot and cold chocolates (20 mg), cola beverages (30 mg/0.2 l), chocolate bars (20 mg/bar containing approximately 20 g of chocolate) – and on which occasions it occurred.

The actual daily caffeine consumption during hospitalization was calculated using four caffeine content measurements, carried out twice on different days (Milon 1987, unpublished; Table 2). The beverages served inside the units (dripped coffee and tea) were lower in caffeine content due to the use of coffee surrogates (approximately 40%) and of lower amounts of tea leaves by the food department of the hospital.

Coffee and tea were served on the ward three times daily during each meal, containing 53 mg (0.13 l/cup) and 23 mg (0.11 l/cup) of caffeine per cup, respectively. Outside the ward, caffeine-containing beverages were available at the cafeteria [coffee, tea and cola beverages containing 70 mg (0.092 l/cup) and 41 mg (0.16 l/cup) per cup, and 30 mg of caffeine/0.2 l bottle]. Patients also had limited access to three vending machines outside the units, spending 80 mg as espresso (0.07 l/cup) or normal coffee (0.15 l/cup), 110 mg as espresso (0.05 l/cup) and 121 mg (0.1 l/cup) of caffeine per cup, respectively.

For statistical purposes, only nonparametric tests were used: Mann-Whitney U-test, Wilcoxon test, Spearman correlation coefficient, Kruskal-Wallis one-way analysis of variance (extended with the 'multiple comparisons' test), χ^2 test (Siegel and Castellan 1988). For statistical comparisons of the three caffeine subgroups during hospitalization, the moderate and the high consumers were grouped and compared with low consumers (because of the low number of patients in the high group). If not otherwise specified, results concern the *before hospitalization* consumption of caffeine or cigarettes, respectively.

Results

Demographic and diagnostic data

Tables 1 and 3 show different demographic and diagnostic variables: 59.6 and 11.2% of the patients had the same DSM-III-R axis-I diagnosis for more than 2 years or less than 3 months, respectively. All were hospitalized between 2 weeks (selection criterion) and 8 months, except two long-term patients.

Caffeine consumption in subgroups of patients (demographic variables)

The caffeine consumption as reported by the patients mainly reflected their coffee consumption. Black tea, colas and chocolate, if any, accounted for less than 100 mg caffeine daily. Over-the-counter medications containing caffeine were rarely taken by our patients, neither before nor during hospitalization.

The average caffeine consumption decreased significantly from 405 mg daily before to 332 mg during hospitalization (Fig. 1). During both periods the consumption varied greatly from patient to patient, with a range from 0 to 2500, and from 10 to 810 mg daily, respectively. But there was a significant correlation between the consumption before and during hospitalization. There were 13 of the 98 patients before hospitalization, but only 5 during hospitalization, who drank more than about eight cups of coffee per day ($\geq$ 750 mg/day). While the former high consumers dramatically diminished their caffeine consumption during hospitalization, the low group had an increased intake. But the consumption of the three groups was still significantly different from each other (Kruskal-Wallis test; $P < 0.01$).

A further examination of the data revealed that these three caffeine subgroups differed with regard to many demographic variables. The younger patients (< 40 years) presented a higher mean caffeine intake, and ten of the 13 high caffeine consumers, but only 11 of the 32 low consumers, were under 40 years old (Table 3). With increasing age there was a tendency towards a decrease in caf-

Table 3 Demographic data in 98 psychiatric inpatients and their caffeine consumption

Caffeine groups	Before hospitalization	During hospitalization	Before hospitalization			During hospitalization		
	All	All	Low	Mod	High	Low	Mod	High
No. of patients	98	98	32	53	13	40	53	5
Caffeine (mg/day mean ± SD)	405 ± 368 (A)	332 ± 213 (B)						
Range (mg/day)	0–2500	10–810						
Cigarette (cig/day)	20.2 (C)	20.6 (D)	15.6	20.8	29.2	13.0	23.8	48.0
Nonsmokers (*n*)	32	32	15	15	2	17	15	0
1–20 cig/day (*n*)	33	28	9	21	3	15	13	0
> 20 cig/day (*n*)	33	38	8	17	8	8	25	5
Age (< 40 years; *n*)	49 (E)	49	11	28	10 (a)	18	26	5
Male (*n*)	50	50	15	27	8	20	29	1
Weight (< 65 kg; *n*)	53	53	21	28	4	26	26	1
Married (*n*)	32	32	13	15	4	15	16	1
Working before admission (*n*)	41 (F)	41 (G)	15	24	2	18	21	0
Evolution of illness (< 3 months; *n*)	11	11 (H)	2	8	1	9	2	0
Voluntary admission (*n*)	45 (I)	45 (J)	9 (b)	31	5 (c)	9 (d)	33	3
Closed-door ward (*n*)	57	57 (K)	19	27	11	28 (e)	27	2
Duration of hospitalization (days)	65.8 ± 45.7		63.3	64	78.8	61	67.4	91.3
Range (days; all < 14 days; *n* = 96*)	15–233		15–176	16–202	21–233	16–180	15–202	38–233

