

RESEARCH ARTICLE

Coffee, Energy Drinks Consumption and Caffeine Use Disorder Among Law Enforcement College Students in Hungary

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Introduction: Caffeine is one of the most popular and consumed substances worldwide. The prevalence of caffeinated beverage consumption stands quite high among young people and in some professions, such as law enforcement.

Aims: The aim of our study was to assess the lifetime and daily prevalence of caffeine consumption, the extent of consumption, and the prevalence of caffeine use disorder among law enforcement students.

Methods: A cross-sectional, questionnaire-based survey was conducted among Hungarian law enforcement students at the University of Public Service (Hungary) Faculty of Law Enforcement (UPS FLE). The study sample ($N = 180$) consisted of 57.2% male ($n = 103$) and 42.8% female ($n = 77$). The Caffeine Use Disorder Questionnaire (CUDQ) was used to measure caffeine use disorder among law enforcement students.

Results: The lifetime prevalence of caffeine consumption is 98.3% ($n = 177$) among law enforcement students. Two-fifths ($n = 72$) of law enforcement students are classified as daily consumers. The average caffeine intake of daily consumers was 177.5 mg/day (range: 60–550 mg/day; SD = 89.54). The majority (64.7%; $n = 110$) of caffeine users had experienced at least one symptom of caffeine use disorder in the past 12 months.

Conclusions: This is the first study on caffeine consumption among Hungarian law enforcement students. Previous results suggest that the consumption of a high dose of caffeine could compromise aiming accuracy and shot placement, thereby jeopardizing the health and welfare of law enforcement personnel. Our results may be useful for researchers, Hungarian and foreign law enforcement agencies and law enforcement colleges, and vocational schools as well.

Keywords: caffeine consumption, caffeine use disorder, law enforcement, college students, Caffeine Use Disorder Questionnaire

Introduction

Coffee remains one of the most popular and consumed beverages worldwide, and caffeine is its best-known component, present also in many other beverages (tea, soft drinks, energy drinks), foodstuffs (cocoa, chocolate), sports supplements, and even medicines (Abalo, 2021). In 2020/2021, around 166.63 million 60-kilogram bags of coffee were consumed worldwide (ICO, 2021). The per capita coffee consumption in the European Union (EU) is 5.18 kg per year (ECF, 2019). In Hungary, the per capita coffee consumption was 2.7 kg and per capita tea consumption was 0.149 kg in 2020 (KSH, 2022).

Coffee consumption also serves as an important part of workplace culture in most countries around the world (Bradley et al., 2007; Rodrigues et al. 2021). The top reasons for drinking coffee during work include: enjoyment (56%), relaxation (40%), increasing alertness (29%), suppressing fatigue (29%), and improving concentration

(24%) (Rogers & Wesnes, 2017). Because of its psychostimulant and physical performance-enhancing effects, caffeine can be useful in all professions that require sustained physical and mental work and exertion, and which may involve sleep deprivation (Bors et al., 2018). However, research suggests that there are significant differences in caffeine intake levels between populations of different occupations (Bouher, 1989; Lieberman et al., 2018; Tsiga et al., 2015). Lieberman et al. (2018) found that adults in “legal” or “management” professions consumed more caffeine than adults in other professions. Researchers believe that, because caffeine increases alertness and reduces fatigue, its use by individuals in these occupations may reflect the demanding nature of their professions. In another study, doctors and nurses were found to consume significantly more caffeine than office workers (Tsiga et al., 2015). Doctors and surgeons use caffeine to reduce fatigue and increase alertness, athletes use caffeine to enhance their physical performance (Jahrami et al., 2020).

