

ORIGINAL ARTICLE

Sensitivity to coffee and subjective health

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Abstract

The question was whether health complaints are associated with coffee consumption and self reported sensitivity to coffee. Participants were 89 men and 107 women, all coffee drinkers. Questionnaires were used at 2 points of time with an interval of 3.7 years. The correlations among coffee consumption, sensitivity and health complaints were significant but were of low importance to health. Coffee consumption was significantly related to intestinal complaints ($r=0.15$) and sensitivity to coffee with sleep-wake complaints ($r=0.30$). An increase in sensitivity to coffee over almost 4 years went along with less health complaints. The interaction of coffee intake and sensitivity to coffee had no influence on subjective health. Since subjective sensitivity data were used, validation of the findings should be done with objectively measured sensitivity and caffeine levels.

The main conclusion is that self-reported coffee intake is not related to subjective health, but claimed sensitivity is.

INTRODUCTION

Blaming coffee for causing negative effects on health and behaviour has been done for centuries. In 1674, at the start of the coffee houses in England, an infamous pamphlet "The women's petition against coffee" was distributed, worrying about the "...grand inconveniences ... from the excessive use of that drying, enfeebling liquor". The complaints focussed on impotency due to coffee and an increased talkativeness (Knibbe & De Haan 1998). In spite of these negative opinions about coffee, coffee was highly appreciated, still we are unsure about coffee's effect on health. In a questionnaire, filled in by 405 civilians and 123 physicians, there were 10 statements concerning coffee as causing or worsening high blood pressure, heart infarct, cancer of the bladder, gastro-intestinal tract and oesophagus, increase of blood sugar and stroke (Heyden & Escher 1973). Of the physicians 2-52% said the statements were right or possibly right against 4-76% of the laymen. The low percentage concerned coffee as a cause of bladder disease and the high percentage for

seeing coffee as the cause of worsening high blood pressure. Not much has changed since then. In 1994 a Danish study among physicians and patients showed that 42% of the patients and 39% of the physicians believed that coffee played a causal role in peptic ulcer disease (Christensen *et al* 1994). A survey among 292 customers of 10 pharmacies in Sweden revealed that the most common perceived cause of gastrointestinal symptoms after poor diet was coffee (Sihvo & Hemminki 1999). Boekema and co-workers (Boekema *et al* 1999) however in their review found no association between coffee consumption and the development of peptic ulcer. Also coffee is not an important contributor to symptoms of bad health in patients with functional dyspepsia (Richter 1991). More recently there is still no consensus among health professionals on the coffee-health relationship (Soroko *et al* 1996; VNKT 2006). Sixty-eight percent of Dutch dieticians and 82% of physicians agreed with the statement that 'coffee can give stomach problems', while 11% and 27% respectively disagreed. The opinions on the statement 'coffee is bad for the heart' diverged even more. Thirteen per-

cent of the dieticians agreed with it against 26% of the physicians, while 46% of the dieticians disagreed with it against 30% of the physicians. Different opinions on coffee must have consequences for given health advice to patients (Binns *et al* 2008).

Also among the general public differing opinions on coffee are found. Page and Goldberg (1986; 1987) studied the perceived consequences of drinking caffeinated beverages (coffee and or other caffeinated drinks) among college students, who always or usually consumed caffeinated beverages or who rarely or never did so (Page & Goldberg 1986; Page 1987). Those who preferred caffeinated drinks were more likely to see these drinks as positive, giving people more energy, helping them to relax and to feel better. Those who never or rarely chose caffeinated beverages were more likely to believe that these drinks would make people more irritated, nervous, anxious and jumpy and that ulcers, headaches, kidney and bladder damage, upset stomachs and high blood pressure, cancer and other negative effects would result from them. Similar differences were found by (Goldstein & Kaizer 1969; Goldstein *et al* 1969) in comparing coffee drinkers of >5 cups per day with light users.