*Except 2 long term patients

All patients
(A) (B) $P < 0.04$, Wilcoxon; caffeine intake before vs during hospitalization
(A) (B) $P < 0.00001$, rho = 0.651; correlation between caffeine before and during
(C) (D) $P < 0.00001$, rho = 0.83; correlation between cigarette before and during
(A) (C) $P < 0.001$, rho = 0.343; correlation between caffeine and cigarette before
(B) (D) $P < 0.00001$, rho = 0.542; correlation between caffeine and cigarette during

The first of the following subgroups presented a higher caffeine consumption:
(E) $P < 0.02$; age < 40 years vs > 40 years
(F) $P < 0.05$; 'No regular working place' before admission vs 'regular working place'
(G) $P < 0.03$, 'No regular working place' before admission vs 'regular working place'
(H) $P < 0.03$, Illness evolution of > 3 months vs < 3 months
(I) $P < 0.02$, voluntary vs non voluntary admission
(J) $P < 0.01$, voluntary vs non voluntary admission
(K) $P < 0.03$, open vs closed-door ward

Comparison between the three caffeine subgroups (low–moderate–high)
(a) $P < 0.03$, $\chi^2 = 7.06$, $df = 2$, chi-square; low vs moderate vs high
(b) $P < 0.02$, $\chi^2 = 6.06$, $df = 1$, chi-square; low vs moderate and high
(c) $P < 0.03$, $\chi^2 = 7.74$, $df = 2$, chi-square; low vs moderate vs high
(d) $P < 0.001$, $\chi^2 = 14.9$, $df = 1$, chi-square; low vs moderate and high
(e) $P < 0.05$, $\chi^2 = 3.89$, $df = 1$, chi-square; low vs moderate and high

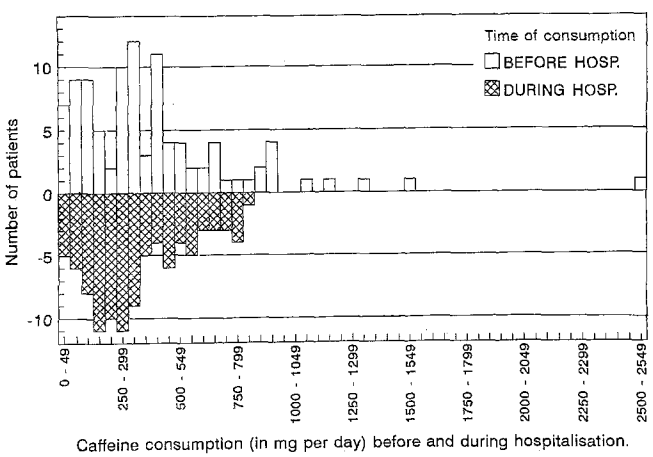

Fig. 1 Caffeine consumption (mg/day) before and during hospitalization in 98 psychiatric patients

feine consumption (rho = 0.187; $P < 0.10$). Patients with a higher weight (> 65 kg) consumed more caffeine ($P < 0.001$). There was a highly significant correlation between weight and caffeine consumption (rho = 0.359; $P < 0.001$), but age and weight did not correlate significantly.

A total of 41 patients had a regular working place before admission (Table 3). Their mean caffeine consumption was significantly lower before and during hospitalization compared with the other patients (housewife, -man; pensioner, rentier, unemployed or patients in a protected workshop; before hospitalization: 307 ± 220 vs 475 ± 434 mg/day; during hospitalization: 278 ± 191 vs 371 ± 222 mg/day).

There were 11 patients with an evolution of the actual illness of under 3 months: compared with the other patients they showed a similar caffeine consumption before

hospitalization, but at the hospital their consumption was significantly lower (199 ± 88 vs 349 ± 219 mg/day; $P < 0.03$), because 9 of them were low consumers (Table 3). The mean number of hospitalizations correlated positively with caffeine consumption (rho = 0.205; $P < 0.05$).

On the other hand, the voluntary admitted patients were underrepresented in the low caffeine subgroup before and after hospitalization. They indicated a higher caffeine intake than the patients admitted nonvoluntarily (Table 3). The voluntarily admitted patients were unequally distributed between the two wards: They represented only 20 of the 57 patients residing in the closed-door unit, but 25 of the 41 patients staying in the open-door ward ($P < 0.02$; $\chi^2 = 6.43$; $df = 1$). Of the 13 high consumers, 11 resided in the closed-door ward, but at the hospital these patients consumed significantly less caffeine than those in the open-door ward ($P < 0.03$). This was probably due to the fact that they had less ready access to caffeine beverages (cf. Discussion).