Crisis response personnel also often use stimulants such as caffeine and nicotine to stay alert (Bergen-Cico et al., 2020). Police officers also commonly use caffeine, nicotine, and other drugs to manage depression and anxiety (Amaranto et al., 2003). In their research, McCormik, Cohen, and Plecas (2011) found that the most commonly consumed beverage among police members was coffee, and coffee is high in caffeine content. In a 12-hour shift, among members who drank at least one drink that contained caffeine, the average amount of caffeine consumed was 116 mg with a range of 30 mg to 385 mg. Lafata (2007) suggested that coffee consumption exists as a part of on-duty police culture. Ogeil et al. (2018) found that police officers and the general population have similar rates of caffeine consumption (90% vs. 89%). However, while mean average consumption is estimated at 186 mg across the population, they found that more than 20% of the police used a high level of caffeine (> 400mg/day), and more than 5% used medication or over-the-counter drug to promote wakefulness (excluding caffeine) in the past month (Ogeil et al., 2018). Meanwhile, the estimated proportion of “high level” (> 400mg/day) caffeine consumers was only 14% in the general adult population (Fulgoni et al., 2015).

However, caffeine consumption also occurs before employment. The prevalence of caffeinated beverage consumption also stands quite high among young people. Youth often consume coffee drinks in large amounts. Caffeine consumption by adolescents and young adults has increased dramatically over the last decade through both increased coffee consumption and so-called “energy drinks”, which may contain other constituents that impact health (El-Nimr et al., 2019). Energy drinks have become a popular product after the millennium, especially among teens and young adults (Torpy & Livingston, 2013). Caffeinated drinks (such as coffee, tea, and energy drinks) differ mainly in their caffeine content and other ingredients. Consumption of energy drinks by young people can be particularly problematic because: (1) energy drinks have a high sugar and sweetener content (Grósz & Szatmári, 2008), which makes them appealing to children; (2) some energy drinks contain extremely high levels (240-505 mg) of caffeine (Reissig et al., 2009); (3) energy drinks are also available in large packets (600-1500 ml), so it is easy to overdose on caffeine (Dojcsákné & Kiss-Tóth, 2018); (4) young people usually mix energy drinks with alcohol (Malinauskas et al., 2007; Miller, 2008; O’Brien et al., 2008) which have serious health consequences.

Young adults usually use caffeine to get more energy, for the taste, or as part of social gatherings (Jahrami et al., 2020). Among students, research suggests that the regular consumption of caffeinated beverages is 24.4% to 50% explained by improved concentration, academic performance, and preparation for exams and projects (Bertasi et al., 2021; Katib et al., 2018; Malinauskas et al., 2007; Mahoney et al., 2019). Hungarian research also suggests that a significant proportion of Hungarian students consume energy drinks and other caffeinated drinks for study. Berényi et al. (2010) found that 42.7% of university students consume caffeinated beverages to improve academic performance. Results from another study also show that more than half (52.3%) of university students use energy drinks during their study, with one fifth (22.6%) of them specifically expecting caffeine to improve mental performance.

Scientific results suggest that the consumption of coffee and energy drinks is explained in most cases by the beneficial pharmacological effects of the main active substance. Caffeine causes most of its biological effects via antagonizing all types of adenosine receptors (ARs): A1, A2A, A3, and A2B and, as does adenosine, exerts effects on neurons and glial cells of all brain areas (Daly et al., 1994; Fredholm et al., 1999; Ribeiro & Sebastião, 2010). It also interacts with dopaminergic transmissions in the central nervous system; increases vigor and reduces tiredness via dopaminergic pathways (Fredholm et al. 1999; Meeusen et al., 2013; Souissi et al., 2012). Caffeine use results in a temporary increase in metabolism, increased wakefulness, attention, and clear thinking (Glaister & Moir, 2019). However, caffeine consumption can also have a number of adverse consequences. The European Food Safety Authority (EFSA) recommends that the safe amount of caffeine for adults should not exceed 400 mg per day (EFSA, 2015). Intake of high doses (> 400 mg) of caffeine can cause anxiety, nausea, tremors, and nervousness (Garrett & Griffiths, 1997), muscle spasms, rambling, or disorientation (Glaister & Moir, 2019). Some studies also suggest that regular high caffeine intake (> 450 mg/day) may increase the risk of cardiovascular disease

(Greenland, 1993). More than 744 mg/day consumption of caffeine has been shown to increase urinary excretion of calcium and magnesium (Tucker, 2003). Even higher doses (~2000 mg/day) lead to muscle convulsions, toxic symptoms, ventricular fibrillation, cardiovascular symptoms, hallucinations, and (~3000 mg/day) death (Glaister & Moir, 2019; Willson, 2018). The frequency of caffeinated drink (energy drink) consumption was positively associated with marijuana use, sexual risk-taking, fighting, and seatbelt omission. In some cases (among white students), it was associated with smoking, drinking, alcohol problems, and illicit prescription drug use (Miller, 2008).