It is obvious that worries concerning the health effects of coffee are counterproductive in establishing coffee as a drink of which the caffeine has beneficial effects on cognition (Bendlin *et al* 2007; Quintana *et al* 2007; Snel *et al* 2004; Tiegies *et al* 2007), and ill health such as Parkinson' disease (Hu *et al* 2007; Saaksjarvi *et al* 2007), diabetes type II (Cadden *et al* 2007; Williams *et al* 2008), certain cancer types (Hu *et al* 2008; Larsson & Wolk 2007; Shimazu *et al* 2008), mood (Ruxton 2008) and fatigue (Lorist & Snel 2008). Obviously spending a lot of time worrying about the appropriateness of one's coffee consumption detracts from the quality of life (Rozin *et al* 2003). The opinion that coffee consumption might have unwanted health effects is not only mentioned in the popular press but is also found in scientific research as a part of an unhealthy or 'risky life style'. In such studies coffee use is seen as a part of an imprudent lifestyle and similar as smoking, alcohol over consumption, insufficient physical exercise and other unhealthy habits (Hulshof *et al* 2003; Kawachi *et al* 1994; Klatsky *et al* 1993; Rasch 2003). No surprise that in case of health complaints people consider to abstain or reduce their coffee consumption. Health professionals are easily inclined to support this wish even if his request is irrelevant for the specific complaint (Knibbe & De Haan 1998). An example: a check on sleep hygiene rules across 7 studies, running from 1977 to 2003, revealed that abstinence from coffee is always recommended as a rule to follow (Stepanski & Wyatt 2003). In a survey among nearly 700 physicians 75% recommended changes in caffeine consumption to patients with common health problems (Hughes *et al* 1988). When asked to evaluate which factors may disturb sleep (Urponen *et al* 1988), caffeine was seen as the most disturbing factor after

work-related causes in men and after relational problems in women. The physician's advice to limit coffee consumption is easily followed and feeds the patient's suspicion that coffee may have negative health effects and confirms his decision to give up his coffee habit. Most who curtail on coffee consumption do so on own initiative, but only 10% on advice of a physician (Soroko *et al* 1996).

This negative attitude towards coffee may be expressed as worries and health complaints. Thirteen per cent of 1,178 coffee consumers (16–70 years old) perceived their coffee consumption as a personal worry and moreover was negatively commented upon by their partners (6.3%) and by others (2%) (Knibbe & De Haan 1998). Eleven per cent of these coffee drinkers reported four of the five studied health complaints of too much coffee consumption (stomach pain, failed attempts to reduce coffee, not able to sleep, feeling sick, trembling hands). One third reported one or more negative consequences and 5.4% reported three or more consequences of coffee consumption. Interesting, there only was a difference of 8 cups in weekly coffee consumption (33.0 cups/weeks) between those reporting one and those with four or more complaints (41.2 cups/week). Although experimental evidence shows that regular coffee consumption is not associated with objectively measured health hazards (Boekema *et al* 1999; Heyden 1993; Nawrot *et al* 2003; Nehlig & Debry 1996), the belief that coffee is bad for health is ineradicable. In other words: coffee may be a reason for subjective health complaints.

The subject of this study was whether coffee consumption was associated to health complaints and whether self reported sensitivity to coffee plays a role in this.

METHODS

Participants

This study is part of the Amsterdam Growth and Health Longitudinal Study (Kemper 1985; 1995; 2004). The AGAHL is approved by the local ethics committee, and started in 1977 to measure the lifestyle, health and psychological characteristics of almost 600 healthy 13 year-old boys and girls who were pupils from two secondary schools. The present analyses are based on the 99 men and 133 women (more than 95% Caucasian). Complete longitudinal data was gathered on coffee consumption and self-rated health measured at a mean age of 32.4 yr ($SD = .80$) and 3.7 years later at the age of 36.1 years.

Measures

Data on coffee consumption (yes or no, and amount of consumption for drinkers) were obtained from a questionnaire. Amount of consumption was asked specifically for eight moments of the day, the sum of the 8 scores formed the usual number of cups per day. The

Table 1. Frequency distribution of coffee consumption (cups/day) at age 32 years, and its change over 3.7-year

	Men N = 91	Women N = 114
% 1-2 cups/day	25.2	26.4
% 3-4 cups/day	27.5	46.4
% 5-7 cups/day	36.2	24.5
% ≥ 8 cups/day	11.0	2.7
4-year change:		
% Decrease >2 cups/day	3.0	5.3
% Decrease 1-2 cups/day	17.2	23.3
% No change	31.3	44.4
% Increase 1-2 cups/day	28.3	19.5
% Increase >2 cups/day	20.2	7.5

question "are you sensitive for the effects of coffee?" was answered on a 5-point rating scale: score 1 was absolutely not sensitive and score 5 extremely sensitive.