All other personal variables, such as gender, marital state and duration of hospitalization, did not present any direct relationship with the daily caffeine consumption.

Caffeine consumption in diagnostic groups

The caffeine consumption of patients grouped by their diagnosis according to the DSM-III-R classification is presented in Table 1. The caffeine intake varied significantly across the diagnostic groups before and also during hospitalization:

The schizophrenic patients presented the highest mean caffeine intake, and it was significantly higher compared with the other patients: 28% of them were high consumers vs 9.1% of the other patients. A still remarkably high caffeine intake was found in the 'psychosis NEC' and the 'other mood disorders' group. Anxiety disorder patients had the lowest consumption, together with the major depression and the adjustment disorder group. The schizophrenia group consumed significantly more caffeine than the major depressives. Also 'other mood disorder' patients consumed more than major depressives, but only during hospitalization. The consumption before and during hopitalization was significantly correlated in the patients with a diagnosis of schizophrenia (rho = 0.604; $P < 0.01$), psychotic disorders NEC (rho = 0.706; $P < 0.01$) and other mood disorders (rho = 0.801; $P < 0.01$). The schizophrenia ($P < 0.04$) and 'organic mental disorder' ($P < 0.02$) groups presented a significant decrease in caffeine consumption from before to during hospitalization, whereas the major depression, other mood and adjustment disorder groups maintained a similar caffeine consumption at hospital. The anxiety disorder patients were the only group for which the caffeine intake tended to increase with hospitalization.

The diagnostic groups did not differ with regard to demographic variables such as gender, marital status and voluntary admission, but the mean age of the diagnostic groups varied significantly: The two diagnostic groups with the lowest mean age (schizophrenia and psychosis NEC) were both significantly younger than the two oldest groups (major depression and organic mental disorder; $P < 0.05$).

Caffeine consumption and medication

The low–moderate–high caffeine subgroups did not show any significant variation in terms of frequency of prescription for neuroleptics, antidepressants and minor tranquilizers, neither before nor during hospitalization.

The comparison of the caffeine consumption of those patients taking one of these medications vs the intake of the others showed no significant difference, with one exception: Compared with the other patients, the 33 patients treated with neuroleptics before hospitalization consumed significantly more caffeine before ($P < 0.05$) and during ($P < 0.01$) hospitalization. But compared with the other patients, this subgroup presented significant differences concerning two important variables, because schizophrenics and patients with a long-time evolution were significantly overrepresented: There were 14 schizophrenics ($P < 0.001$; $\chi^2 = 11.2$; $df = 1$), and 28 of these 33 patients had an illness evolution of more than 2 years ($P < 0.001$; $\chi^2 = 11.1$; $df = 1$).

At the hospital 62 patients were treated with neuroleptics (31 continued and 31 started such a treatment). Compared with the patients without neuroleptics, these 62 patients showed a higher caffeine consumption before hospitalization (481 ± 424 vs 273 ± 185 mg/day; $P < 0.02$; U-test), which decreased significantly at the hospital ($P < 0.01$; Wilcoxon test). But during hospitalization both subgroups showed similar consumption rates (349 ± 223 vs 302 ± 194 mg/day). Both subgroups presented a high correlation between the caffeine intake before and during stationary treatment (patients with neuroleptics at hospital: $P < 0.00001$, rho = 0.716; without neuroleptics: $P < 0.02$, rho = 0.430).

Cigarette consumption

The cigarette consumption is representative of the overall tobacco consumption because pipes and cigars were not used by our population. A significant and positive correlation existed between cigarette consumption during hospitalization and age ($P < 0.02$; rho = 0.262), and a significant and negative correlation was calculated between cigarettes and the number of hospitalizations (before: $P < 0.00001$, rho = 0.527; during: $P < 0.0001$, rho = 0.438). There was no significant difference in tobacco use in the closed ward compared with the open-door ward. The smoking behaviour before and during hospitalization was not only similar, but strongly correlated (Table 3). Between caffeine and cigarette consumption, a strong correlation existed both before and during hospitalization.

The three caffeine groups (low–moderate–high) showed significant differences in cigarette use (Fig. 2 and Table 3).