High caffeine-content beverage drinking, such as coffee or energy drinks, becomes habit-forming (Budney & Emond, 2014; Olekalns & Bardsley, 1996). Numerous controlled laboratory investigations show that caffeine produces behavioral and physiological effects similar to other drugs of dependence. Moreover, several recent clinical studies indicate that caffeine dependence is a clinically meaningful disorder that affects a nontrivial proportion of caffeine users (Addicott, 2014; Meredith et al., 2013). The DSM-5 includes Caffeine Use Disorder (CUD) as a condition of further study. DSM-5 proposed three necessary and sufficient diagnostic criteria for CUD: (1) a persistent desire or unsuccessful efforts to cut down or control caffeine use; (2) continued caffeine use despite knowledge of having a persistent or recurrent physical or psychological problem that caffeine is likely to have caused; and (3) withdrawal, as manifested by the characteristic withdrawal syndrome for caffeine, or caffeine or a closely related substance is taken to relieve or avoid withdrawal symptoms. Six additional diagnostic criteria included in other substance use disorders, such as craving or strong desire or urge to use caffeine, tolerance, and taking caffeine in larger amounts or over a longer period of time than intended, were also included as markers for greater severity beyond the three key criteria for CUD (Sweeney et al., 2019).

Overall, research findings suggest that caffeine consumption is positively related to the law enforcement profession and to university education. However, very little is known about caffeine use and CUD among young people who choose the law enforcement profession. Higher education is one of the most important settings for professional socialization; for this reason, certain health behavioral issues related to the chosen profession should be addressed at school. This is the first study on caffeine consumption among Hungarian law enforcement students.

Methods

Data Collecting and Sample

A cross-sectional, questionnaire-based online survey was conducted among Hungarian law enforcement students at the University of Public Service (Hungary) Faculty of Law Enforcement (UPS FLE). The research was carried out in accordance with the UPS's Code of Scientific Ethics.

The research was conducted between October 2020 and January 2021. Participation was voluntary and anonymous. We reached all 556 students at the UPS FLE, and almost a third of the students (32.3%) took part in the survey. A total of 180 respondents provided accessible answers and formed the research sample.

The study sample ($n = 180$) consisted of 57.2% male ($n = 103$) and 42.8% female ($n = 77$). The majority of respondents were male, reflecting the gender distribution in the population of the UPS FLE. 90.6% of the respondents ($n = 163$) are so-called “cadets”, and 9.4% are “double-status-student”. The “cadet” is a special status, close to the professional status, but its primary purpose is to help prepare one for a career as an officer. “Double-status” students are professional non-commissioned officers who study full-time. The distribution of the sample by gender and academic year corresponds to these characteristics of the total population. Table 1 shows other socio-demographic data.

Table 1. Socio-demographic characteristics of the study participants, n (%)

		Sample ($N = 180$)	
		(n)	(%)
Sex	male	103	57.2
	Female	77	42.8
Status	cadet	163	90.6
	double-status	17	9.4
Academic year	1st-year	55	30.6
	2nd-year	38	21.1
	3rd-year	46	25.6
	4th-year	41	22.8
Type of residence	villages	49	27.2
	small town	44	24.4
	large town	30	16.7
	capital/county seat	57	31.7

Measures

In our study, the caffeine content of caffeinated products was calculated on the basis of previous studies (AIS, 2021; Attipoe et al., 2016; Barone & Roberts, 1996; Bunker & McWilliams, 1979; Burg, 1975; Chin et al., 2008; Gilbert et al., 1976; Greden, 1974; Grósz & Szatmári, 2012; McLellan et al., 2016; Mineharu et al., 2009; Nagy & Litt, 1974; Roehrs & Roth, 2008; Zocconi et al., 2013). The estimated caffeine content was 100 mg per cup (150 ml) of ground coffee (including espresso, brewed, and drip coffee), 60 mg per cup (150 ml) of instant coffee. Energy drinks contain an average 75 mg caffeine per can (250 ml).