A 13-item questionnaire asked for the presence or absence of specific health complaints (dizziness, bad stomach, trembling hands, listlessness, tiredness, shortage of breath, chest or back pain, pain in muscles or bones, and headache (Jansen & Sikkel 1981). Sleep-wake complaints were assessed with a 15-item questionnaire on problems with falling asleep, waking up during the night, waking up too early, difficulty with waking up, being tired when waking up, and being tired during the day (Diest R. van *et al* 1989). General health experience was assessed using the question "Taken altogether how healthy are you" on a five-point scale, running from 'very well' to 'bad'. The question on general intestinal complaints was asked at the age of 32 years (10-point scale), and questions on happiness "taken altogether, how happy are you?" (4-point scale) and life satisfaction (10-point scale) at the age of 36 years.¹

Data Analysis

The cross-sectional data were used to investigate whether subjects who differ on coffee consumption (not on other caffeinated drinks) and on claimed coffee sensitivity differ in reported subjective health. The longitudinal data were used to examine whether individual changes over the 3.7-year follow-up in coffee consumption or in claimed sensitivity were related to changes in subjective health. Both the cross-sectional and longitudinal data were used to study the interaction between coffee consumption and claimed sensitivity on subjective health characteristics. To analyze these data tertiles were formed of the 6 cross-sectional and 3 longitudinal outcome variables. Multinomial logistic regression analyses were then performed to investigate

¹ In this study, 'happiness' and 'life satisfaction' are considered indicators of subjective health.

Table 2. Frequency distribution of the reported sensitivity to coffee at age 32, and its change over 3.7-year

	Men N = 89	Women N = 107
Sensitivity to coffee:		
% Not at all	29.7	43.8
% A bit	52.7	42.0
% Quite	13.2	11.6
% Very / Extremely	4.4	2.7
4-year change in sensitivity:		
% Decrease	22.5	18.7
% No change	64.0	66.4
% Increase	13.5	15.0

whether a score-difference of 'one cup' on coffee, or on claimed sensitivity was related to the chance to belong to the highest tertile (33%) or to the lowest tertile of each perceived health characteristic.

Because coffee non-consumers may be a specific population, only the participants who reported to consume coffee at both assessments are included in the analyses, so that starters, stoppers, and stable non-consumers are excluded.

RESULTS

Descriptive population data on coffee consumption are shown in **Table 1** and on reported sensitivity to coffee in **Table 2**. Because the subjects who did not consume coffee were not asked to answer the question on sensitivity, the numbers of subjects are smaller in **Table 2**. At the age of 32 years, 8.1% of the men and 14.3% of the women reported no coffee consumption, while respectively 10.1% and 2.3% reported to consume at least 8 cups/day. Over the four years of follow-up, five coffee drinkers stopped (one man), while four non-consumers started to drink coffee (all women). In men, a significant average increase of .75 cups per day was seen, whereas women did not significantly change coffee consumption. The average sensitivity to coffee did not change significantly between men and women.

Table 3 shows the descriptive data on the subjective health characteristics. On average, women reported more health and sleep-wake complaints than men. No gender differences were observed for the other variables or for the 3.7-year changes.

Table 4 shows the gender-controlled correlation coefficients among the central variables. No correlation was observed between coffee consumption and claimed sensitivity to coffee. The amount of coffee consumption was correlated significantly with intestinal complaints, while the reported sensitivity to coffee was related to more sleep-wake complaints. All subjective health vari-

Table 3. Means (SD) of the subjective health characteristics

		Men N = 99	Women N = 133
Health complaints	Age 32	2.6 (3.2)	3.6 (3.2)
	4-year change	.1 (3.1)	.1 (2.9)
Sleep-wake complaints	Age 32	3.2 (3.1)	4.5 (3.4)
	4-year change	.5 (3.3)	.6 (2.8)
General health experience	Age 32	4.1 (0.6)	4.1 (0.7)
	4-year change	-.0 (0.7)	-.1 (0.7)
General intestinal complaint	Age 32	2.2 (1.8)	2.3 (1.9)
Happiness	Age 36	3.3 (0.6)	3.3 (0.6)
Life satisfaction	Age 36	7.6 (1.4)	7.8 (1.4)

Table 4. Partial correlations among central variables (cross-sectional data)

	Sensitivity	Health complaints	Sleep-wake complaints	General health	Intestinal complaints	Happiness	Life satisfaction
Coffee	-.02	.08	-.02	-.03	.15*	-.11	-.14
Sensitivity		.12	.30***	-.12	.06	-.05	-.08
Health complaints			.45***	-.45***	.36***	-.24***	-.31***
Sleep-wake complaints				-.31***	.25***	-.25***	-.33***
General health					-.34***	.34***	.31***
Intestinal complaints						-.01	-.06
Happiness							.78***