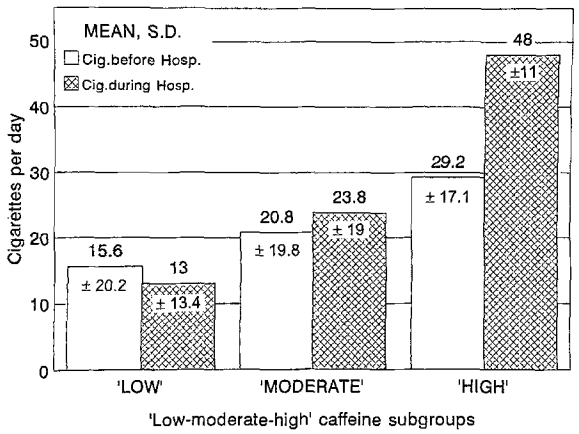

Fig. 2 Cigarette consumption of the low–moderate–high caffeine subgroups. Cigarette consumption before hospitalization: $P < 0.05$; H = 6.2; $df = 2$ (Kruskal Wallis test); $P < 0.05$, Kruskall-Wallis multiple comparisons: high > low caffeine consumers. Cigarette consumption during hospitalization: $P < 0.001$, H = 17.3, $df = 2$ (Kruskal Wallis test); $P < 0.05$, each, Kruskall-Wallis multiple comparisons: high > moderate > low caffeine consumers

High caffeine consumers smoked more than low consumers. During hospitalization high caffeine users smoked significantly more than moderate, and moderate more than low caffeine consumers.

The diagnostic groups also showed important differences in their cigarette consumption. Especially the schizophrenic patients appeared to be heavier smokers than the other patients [psychoses not elsewhere classified (NEC) and delusions, major depression, organic mental disorders ($P < 0.05$ for each comparison) before and/or during hospitalization].

Comparing the caffeine intake across five levels of alcohol consumption, no significant variation was noted (Kruskal-Wallis test).

The Hopkins Symptom List (HSCL-58) and Somatic Symptom List (SL-29)

For the whole sample the SL-29 and the HSCL-58 total scores were highly and positively correlated ($P < 0.0001$; rho = 0.72). The same association existed for the diagnostic groups: schizophrenia, major depression, other mood disorders, adjustment disorders (each: $P < 0.02$).

Table 4 presents an overview of the HSCL total and factor scores and the SL-29 total scores of the low–moderate–high caffeine subgroups. The moderate caffeine consumers before hospitalization scored lowest on the HSCL factor 'somatization' and on the SL-29 total.

At hospital the high caffeine users showed the significantly highest score on the factor depression. Furthermore, this factor was positively correlated with the caffeine consumption at hospital ($P < 0.05$; rho = 0.201).

Significant, positive correlations were found between the following diagnostic group's factor scores and caffeine consumption during hospitalization:

1. 'Schizophrenia', factor 'interpersonal sensitivity' ($P < 0.01$, rho = 0.638)
2. 'Adjustment disorder', factor 'somatization' ($P < 0.05$; rho = 0.514)
3. 'Adjustment disorder', factor 'anxiety' ($P < 0.05$; rho = 0.515)

The HSCL-58 total score was positively correlated with cigarette consumption before ($P < 0.05$; rho = 0.204) and also during hospitalization ($P < 0.02$; rho = 0.243; Spearman test). Two of the five HSCL-58 factors, interpersonal sensitivity and depression ($P < 0.05$), were positively associated with cigarette use at hospital.

Table 4 Hopkins Symptom Checklist (HSCL-58) total and factor scores, and Somatic Symptom List (SL-29) total score of the low–moderate–high caffeine subgroups

	All	Before hospitalization			During hospitalization		
		Low	Mod	High	Low	Mod	High
HSCL-58 (n)	96	30	53	13	38	53	5
Total score	94.9	98.9	90.3	104.2	93.5	93.6	117.6
Factors							
Somatization	18.4	19.9	17.1	20.4[a]	18.6	17.9	22.8
Obsessive–compulsive	14.3	15.0	13.6	15.2	13.8	14.5	15.8
Interpersonal sensibility	11.1	11.1	10.9	12.2	11.0	10.9	14.8
Depression	18.6	18.0	18.1	21.7	17.7	18.5	25.8[b]
Anxiety	9.7	10.6	9.1	10.4	9.6	9.7	11.2
SL-29 (n)	98	32	53	13	40	53	5
Total score	17.4	21.2	13.6	23.5[c]	17.0	17.3	21.6

[a] $P < 0.05$, H = 7.8, $df = 2$, Kruskal-Wallis: scores of the HSCL factor somatization of the three caffeine subgroups before hospitalization

[b] $P < 0.05$, H = 6.4, $df = 2$, Kruskal-Wallis: scores of the HSCL factor depression of the three caffeine subgroups 'during' hospitalization

$P < 0.05$, score of high > low, Kruskal-Wallis multiple comparisons

[c] $P < 0.001$, H = 19.7, $df = 2$, Kruskal-Wallis: scores of the SL-29 of the three caffeine subgroups before hospitalization