Prevalence of use

Participants had to rate the frequency of caffeine consumption on an 8-point scale (1 = never, 2 = weekly or less, 3 = several times in a week, 4 = one portion per day, 5 = two portions per day, 6 = three portions per day, 7 = four portions per day, 8 = five or more portions per day) for the following caffeinated products: brewed coffee, instant coffee, and energy drink(s).

Caffeine Use Disorder Questionnaire

The Caffeine Use Disorder Questionnaire (CUDQ), tested on the Hungarian population, was used to measure CUD among law enforcement students (Ágoston et al., 2018). The 10-item CUDQ comprises the proposed DSM-5 (Diagnostic and Statistical Manual of Mental Disorders) criteria of CUD. The first nine items of the CUDQ measure symptoms of CUD, and the last item asks whether the respondent has experienced significant distress because of the symptoms – although this last criterion (significant distress) is not included in the DSM-5 recommended symptoms (August, 2018).

Based on previous research involving this topic, the most clinically relevant symptoms are (1) persistent desire or unsuccessful efforts to cut down or control caffeine use, (2) continued caffeine use despite the knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by caffeine, and (3) characteristic caffeine withdrawal syndrome or caffeine use to relieve or avoid withdrawal symptoms (Meredith et al., 2013).

According to Ágoston (2018), in the clinical assessment of CUD, three other symptoms that we should pay particular attention to are (1) symptomatic distress, (2) non-compliance with work- or school-related obligations, and (3) the appearance of social problems. All three symptoms indicate a functional impairment in everyday life and may therefore at the clinical level be able to capture problems that have developed or are developing (Ágoston, 2018).

Participants had to indicate on a 4-point Likert scale (1 = Never, 2 = Sometimes, 3 = Often, 4 = Very often) their choice regarding how often they experienced the symptoms during the last 12 months. The internal consistency of CUDQ was acceptable (Cronbach's $\alpha = 0.71$ – 0.83) in the previous studies (Ágoston et al., 2019; Kaya et al., 2021). The internal consistency value of CUDQ was (Cronbach's α) .76 in this study, which indicates a high level of reliability.

Statistical Analysis

For statistical analysis, frequencies were calculated and significance levels were determined using χ^2 tests. The significance level was taken as $p < .050$. The association relationship between the test values was measured using the Cramer V (V) and Phi (ϕ) coefficient. For the metric variables, a two-sample t-test (t) and a Cohen's effect size index (d) were used.

Aims and Hypotheses

The aim of our study was to assess the lifetime and daily prevalence of caffeine consumption, the extent of consumption, and the prevalence of CUD among law enforcement students.

Due to the chosen profession, it is assumed that the prevalence of caffeine consumption among Hungarian law enforcement students stands higher than in the general population (H.1). It is also assumed that CUD remains more prevalent among females than males (H.2). On the one hand, women are more likely to use drugs for mood and emotion regulation and stress reduction, while for men it is more related to risk and pleasure seeking (Greenfield et al., 2010). On the other hand, women have higher somatosensory amplification (Köteles et al., 2009), which may indicate higher levels of CUD.

Given the results of previous national studies (Ágoston, 2018), it is also assumed that the most common symptoms of CUD among law enforcement students are cravings, uses to relieve withdrawal symptoms, and uncontrolled use (H.3).

Results

Prevalence and Frequency of Consumption

The lifetime prevalence of coffee or energy drink (hereinafter: caffeinated beverages) stands at 98.3% ($n = 177$) among law enforcement students. A total of 97.1% of males and all females without exception had consumed a caffeinated beverage in their lifetime. Based on life prevalence values, brewed coffee consumption accounts for the largest share (39.6%) of caffeine intake, followed by energy drinks (33.5%) and instant coffee (26.9%).