* $p \leq .05$ *** $p \leq .001$ **Table 5.** Partial correlations among central variables (longitudinal data)

	Sensitivity	Health complaints	Sleep-wake complaints	General health experience
Coffee	-.02	-.04	-.13	.13
Sensitivity		-.16*	.05	.06
Health complaints			.23***	-.23***
Sleep-wake complaints				-.09

* $p \leq .05$ *** $p \leq .001$

ables, except intestinal complaints showed significant correlations.

In **Table 5**, a significant negative correlation is reported between changes in the sensitivity to coffee and health complaints. The change in health complaints was also significantly related to changes in sleep-wake complaints and general health experience.

The logistic regression analyses using cross-sectional data showed no significant relationships between the amount of coffee consumed and any perceived health characteristic (all $ps > .10$). For the reported sensitivity to coffee, significant relationships were found with sleep-wake complaints and general health experience. Participants with a coffee sensitivity rating that was one value higher were 2.25 times more likely to be in the

highest tertile of sleep-wake complaints as compared with the lowest, and they were more than two times less likely ($OR = .46$) to be in the highest tertile of experienced general health. In line with these findings were the non-significant trends for more health complaints and intestinal complaints in participants with a higher reported sensitivity to coffee ($p = .07$ and $.11$, respectively). **Table 6.**

The logistic regression analyses using longitudinal data showed a significant relationship between the change in reported sensitivity to coffee and the change in reported health complaints (**Table 7**). Participants with a four-year increase of one on reported sensitivity to coffee were almost two times more likely to have

Table 6. Odds ratio (OR) and 95% Confidence interval (CI) for being in the upper as compared with the lower tertile of a subjective health characteristic if coffee consumption is one cup/day higher, respectively, if reported sensitivity to coffee is one point higher (cross-sectional analyses)

	Coffee		Sensitivity	
	OR	95% CI	OR	95% CI
Health complaints	1.06	.93 – 1.21	1.55	.97 – 2.48
Sleep-wake complaints	1.00	.87 – 1.14	2.25	1.40 – 3.60
General intestinal complaint	1.10	.97 – 1.25	1.41	.93 – 2.16
General health experience	1.01	.83 – 1.22	.46	.25 – .86
Happiness	.88	.75 – 1.04	.82	.43 – 1.55
Life satisfaction	.96	.84 – 1.09	.74	.46 – 1.19

Table 7. Odds ratio (OR) and 95% Confidence Interval (CI) for being in the upper as compared with the lower tertile of the 3.7-year change of a subjective health characteristic if the change in coffee consumption is one cup/day, respectively, if the change in reported sensitivity to coffee is one point higher (longitudinal analyses)

	Coffee		Sensitivity	
	OR	95% CI	OR	95% CI
Health complaints	.92	.76 – 1.11	.53	.32 – .83
Sleep-wake complaints	.96	.80 – 1.15	1.01	.68 – 1.51
General health experience	1.23	.97 – 1.58	1.17	.68 – 2.03

decreased than increased the number of reported health complaints ($OR = .53$).

The interaction between coffee and reported sensitivity to coffee was significant for the longitudinal analysis of health complaints (Table 7; $p = .04$), indicating that the non-significant inverse relationship between coffee consumption and health complaints was stronger (more inverse) in participants reporting an increase in sensitivity, and likewise, that the significant inverse relationship between reported sensitivity and health complaints was stronger (more inverse) in participants who had increased their coffee consumption. In all other analyses, the amount of coffee consumption did not interact with reported coffee sensitivity regarding their relationships with the perceived health characteristics.

DISCUSSION

In the present study the cross-sectional data on amount of coffee consumption was significantly correlated ($r=0.15$) with intestinal complaints. The reported sensitivity to coffee was related ($r=0.30$) to more sleep-wake complaints. Although statistically significant, the explained variance is low with 2% and 9% respectively which points to other, unknown factors that are involved. These findings are of low clinical significance, which is supported by the finding that when the highest tertile of health complaints is compared to the lowest, an increase of the sensitivity to coffee with one

point did not result in an increase of health complaints (Table 6).