$P < 0.05$ each: score of low > moderate; high > moderate; Kruskal-Wallis multiple comparisons

Discussion

Methodological aspects

The present data concerning the caffeine intake is based on the patients' indications of their consumption and cannot be considered as hard data, as in almost all studies. An important aspect is the difference in caffeine availability at home and at the hospital, where caffeine is not freely available, and even more restricted in the closed-door ward (lowered caffeine content inside and limited access outside the ward). Patients in the open-door ward had free access to the cafeteria and to coffee vending machines. Compared with the open-door ward, the caffeine consumption was significantly lower in the closed-door ward (Table 3), although 11 of the 13 high caffeine users before hospitalization resided in this unit. On the other hand, the mean body weight of the patients in the closed unit was lower, whereas the overall sample showed a positive correlation between weight and caffeine before and also during hospitalization. Additionally, financial aspects (each beverage outside the ward has to be paid for, mostly at a higher price than at home) may limit caffeine excesses at hospital by poorer patients. Furthermore, the before and during hospitalization consumption was calculated differently: For the before consumption, we used figures cited in the literature, but for the during hospitalization consumption, the calculation was based on several caffeine-containing analyses of the caffeine sources at the hospital (cf Patients and methods), which represents a more precise method.

The comparison of the caffeine intake from before to during hospitalization revealed a high correlation, reflected by the low–moderate–high caffeine subgroups: No patient changed more than one level of consumption, and the subgroups before were still clearly distinguishable at the hospital. This suggests that patterns of consumption before hospitalization are conserved during a psychiatric hospital treatment. In the literature, no other study dealt with changes of caffeine intake with hospitalization.

High caffeine consumers

Table 5 presents available data on the distribution of low, moderate and high caffeine consumers in different populations and countries. Such information is not available for the Swiss or European general population, but the consumption of the major caffeine sources (coffee and tea) of Switzerland is comparable to that of the United States, i.e. 200 mg (Gilbert 1976; Graham 1978; Barone and Roberts 1984). Therefore, the mean caffeine intake in the psychiatric inpatients of the present study (Table 1) may proba-

Table 5 Studies concerning the caffeine consumption of psychiatric and medical patients, and healthy adults

Patients (*n*)	Mean ± SD (mg caffeine)	Daily caffeine consumption (mg)							Remarks	References
		0	< 250 (Low)	250–750 (Moderate)	> 500	> 750 (High)	> 1000	> 1500		
Psychiatric adult inpatients:										
98	405 ± 368	7%	33%	54%	26%	13%	5%	2%	Before hospitalization	Present study
98	332 ± 213	5%	41%	54%	23%	5%	0%	0%	During hospitalization	Present study
154		26%	53%	31%	31%	16%	10%	3%	(a)(b)	Furlong (1975)
135					25%				(b)	Winstead (1976)
83			36%	42%		22%				Greden et al. (1978)
15	910 ± 367								(c)	Galliano (1982)*
173	535 ± 410								(d)	James et al. (1987)
Psychiatric adult outpatients:										
15	856 ± 318								(c)	Galliano (1982)*
Normal adults:										
67		9%	43%	52%	21%	5%	3%	1.50%	(b)	Furlong (1975)
1883		24%	58%	38%	19%	4.50%	2%	0.20%		Gilbert (1976)
20	621 ± 210								(c)	Galliano (1982)*
174	359 ± 189		28%	67%	20%	5%			(c)	Scott et al. (1989)
Medical inpatients:										
124			41%	43%		16%				Victor et al. (1981)
16	768 ± 266								(c)	Galliano (1982)*

(a) In- and outpatients
(b) Calculated from the number of cups of coffee/day, with 100 mg caffeine/cup
(c) United Kingdom
(d) Australia; all other studies USA or Canada
* From "Caffeine consumption in psychiatric patients", M. Phil, Univ London (unpublished)

bly be higher than in the adult general population. In fact, Furlong (1975) found a higher rate of high caffeine consumers in psychiatric inpatients than in normal adults. Greden et al. (1978) and Victor et al. (1981) compared psychiatric to medical inpatients: although the medical inpatients showed a high rate of high caffeine consumers (16%), the psychiatric inpatients used caffeine in higher amounts (22% of high caffeine users).

In our study 13% of 98 patients were high consumers before hospitalization. Earlier investigations on caffeine consumption in psychiatric patients showed similar proportions of high (> 750 mg caffeine daily) consumers: 16% of 154 Canadian in- and outpatients (Furlong 1975), and 22% of 83 American inpatients (Greden et al. 1978). A clearly higher caffeine intake, but in a small population sample ($n = 15$), was reported by Galliano (1982, unpublished; cf Table 5) in a UK study. The data of James et al. (1987) about the caffeine consumption in 173 psychiatric inpatients in Australia suggests that it is between 30 and 80% higher than that measured in the present study. However, there is no indication of whether these habitual consumptions relate to the time period before or during hospitalization.

