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Consumption of caffeinated beverages and the awareness of their caffeine content among Dutch students

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ABSTRACT

The purpose of the current study was to examine the knowledge of caffeine content of a variety of caffeinated beverages among Dutch university students. A pencil-and-paper survey was conducted among N = 800 Dutch students. Most participants (87.8%) reported consuming caffeinated beverages during the past 24 h. Their mean ± SD past 24-h caffeine intake from beverages was 144.2 ± 169.5 mg (2.2 ± 3.0 mg/kg bw). Most prevalent sources of caffeine were coffee beverages (50.8%) and tea (34.8%), followed by energy drink (9.2%), cola (4.7%), and chocolate milk (0.5%). Participants had poor knowledge on the relative caffeine content of caffeinated beverages. That is, they overestimated the caffeine content of energy drinks and cola, and underestimated the caffeine content of coffee beverages. If caffeine consumption is a concern, it is important to inform consumers about the caffeine content of all caffeine containing beverages, including coffee and tea. The current findings support previous research that the most effective way to reduce caffeine intake is to limit the consumption of coffee beverages and tea.

1. Introduction

Recently, the European Food Safety Authority (EFSA) published the "Scientific Opinion on the safety of caffeine" (EFSA NDA Panel (EFSA Panel on Dietetic Products, Nutrition and Allergies), 2015). In the EFSA opinion, data from 39 national representative European surveys conducted in adults, adolescents and children were summarized. Based on the outcome of these surveys, and an extensive search of the available other scientific literature, the EFSA panel concluded that, for healthy adults, daily caffeine consumption up to 400 mg (3 mg/kg body weight) does not give rise to safety concerns. This recommendation is in line with other guidelines such as those formulated by Health Canada (Health Canada, 2010).

As a guidance for consumers, EFSA lists the caffeine content of various caffeinated beverages on their website (EFSA Fact Sheet on Caffeine). In addition, individual Member States of the European Union also present these listings. The latter is important as typical beverage serving sizes may differ between European countries. For example, the Dutch standard serving sizes (which can be found at www.voedingscentrum.nl) are slightly different from the ones presented by EFSA.

Although the information on serving sizes and the corresponding caffeine content of caffeinated beverages is readily available for the Dutch general public, it is not known whether consumers actually visit corresponding websites. It is thus unclear if consumers are aware of the actual caffeine content of caffeinated beverages. A literature search revealed that, to date, this topic has received very little research attention.

The 2013 Australian Galaxy Poll revealed that only 4% of Australians correctly state that coffee from a café contains the highest amount of caffeine (Galaxy Poll 2013). Instead, Australians in this survey reported that energy drinks contain the most caffeine. Another study showed that US adolescents were poor in addressing whether common beverages contain caffeine or not (Thrake, Deoras, Griffin, Vemana, & Podmore, 2015). Almost one third of seventh and eighth graders (29%) were unaware that their favorite drinks contain caffeine.

Given the limited scientific information on this topic, the current study was conducted to examine the knowledge of caffeine content of a variety of caffeinated beverages among Dutch university students.

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2. Methods

A pencil-and-paper survey was conducted among N = 800 Dutch students. Participants were recruited at various locations at Utrecht University, Utrecht, The Netherlands. Both male and female students were approached. To be included, participants had to be students and aged 18–30 years old. In accordance with local guidelines, no ethics approval was required for this anonymous survey. Consent to take part in the study was implied by completion of the questionnaire.

This one-page survey comprised questions on demographics, including age, gender, height, weight, study type, past 24-h caffeine consumption and questions about their knowledge of the caffeine content of various beverages.

Past 24-h caffeinated beverage consumption was computed by asking how many of these beverages were consumed by participants. These beverages included standard Dutch serving sizes of tea (125 ml), energy drink (250 ml), filter coffee (125 ml), instant coffee (125 ml), espresso (50 ml), cola (180 ml), chocolate milk (180 ml), alcohol + energy drink (250 ml) and alcohol + cola (180 ml). Pictures of standard serving sizes were shown, including the corresponding amount of the beverage in ml, and participants were instructed to adjust their counting if they consumed other serving sizes than shown. Standard serving sizes and corresponding caffeine content were taken from the caffeine information of the Dutch Food Center (www.voedingscentrum.nl), a public source on food for Dutch consumers. Cappuccino was not listed, but participants were instructed to count a cup of cappuccino as a cup of filter coffee. Past 24-h caffeine consumption was calculated, both in mg/day as well as mg/kg body weight/day. Total caffeine consumption was computed for past 24-h caffeine consumers only. The relative contribution of the different caffeinated beverages to total caffeine intake was also computed. Other sources of caffeine than beverages (e.g., food) were not considered in this survey, as previous nationally representative surveys pointed out that the contribution of these sources to total daily caffeine intake is usually less than 5%–10% (EFSA NDA Panel (EFSA Panel on Dietetic Products, Nutrition and Allergies), 2015).