Since coffee drinking is a regular habit for many people, they are not likely to monitor exactly how many units they consume. This may provoke underreporting and over reporting. In representative samples of the population caffeine consumption is systematically underestimated with about 20–25% (Brown *et al* 2001; Ferraroni *et al* 2004; Schreiber *et al* 1988; Wendte *et al* 2003). However, those who do have health complaints may worry more about possible causes, so their recall of prior coffee use could be more accurate (Ferraroni *et al* 2004). If true, it might mean that healthy people underreport while those with health complaints over report their coffee consumption, which leads to spurious correlations between coffee intake and health problems. Worrying about one's coffee consumption may also result in an exaggeration of reported sensitivity. The combination of worry and claimed oversensitivity may form a chronic stress, the first signs of it could be impaired sleep and gastrointestinal functioning (Kikkert *et al* 1996; Snel *et al* 2001; Snel, Hofman, & Van Kuler 2001). Thus, the reported health symptoms may represent the effect of mild chronic stress rather than the effect of coffee consumption and sensitivity to it.

The finding based on longitudinal data that an increase of reported sensitivity is associated with less health complaints is unexpected. It could reflect a strategy to enforce a supposedly healthier lifestyle. Shlonsky and co-workers (Shlonsky *et al* 2003) found that a

large proportion of decaffeinated coffee drinkers not only avoided caffeinated coffee but also other vehicles containing caffeine and rigidly adhered to special diets, vitamin pills and rigorous exercise. Eighty per cent of coffee consumers who change from caffeinated to decaffeinated coffee do so predominantly for health reasons (Soroko *et al* 1996). The effort to change to such healthier lifestyle could be helped by a claimed higher sensitivity to caffeine, but also by reporting less health problems. The wish to change one's coffee consumption may come from the view that coffee is still seen as a 'negative' food item in spite of studies showing that coffee is safe for objectively measured health (Binns *et al* 2008; Cadden *et al* 2007; Driessen *et al* 2008; George *et al* 2008; Klatsky *et al* 2008; Taylor & Demmig-Adams 2007).

Most people are unaware of taking caffeine, since it is present in various beverages, chocolate, chocolate flavoured products, baked goods, dairy products, soft candies and certain medicaments. It means that also strict non-coffee drinkers are not caffeine-naive, continuously 'under influence' which implies that true control subjects do not exist. The present study was done on 'coffee drinkers', without knowing how many consumed decaffeinated coffee and to which degree caffeine was taken from other sources. Possibly, those who prefer decaffeinated coffee do so as a part of a healthy lifestyle. Although some studies show that coffee users have more subjective health complaints than decaffeinated coffee drinkers or abstainers (Shirlow & Mathers 1985), the reverse is also true. Health complaints may lead to abstinence from coffee and to decaffeinated products (Leviton & Allred 1994). The choice of decaffeinated coffee could be seen as a marker of fear for illness and for running a low risk on ill health. (Shlonsky *et al* 2003) compared 4 groups: 4,400 regular caffeinated coffee users, 1,545 only decaffeinated coffee drinkers, 3,307 subjects who consumed both coffee types and 2,837 non-users on medical history, current symptoms and special diets. A composite of cardiovascular ailments resulted in a decaffeinated-caffeinated OR of 1.5 (95% CI 1.3–1.7, $p < .001$) and a decaffeinated-abstinence OR of 1.3 (95% CI 1.2–1.6, $p < .01$). The gastrointestinal composite also showed an OR of 1.3 (95% CI 1.1–1.5) for the decaffeinated-caffeinated comparison, but not for the decaffeinated/abstinence comparison. The subjects were also questioned on sleep problems, loss of libido, stomach pain, eye trouble, headache and backache. On all these subjective health complaints the ORs were significant, ranging from 1.2 to 1.4 and all showed that decaffeinated coffee use went together with *more* complaints in comparison with regular coffee. However, decaffeinated coffee drinkers were less tired or rundown (OR = 0.6, 95% CI 0.7–0.9 $p = .008$) than non-coffee users and had more unexplained weight loss (OR = 0.5, 95% CI 0.3–0.9 $p = .04$). It suggests an energetic component in decaffeinated coffee compared with abstinence from coffee that is not caffeine.

In sum decaffeinated coffee is either related to bad or good health. Thus, the common view that caffeinated coffee drinkers are worse off concerning their health than decaffeinated coffee consumers or abstainers is not warranted.