Caffeine consumption and demographic variables

Although there was no significant correlation between age and caffeine consumption, the group of patients younger than 40 years had a significantly higher caffeine consumption than the older group (Table 3; $P < 0.02$). A further analysis of the data suggests, however, as discussed below, that this finding is secondary to diagnosis-related caffeine–intake behaviours. Indeed, from several other studies it cannot be concluded that caffeine consumption is age dependent (Victor et al. 1981; Winstead 1976; Furlong 1975; James et al. 1987; Gilbert 1976), but recently an American study (Greden and Walters 1993) has shown that with increasing age the number of persons drinking coffee increases and that the maximum number of cups of coffee drunk per person per day reaches a plateau between 30 and 59 years. This seems to contradict our above-mentioned findings.

The present study shows that caffeine consumption before and during hospitalization was strongly correlated with body weight, but that the regularly working part of this population consumed less caffeine. If the fact of having a working place is taken as a sign of health, this subgroup may be seen as being closer to the normal healthy population than the other patients. On the other hand, the number of hospitalizations correlated significantly with the caffeine consumption. These results therefore suggest that a more socially disabling psychiatric illness might be associated with a higher caffeine consumption.

Caffeine consumption and diagnosis

The fact that schizophrenics consumed more caffeine than the major depression group may be influenced by the different age of these two groups, because the younger of our patients consumed more caffeine, and the schizophrenic patients were significantly younger than major depressives. Nevertheless, such a relationship between caffeine consumption and diagnosis has also been found by other authors: Winstead (1976) found between the 25% higher caffeine consumers (> 500 mg/d) a significantly higher incidence of psychosis and a lower incidence of depressive neurosis.

The anxiety disorder group was represented only by 5 patients and consumed the least caffeine before admission. This was the only group that slightly increased caffeine consumption with hospitalization to a level corresponding to the mean intake of all patients. This could be due to sedative medication (all received neuroleptics), or to an actual reaction to a security-giving environment (hospital), or to a healing process. A low caffeine consumption has also been observed by Boulenger et al. (1984) in panic disorder outpatients.

The adjustment disorder group was the only group with a highly significant correlation between caffeine before hospitalization and age. Yet, this diagnosis is defined as 'a transient reaction to psychosocial stress' with a maximal duration of 6 months. Therefore, this group could be considered as closest to a healthy population.

Caffeine consumption, medication and smoking behaviour

Because about two thirds of the patients under neuroleptics belong to the schizophrenia or the psychosis NEC group, it was not surprising to find a higher caffeine intake in patients treated with neuroleptics. Shisslak et al. (1985) found significantly higher phenothiazine doses in inpatients consuming regular coffee vs decaffeinated coffee. The present results confirm previous findings of Prosser and Pickens (1979) who showed a significant correlation between the average daily caffeine consumption and the neuroleptic dose in schizophrenics, whereas Winstead (1976) found a treatment with phenothiazines or antidepressants more often in his higher caffeine group (> 500 mg). Stephenson (1977) suggested that a relatively high caffeine consumption might be related to increased thirst due to anticholinergic drugs, or time structuring by drinking beverages or smoking to counteract boredom. As observed in our sample, a lower caffeine intake at hospital could also be interpreted as partially due to a better time structuring (occupational workshops, regulated daily routine of eating/sleeping).

On the other hand, the cigarette consumption did not change from before to during hospitalization, and no significant difference in tobacco use could be found between the two investigated wards. This may be at least partially explained by the fact that there are no or only few restrictions for cigarette smoking at the hospital. The highly significant association between caffeine and cigarette use (Table 3) is also well documented in the literature for healthy, as well as psychiatrically ill, subjects (Gilbert

1976; Zeiner et al. 1985). Hughes et al. (1986) observed a significantly higher prevalence of smoking among 277 psychiatric outpatients than among either local or national population-based samples, but this prevalence was not associated with the age, gender, marital status, socioeconomic status, alcohol use, coffee use or institutionalization of the psychiatric patients. No relevant relationship was found between caffeine and alcohol consumption.