Current caffeine consumption prevalence stood at 94.4% ($n = 170$), meaning that more than 90% of students use coffee or energy drinks with some regularity. Two-fifths (40.0%) of law enforcement students are classified as daily consumers, who drink at least one type of caffeinated beverage every day. And 54.4% of respondents are occasional consumers who drink coffee or energy drinks once a week or less. Females had slightly higher rates of daily caffeine consumption than males. Almost half of the women (48.6%) compared to only 37.5% of men consume coffee or energy drinks at least once a day. The difference was not significant between females and males, however, in the frequency of caffeinated beverage consumption ($\chi^2(1) = 2.12; p = .145; \phi = 0.11$). The results also suggest that academic years do not influence the frequency of caffeinated beverage consumption. Among first, second, third and fourth-year students, no significant difference existed between the proportion of daily and occasional consumers ($\chi^2(1) = 4.26; p = .233; \phi = 0.16$). Examining the regularity of caffeine consumption, no significant pattern was found across sociodemographic variables (Table 2).

Table 2. Prevalence of daily caffeine consumption by different socio-demographic variables, percentage of respondents (%)

	<i>n</i>	Daily consumption prevalence (%)	$\chi^2(df)$	<i>p</i>	<i>V</i> / ϕ
Sex					
male	36	37.5	2.12(1)	.145	0.11
female	36	48.6			
Status					
cadet	63	41.2	0.86(1)	.352	0.07
double-status	9	52.9			
Academic year					
1st-year	27	50.9	4.26(3)	.233	0.16
2nd-year	15	45.5			
3rd-year	18	40.9			
4th-year	12	30.0			
Type of residence					
villages	22	46.8	2.65(3)	.447	0.12
small town	20	50.0			
large town	11	36.7			
capital/county seat	19	35.8			

n: answers number
 χ^2 (df): chi-square statistics and the degree of freedom;
p: significance value associated with the Chi-squared test;
V: Cramer's V (for variables with several categories);
 ϕ : Phi values (for dichotomous variables).

Table 3. Distribution of caffeinated beverage consumers by product and frequency of consumption, % (*n*)

% (<i>n</i>)	Never	less frequently than weekly	a few times a week	1 prop./day	2 prop./day	3 prop./day	4 prop./day
brewed coffee*	16.6 (30)	26.1 (47)	19.4 (35)	16.1 (29)	11.7 (21)	5.6 (10)	.6 (1)
instant coffee**	41.1 (74)	31.7 (57)	12.8 (23)	6.7 (12)	2.2 (4)	.6 (1)	.0
energy drinks***	26.7 (48)	47.2 (85)	15.6 (28)	2.2 (4)	2.2 (4)	.0	.0

* missing: 4; ** missing: 7; *** missing: 8

The majority (96.6%) of students who partake of caffeine on a regular basis consume more than one type of caffeinated product. Only 25.3% of consuming law enforcement students are not considered to be polycaffeine users; which means that they only consume one type of caffeinated beverage at a time. The frequency of consumption regarding each caffeinated product is shown in Table 3.

The average caffeine intake of daily consumers came to 177.5 mg/day (range: 60–550 mg/day/person; *SD* = 89.54). Almost a fifth (18.1%) of daily consumers consume 300 mg or more of caffeine per day. And 1.4% have a daily caffeine intake of 400 mg or more. Among daily drinkers, males (178.3 mg; *SD* = 83.80) use more caffeine on average than females (176.6 mg; *SD* = 96.12). However, the difference in average daily caffeine intake between the two sexes was not significant ($t(69) = 0.07, p = .937$, Cohen's *d* = 0.01).

In addition to the regularity and quantity of caffeine consumption, the study also examined the prevalence of caffeine use disorder.

According to the results, the majority (64.7%; *n* = 110) of current caffeine users had experienced at least one symptom ($M(SD) = 2.73(2.34)$) of CUD in the past 12 months. Results indicate a higher prevalence of substance use disorder symptoms among women. Female students reported more ($M(SD) = 1.98(1.96)$) symptoms of caffeine use disorder than male students ($M(SD) = 1.86(2.39)$), although the difference between the means was not significant ($t(167) = -0.36; p = .715$). However, a significant difference manifested – ($t(134) = 4.21; p < .001$; Cohen's *d* = 0.67) – in the average number of symptoms experienced between regular (daily) users ($M(SD) = 2.73(2.34)$) and occasional users ($M(SD) = 1.31(1.90)$). On average, regular users experienced twice as many diagnostic criteria in the 12 months prior to the survey than occasional caffeine users.