In a subsequent question, participants were asked to rank the caffeine content of these beverages from lowest (1) to highest (7). The beverages included tea (30 mg), energy drink (80 mg), filter coffee (85 mg), instant coffee (60 mg), espresso (65 mg), Starbucks coffee (≥160 mg), cola (18 mg) and chocolate milk (4 mg). The average caffeine rankings were calculated and compared with the actual rankings.

In the next question it was explained that EFSA concludes that for healthy adults 400 mg of caffeine per day does not raise any safety concerns. Participants were asked to indicate how many standard servings of filter coffee, energy drink or cola equals 400 mg caffeine. This question allowed calculation of the perceived amount of caffeine of a standard serving of coffee, energy drink, and cola, and to compare these with the actual caffeine content of these beverages.

Finally, participants were informed about the fact that only few caffeinated beverage products currently disclose their caffeine content on the package. It was asked whether participants felt it was necessary that every caffeine containing product should label its caffeine content. Participants could answer either ‘yes’ or ‘no’, and space was provided to add any comments.

3. Results

N = 800 participants were invited to complete the survey. Data from N = 43 participants were excluded, because they were either incomplete, unreliable, or outside the predefined age range of 18–30 years old. Data from N = 757 participants were included in the statistical analyses. The sample included N = 253 (33.4%) men and N = 504 (66.6%) women, reflecting the current Utrecht student population. Their mean (SD) age was 20.5 (2.1) years.

Surveys were completed on Tuesdays and Wednesdays. Hence past 24-h caffeine intake concerned week days (i.e. Monday and Tuesday). The majority of participants (87.8%) had consumed caffeinated beverages during the past 24 h. Mean ± SD past 24-h caffeine intake was 144.2 ± 169.5 mg (2.2 ± 3.0 mg/kg bw). No significant differences were found between men and women. Most prevalent sources of caffeine were coffee beverages (73.3 mg) and tea (50.2 mg), followed by energy drink (13.3 mg), cola (6.8 mg) and chocolate milk (0.7 mg). The relative contribution to total caffeine intake of these beverages is depicted in Fig. 1.

Participants ranked the relative caffeine content of standard servings of tea, energy drink, filter coffee, cola, chocolate milk, espresso, Starbucks coffee and instant coffee. The results are shown in Fig. 2.

Fig. 2 demonstrates that participants wrongly assume that energy drinks have the highest caffeine content, whereas the drink with the actually highest caffeine content (Starbucks coffee) received only a middle-ranking among the beverages. Although the caffeine content of Starbucks Coffee (160 mg caffeine for Short, 236 ml, up to 400 mg of caffeine for Venti, 591 ml) is two to five times higher when compared to energy drink (250 ml, 80 mg caffeine), 81.6% of participants stated that the caffeine content of energy drink was higher.

The discrepancy between perceived and actual caffeine content was also clear from the participants’ answer to the question of how many standard servings of filter coffee, energy drinks or cola equals 400 mg of caffeine. Participants reported that according to them 400 mg caffeine equates to a mean (SD) of 4.8 (3.3) cups of filter coffee, 2.8 (2.9) cans of energy drink, and 7.4 (7.0) glasses of cola. However, the actual amount of servings to equate 400 mg caffeine are 4.7 cups of filter coffee, 5.0 cans of energy drink, and 22.2 glasses of cola. Fig. 3 illustrates the discrepancy in actual and perceived caffeine content of energy drink and cola, when expressed in mg caffeine per serving.

Fig. 3 illustrates that participants overestimate the caffeine content of energy drinks and cola. Whereas filter coffee and energy drinks contain approximately the same amount of caffeine per serving, participants perceive that the caffeine content of energy drinks is approximately 1.7 times higher than that of a cup of coffee. The caffeine content of a typical 250 ml can of energy drink is rated about 1.7 times higher than its actual caffeine content (142.9 mg versus 80 mg, respectively), and the caffeine content of a glass of cola is perceived three times higher than its actual content (54.1 mg versus 18.0 mg, respectively). Only 13.6% of participants correctly identified that a cup of coffee contains more caffeine than a can of energy drink. All differences between perceived and actual caffeine content were statistically significant ($p < 0.001$). Perceived caffeine content was significantly ($p < 0.05$) higher when rated by women when compared to men for filter coffee (90.9 mg versus 72.7 mg, respectively), cola (61.5 mg versus 43.0 mg, respectively), and energy drink (160.0 mg versus 125.0 mg, respectively).

Finally, the vast majority of participants (85.5%) agreed with the statement that caffeine content should be labeled on any type of caffeine containing product.

4. Discussion

The main finding of our study is that participants have little knowledge of the relative caffeine content of caffeinated beverages. For example, 86.4% of participants stated that a typical energy drink (250 ml, 80 mg caffeine) contains more caffeine than a cup of filter