Caffeine consumption and Hopkins Symptom Checklist and Somatic Symptom List

The significant positive correlation found between the caffeine consumption at hospital and the HSCL factor depression confirms previous findings of Greden et al. (1978) who observed elevated Beck Depression Inventory (BDI) scores in psychiatric inpatients with a higher caffeine consumption. In healthy volunteers, Gilliland and Andress (1981) observed higher trait anxiety and depression scores in moderate and high consumers than in abstainers. Moreover, 100–400 mg caffeine has been found to increase dysphoria in healthy persons (Stern et al. 1989). These studies suggest a 'depressiogenic action' of caffeine. Interestingly, our patients suffering from a major depression were low caffeine consumers, and their depression factor score was neither elevated nor related to caffeine. On the other hand, these major depression patients presented a strongly positive correlation between cigarette use and the SL-29 total score, which was not significant for caffeine. This result suggests an interrelation in depressive patients concerning smoking and the presence of physical symptoms. Our sample showed also a correlation between the depression factor and cigarette consumption. Smoking therefore has to be considered as another important variable, but as already stated by Nil (1991), there seem to be subtle, perhaps situationally and individually defined interactions between caffeine and nicotine. Indeed, in the present study there was a positive association between the factor interpersonal sensitivity and cigarette consumption for all patients, and for the schizophrenia group alone. The latter presented also a relation between this factor and caffeine: These findings could illustrate the social aspect of cigarette and coffee/tea consumption. The fact that this trend is expressed most by schizophrenia patients might be related to the insecurities that are normally present concerning social relations, where the cigarette or cup of coffee helps to structure the situation (being with another person or also being alone doing something 'social').

Conclusions

In conclusion, this study confirms the results of previous studies concerning the caffeine consumption of psychiatric patients in other countries, indicating a high caffeine consumption which is unrelated to gender and marital status, not obviously related to age, but to cigarette use, medication patterns (neuroleptics, especially phenothiazines) and the diagnosis. Results such as the caffeine-related depression factor of the HSCL-58 are comparable to findings concerning the BDI or complaints questionnaires.

The present study shows for the first time that patterns of consumption before hospitalization are conserved during hospitalization, although intrahospital consumption is reduced, probably due to limited availability or other environmental factors such as time structuring.

Patients with greater disability, e.g. with a longer evolution of their illness, expressed by a higher number of hospitalizations, having lost their jobs, seem to be at higher risk for excessive caffeine consumption, especially in patients with a psychotic disorder. Therefore, an inquiry on caffeine consumption should be included routinely for psychiatric patients, e.g. at admission. Patients should be instructed concerning quantitative and qualitative aspects of caffeine consumption: Although there is no evidence that small amounts of caffeine consumed regularly expose a patient to an elevated risk, a high consumption and also a rapid change of consumption may be followed by psychopathological symptomatology (e.g. elevated anxiety, nervousness). Instructions should include the possibility of pharmacodynamic interactions with drugs, especially minor and major tranquilizers.

Acknowledgements We are grateful to Dr. H. Milon of the Biological Experimentation Services, Orbe, Switzerland for the caffeine content measurements of beverages of the Psychiatric Clinic of the University of Lausanne, Switzerland, and to Laura Head and C. Bertschi for their help in preparing the manuscript.

References

American Psychiatric Association (1987) Diagnostical and statistical manual of mental disorders (DSM-III-R), 3rd edn, revised. American Psychiatric Press, Washington, DC

Barone JJ, Roberts H (1984) Human consumption of caffeine. In: Dews PB (ed) Caffeine. Springer, Berlin Heidelberg New York, pp 59–73

Boulenger JP, Uhde TW, Wolff III EA, Post RM (1984) Increased sensitivity to caffeine in patients with panic disorders. Arch Gen Psychiatry 41:1067–1071

Boulenger JP (1985) La caféine, le stress et l'anxiété. Concours Médical 107:1051–1054

Boulenger JP, Uhde TW (1986) Les effets anxiogènes de la caféine. Acta Méd Int Psychiatr (Suppl) 3:35–37

Bruce MS, Lader MH (1986) Caffeine: clinical and experimental effects in humans. Hum Psychopharmacol 1:63–82

Bruce M, Scott N, Lader M, Marks V (1986) The psychopharmacological and electrophysiological effects of single doses of caffeine in healthy human subjects. Br J Clin Pharmacol 22: 81–87

Burg AW (1975) How much coffee in the cup. Tea Coffee Trade J 147:40–42

Derogatis LR, Lipman RS, Rickels K, Uhlenhuth EH, Covi L (1974) The Hopkins Symptom Checklist (HSCL): a self-report symptom inventory. Behav Sci 19:1–15

Dews PB (ed) (1984) Caffeine Springer, Berlin Heidelberg New York

Food and Drug Administration (1980) Caffeine content of various products. Washington, FDA (FDA Talk Paper, T80-45)

Furlong FW (1975) Possible psychiatric significance of excessive coffee consumption. Can Psychiatr Assoc J 20:577–583

Gilbert RM (1976) Caffeine as a drug of abuse. In: Gibbons RJ, Israel Y, Kalant H, Popham RE, Schmidt W, Smart RG (eds) Research advances in alcohol and drug problems. Wiley, New York, pp 49–176