A total of 49.1% had at least three symptoms (mild CUD), 20.0% met four or more criteria (moderate CUD), and 7.1% of the current caffeine users experienced six or more CUD symptoms (severe CUD) in the past 12 months. 5.9% (*n* = 10) of the students met all three symptom criteria considered most clinically important (Meredith et al., 2013).

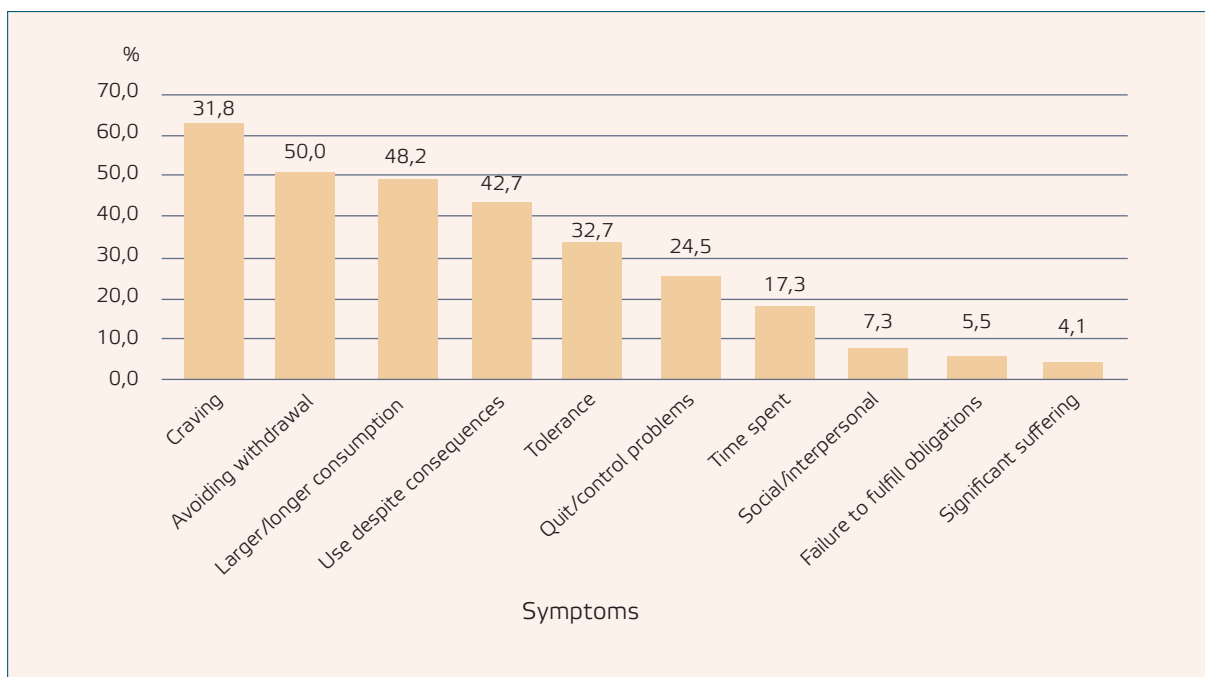
In this study, the three most serious symptoms that indicate a functional impairment in everyday life were reported in the following proportions among students experiencing symptoms: significant suffering from symptoms (4.1%); dereliction of duty (5.5%) and social problems (7.3%).

The most common symptoms of caffeine use disorder consisted of craving (61.8%), drinking to avoid withdrawal symptoms (50.0%), and drinking longer than planned or more caffeine (48.2%). Symptoms such as drinking caffeine despite negative symptoms in social relationships (7.3%) or in the context of failure to fulfill obligations (5.5%) were the least common among current caffeine users (Figure 1).

Discussion

We assumed that the prevalence of caffeine consumption among Hungarian law enforcement students is higher than in the general population (H.1). Rehm et al. (2020) found that 59.5% of the US adult population (≥ 20 years) consume caffeine-containing products daily. Benson, Unice, and Glynn (2018) suggest that the daily prevalence of caffeine use among the 18–24 age group is 35.3%, while the daily prevalence among 25–29-year-olds is 53.4%. According to the results of the latest Hungarian national youth survey, 59% of young Hungarians aged 15–29 consume coffee and 13% of them drink energy drinks at least once a day (Domokos et al., 2020). Our results suggest, however, that the daily prevalence of caffeine consumption among law enforcement students is not higher than among the general population. So the first hypothesis is not confirmed.