That health complaints could be related to self reported sensitivity to coffee might be caused by differences in experimental procedures. In most studies, in the same session self-ratings of health are combined with questions on diet and health behaviour, which suggests an association among these variables and hence may bias self-rating of health. This suggestion is even stronger when a questionnaire is used which asks both for coffee consumption and based on a description of the pharmacological action of caffeine asks for somatic symptoms (James *et al* 1989). In the present study, the assessment of health, diet and coffee consumption formed a minor part of a multitude of different physical, psychosocial and demographic measurements and were distributed amply in time. Several questionnaires were filled in at home at home; some weeks later measurements were done in the laboratory (Kemper 1985; 1995; 2004).

We found that women reported more health and sleep-wake complaints than men, although they did not differ on sensitivity to coffee. Women in general complain more about health, possibly because of its acceptance in our culture to receive more social support (Verbrugge 1985; 1989). However, this difference between men and women is not consistently found.

Male and female students (age 20–21 yr) were questioned on 30 typical complaints most associated with poor health or uncomfortable physical states (headache, difficulty sleeping, etc) (Gondola & Tuckman 1983) and also on the consumption of 10 categories of food, among them coffee. Men whose consumption of coffee fell in the highest quartile reported on average almost 2 symptoms of physical discomfort more than those who consumed less. In women coffee consumption and discomfort were unrelated. It could mean that at each level of coffee consumption women report health complaints. Puzzling was that from the women, the heavy consumers had a better health knowledge than those who drank coffee moderately or not at all. That with a higher coffee consumption more physical discomfort was reported is consistent with the expectation that ingestion of certain so-called 'negative' foods, such as coffee is related to more discomfort.

A similar gender difference was found in a study (Botella & Parra 2003) in which caffeinated coffee was given to male and female healthy regular coffee drinkers. Thirty minutes after intake, coffee increased state anxiety in a dose-dependent manner in males, but not in females, which was ascribed to a possible lesser sensitivity of females to caffeine. Since saliva caffeine levels were similar in men and women, this gender difference was not caused by the systemic availability of caffeine. The authors interpreted this finding by suggesting that

oestrogens could have made the difference in making the dopamine system less sensitive in females to coffee. These interpretations do not help much to explain why in the present study women had more health complaints than men with similar coffee consumption and sensitivity. Other factors could be involved as well such as differences of lifestyle.

Differences in sensitivity to caffeine may imply that healthy people differ in the amount of coffee they habitually consume. If an optimal adjustment to their sensitivity is the case, negative effects of coffee such as feelings of being 'high', jitteriness, tenseness and physical symptoms such as headaches and stomach problems should be absent. If people are not able to attune coffee consumption to their sensitivity, it may lead to subjective health complaints. Although most people know from experience not to surpass a certain amount of coffee consumption to prevent unwanted side effects, apparently not all people are aware or are able to attune coffee intake to their sensitivity. There are several studies and casus descriptions that support this interpretation. A reduction of an excess of caffeine intake may lead to improvement in anxiety, irritability, headache, sleep complaints and hand instability (James & Crosbie 1987; Mackay & Rollins 1989; Shaul *et al* 1984; Smith 1988). An other reason for health complaints could be that even if one knows the personal limit of coffee consumption, social pressure could bring people to drink more coffee than usual. In our culture coffee drinking is ritualised to specific times of the day and to fixed amounts, so refusing offered coffee could be seen as impolite by the host.

CONCLUSIONS

In this study, the main finding is that self reported coffee consumption is not related to subjective health complaints. Also there was no correlation between coffee consumption and claimed sensitivity to coffee. The correlations among coffee consumption, sensitivity to coffee, health complaints and satisfaction with life showed two significant positive, but clinically insignificant correlations. Amount of consumed coffee was associated with intestinal complaints and sensitivity to coffee with sleep-wake complaints. The interpretation was that the stress of health concern and the ambivalent attitude to coffee in our culture could possibly have caused these associations. Underreporting and over reporting of coffee consumption and sensitivity to coffee could also have played a role.

Also an increase in sensitivity to coffee over almost four years went along with less health complaints. Our speculation is that the wish to attain a healthier lifestyle and the effort it takes for those who reduce coffee intake or change to decaffeinated results in reporting higher sensitivity and less health complaints. The interaction of coffee intake and sensitivity to coffee did not affect subjective health. Subjective sensitivity might be the

crucial factor. Since no causality can be derived from correlational data, the alternative conclusion could be that subjective health has no influence on coffee consumption, but may have on self reported sensitivity.

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