Gilbert RM (1981) Caffeine: overview and anthology. In: Miller SA (ed) Nutrition and behaviour. Franklin Institute Press, Philadelphia, pp 145–166

Gilliland K, Andress D (1981) Ad lib caffeine consumption, symptoms of caffeinism, and academic performance. Am J Psychiatry 138:512–514

Goldstein A, Kaiser S, Warren R (1965) Psychotropic effects of caffeine in man. II. Alertness, psychomotor coordination and mood. J Pharmacol Exp Ther 150:146–151

Goldstein A, Kaiser S (1969) Psychotropic effects of caffeine in man. III. A questionnaire survey of coffee drinking and its effects in a group of housewives. Clin Pharmacol Ther 10:477–488

Graham DM (1978) Caffeine – its identity, dietary sources, intake and biological effects. Nutr Rev 36:97–102

Greden JF, Fontaine P, Lubetsky M, Chamberlin K (1978) Anxiety and depression associated with caffeinism among psychiatric inpatients. Am J Psychiatry 135:963–966

Greden JF, Procter A, Victor B (1981) Caffeinism associated with greater use of other psychotropic agents. Compr Psychiatry 22:565–571

Greden JF, Walters A (1993) Caffeine. In: Lowinson JH, Ruiz P, Millman RB, Langrod JG (eds) Substance abuse. A comprehensive text book, 2nd edn. Williams and Wilkins, Baltimore, pp 357–370

Griffiths RR, Bigelow GE, Liebson IA (1986) Human coffee drinking: reinforcing and physical dependence producing effects of caffeine. J Pharmacol Exp Ther 2:416–425

Griffiths RR, Evans SM, Heishman SJ, Preston KL, Sannerud CA, Wolf B, Woodson PP (1990) Low-dose caffeine discrimination in humans. J Pharmacol Exp Ther 252:970–978

Hughes JR, Oliveto AH, Helzer JE, Higgins ST, Bickel WK (1986) Should caffeine abuse, dependence, or withdrawal be added to DSM-IV and ICD-10? Am J Psychiatry: 149:33–40

James JE, C rosbie J, Paull I (1987) Symptomatology of habitual caffeine use amongst psychiatric patients. Aust J Psychol 39:139–149

Nil R (1991) A psychopharmacological and psychophysiological evaluation of smoking motives. In: Samuelov S (ed) Reviews on environmental health. Freund Publ House, London, pp 85–115

Oliveto AH, Bickel WK, Hughes JR, Higgins ST, Shea P (1990) Caffeine as a discriminative stimulus in humans (abstract). Pharmacol Biochem Behav 36:428

Paul SM, Skolnick P (1981) Benzodiazepine receptors and psychopathological states: towards a neurobiology of anxiety. In: Klein DF, Rabkin JG (eds) Anxiety: new research and changing concepts. Raven Press, New York, pp 215–233

Prosser RA, Pickens R (1979) Catecholamines, drug abuse and schizophrenia. In: Pickens RW, Heston LL (eds) Psychiatric factors in drug abuse. Grune and Stratton, New York, pp 285–300

Rihs M, Baumann P (1989) Koffeinverbrauch von hospitalisierten Psychiatrie-Patienten. In: Saletu B (ed) Biologische Psychiatrie, 2. Drei-Länder-Symposium für Biologische Psychiatrie, Innsbruck, Sept 1988. Thieme, New York, pp 530–532

Scott NR, Chakraborty J, Marks V (1989) Caffeine consumption in the United Kingdom: a retrospective survey. Food Sci Nutrition 42:183–191

Siegel S, Castellan NJ Jr (1988) Nonparametric statistics for the behavioural sciences. McGraw-Hill International Editions, 2nd edn, New York

Shisslak CM, Beutler LE, Scheiber S, Gaines JA, La Wall J, Crago M (1985) Patterns of caffeine use and prescribed medications in psychiatric inpatients. Psychol Rep 57:3942

Stephenson PE (1977) Physiologic and psychotropic effects of caffeine on man. A review. J Am Diet Assoc 71:240–247

Stern KN, Chait LD, Johanson CE (1989) Reinforcing and subjective effects of caffeine in normal human volunteers. Psychopharmacology, (Berlin) 98:81–88

Victor BS, Lubetsky M, Greden JF (1981) Somatic manifestations of caffeinism. J Clin Psychiatry 42:185–188

Winstead DK (1976) Coffee consumption among psychiatric inpatients. Am J Psychiatry 133:1447–1450

World Health Organization (1992) ICD-10 international classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines. WHO, Montreux

Zeiner AR, Stanitis T, Spurgeon M, Nicholos N (1985) Treatment of alcoholism and concomitant drugs of abuse. Alcohol 2:555–559