Figure 1. Prevalence of symptoms regarding caffeine use disorder according to the CUDQ



Previous studies among university students have found no gender differences in caffeine consumption (El-Nimr et al., 2019; Năsui et al., 2021; Jahrami et al., 2020). Among law enforcement students; moreover we found no differences in the frequency of caffeine consumption between males and females. Fulgoni et al., (2015) in their study also found no gender difference in the frequency of caffeine consumption. However, males had a higher average daily caffeine intake compared to females (211 ± 5 vs. 161 ± 3 mg/day).

The average daily intake of caffeine came to 177.5 mg/day (range: 60–550 mg/day; *SD* = 89.541). Daily caffeine intake stood higher among male students than females (178.3 vs. 176.6 mg/day), but the difference was not significant. According to previous national and international studies regarding university student populations, daily caffeine intakes range from 159 to 224 mg (Ágoston et al., 2017; Ágoston, 2014; Mahoney et al., 2019). Compared with the results of previous studies, the average daily caffeine intake of law enforcement students is not at all outstanding.

On the other hand, it is important to note that 18.1% of daily users consume 300 mg or more of caffeine per day. And the daily caffeine intake for 1.4% of the law enforcement students amounts to 400 mg or more. These results are noteworthy because more than 400 mg of caffeine consumption can cause serious physical and psychological symptoms such as anxiety, nausea, tremors, nervousness, muscle spasms, or confusion (Garrett & Griffiths, 1997; Glaister & Moir, 2019). Some adverse clinical effects can occur at intakes of 300 mg or more (Nawrot et al., 2003).

In addition to the “general risks” of high-dose caffeine intake, there are also profession-specific problems among law enforcement officers. For example, police officers have a significantly higher prevalence of prehypertension and arterial hypertension, and should therefore be more vigilant in reducing alcohol and caffeine consumption (Arredondo, 2019). An et al. (2020) found that, among police officers, factors such as job stress, smoking, alcohol, and caffeine consumption lead to an increase in diastolic blood pressure (DBP). Furthermore, an increase in daily caffeine consumption by police officers is positively associated with an increase in the prevalence of irritable bowel syndrome (IBS) (Sertbas, 2014). In another study, caffeine use was independently associated with increased odds of errors, stress, and burnout (Ogeil et al., 2018). Some research also suggests that caffeine may reduce hand stability (Bovim et al., 1995; Jacobson et al., 1991). Monaghan et al. (2017) analysis revealed that the energy shots significantly ($p \leq .050$) impaired pistol steadiness, whereas the placebo yielded no significant difference in aiming steadiness. Based on these results, it was concluded that the consumption of energy shots could compromise aiming accuracy and shot placement, thereby jeopardizing the health and welfare of law enforcement personnel (Monaghan et al., 2017; Monaghan et al., 2014). On the other hand, according to Copenhaver (2016), as officers consume more stimulant drinks per shift they also drink alcohol for a greater number of days per week, normally consume an alcoholic drink after work, sleep less, and consume more fast food.

Based on previous studies, it was also assumed that CUD is more prevalent among females than males (H.2). In our study, the CUDQ was used to assess the prevalence of CUD-related symptoms among students. More than half (64.7%) of the students who drank caffeinated beverages had at least one symptom of CUD. Some 49.1% of the current coffee and energy drink users have mild CUD, 20.0% moderate, and 7.1% severe; 5.9% (n=10) of the students met the three clinically most important symptom criteria. The observed CUD symptoms' prevalence in the present study stands lower than do prior estimates of meeting criteria roughly similar to the three key diagnostic criteria, which range from less than 10% to 13% among general samples of adults (Sweeney et al. 2020). On average, female students reported more ($M=1.98$) symptoms of caffeine use disorder than male students ($M=1.98$ vs. $M=1.86$), although the difference between the means was not significant. Our second hypothesis is therefore only partially confirmed.

Finally, given the results of previous national studies, it is also assumed that the most common symptoms of CUD among law enforcement students are cravings, uses to relieve withdrawal symptoms, and uncontrolled use (H.3).

We found that daily users experienced significantly more symptoms than occasional drinkers. This result suggests that more frequent consumption of coffee and other caffeinated beverages is associated with a higher number of caffeine use disorder symptoms. This observation remains generally consistent with prior research (Ágoston, Urbán & Demetrovics, 2016). Among the individual symptoms indicative of CUD, craving, avoidance of withdrawal symptoms and loss of control were the most common. Our findings are almost identical to those of a previous study in Hungary (Ágoston, 2018). These results suggest that cravings, use to relieve withdrawal symptoms, and uncontrolled substance use may be the primary symptoms of CUD. So the third hypothesis is confirmed.

Strengths and Limitations

This is the first study to investigate caffeine consumption patterns and the prevalence of substance use disorder among Hungarian law enforcement students. The results presented may be useful for researchers, law enforcement colleges, and vocational schools as well.

The topic of this study bears great importance for law enforcement agencies. The occupational stress experienced by law enforcement officers is arguably different from the stress experienced by individuals in other occupations. One factor contributing to the difference involves the nature of the work (Mann & Neece, 1990). Police work, by nature, is highly unpredictable and stressful. Moreover stress – particularly occupational stress – has been shown to lead to increased coffee and cigarette consumption (Burke, 1994; Conway et al., 1981; Swanson et al. 1994). On the other hand, although less clearly delineated in the literature, the amount of coffee intake may influence the size of heart-rate variability in response to stress situations (Hickman et al., 2011). All of these can jeopardize the safe and professional implementation of law enforcement measures.

Though this study is believed to have provided useful information regarding caffeine use, and CUD among law enforcement students, it carries several limitations. First, the study is strictly self-report. Thus, estimations of caffeine consumption rely on both participants' awareness of and accuracy in their reports of daily caffeine intake. On the other hand, the study only focuses on the consumption of coffee, instant coffee, and energy drinks, not other caffeinated products (e.g. tea or caffeine pills). The actual prevalence of caffeine consumption and level of caffeine intake may also be affected. A further limitation in the results of the study is that convenience sampling was used in the sampling procedure. Due to the sample size, only cautious conclusions can be drawn from the results for this specific population.

Conclusion, Implications, and Future Directions

Young people in their early twenties face a number of risk factors related to health behaviors (e.g. stress, irregular lifestyle, lack of time, and many temptations) that can lead to health risk behaviors such as irregular eating, high intake of sweets, smoking, alcohol consumption and high caffeine intake (Kontor et al., 2016). The rate of caffeine consumption among police students and the prevalence of CUD is not high compared to the general population.

Although caffeine has a lower addictive potential compared to other psychoactive substances, the widespread use of caffeine-content products makes important studies on its use and its impact on public health, both in the physical and mental fields (Ágoston, 2018). It is also important to note that according to the results from several

surveys, a significantly higher proportion of coffee drinkers are smokers (Olsen, 1991; Palatini et al., 2016). This may be due to the key role that coffee consumption plays in relation to smoking.

It would be particularly important to provide opportunities for law enforcement students in training to acquire relevant knowledge about the potential risks of consuming this psychoactive substance.

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Author contribution

Ákos ERDŐS: conceptualization, design, methodology, investigation, project administration, data management, formal analysis, interpretation, writing original draft, writing review and editing.

Declaration of interest statement

The authors declare no conflict of interest.

Ethical statement

The research was carried out in compliance with the University of Public Services' (UPS) Ethical Code (Code of Ethics adopted by the Senate of the University of Public Service by Resolution 32/2019 (VII. 10.) and amended by Resolution 23/2020 (I. 29.)). The study has been prepared in accordance with the UPS' Code of Ethics (7. §), so without approval procedure. All participants engaged in the research voluntarily and anonymously.

The participants provided their written informed consent to participate in this study.

Their data are stored in coded materials and databases without personal data.

Data Availability Statement

The data supporting this study's findings are available to the public.

We have policies in place to manage and keep data secure.

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