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# Effect of caffeine on medical student's performance during exams in Northern Border University (NBU), Saudi Arabia

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## ABSTRACT

*Background:* Caffeine is a somewhat psychoactive element that is broadly ingested. *Objective:* To confer consequence of caffeine on university student's performance thru exams in NBU, Saudi Arabia. *Methods:* This is across sectional study was conducted among 395 of the students of Northern Border University, KSA. Respondents were interviewed and filled a predesigned questionnaire. *Results:* The percentage of pupils that use caffeine was determined to be 92.2% in our survey. Caffeine use had no significant relationship with sex, age, BMI, study level, or GPA (P> 0.05). Coffee was the most prevalent source (89.3%), followed by chocolate (54.4%). In terms of daily caffeine use, 29.9% consume it three times a day, 28.6% two times a day, 13.7% four times a day, and 17.0% three times a day. When it comes to the rationale for daily intake, 40.9% use caffeine to improve attention, 29.7% use it to stay awake during courses, and 28.6% use it for morning vigour.When it comes to the time of day when people consume the most caffeine, 40.1% consume it in the late evening, which accounts for more than half of all cases. 61.3% believed that caffeine improves his or her GPA, and 59.9% agreed that caffeine extends study time. The majority (60.4%) believe that caffeine reduces body weight, while 44% have experienced negative side effects as a result of caffeine usage. 16.8% of people suffered tachycardia, while 14% felt gastrointestinal discomfort. *Conclusion:* Almost all studied students of NBU consume caffeine products. The most common source was coffee. Most of the students agreed that caffeine increases study hours and increases his/her GPA.

**Keywords:** caffeine, consumption, student's performance, GPA, NBU, KSA

## 1. INTRODUCTION

People worldwide have been consuming caffeine for over 1,000 years. Caffeine has lengthened histories of use and may be determined in lots of not unusual place foods, drinks, and medications. While caffeine has been the

situation of pharmacological research for numerous decades, the mechanism of action of caffeine was identified only recently as a blockage of adenosine receptors (Karapetian et al., 2012). Caffeine enhances psychomotor and cognitive performances in healthy volunteers, improve mood. Caffeine has diverse physiological effects including central nervous system stimulation associated with the successful sport, exercise, and cognitive performance, including alertness, concentration, energy levels, and self-reported feelings of fatigue (Huntley et al., 2012). Caffeine undergoes a complex interaction at the vascular level to regulate vascular tone, which involves direct antagonism of vascular adenosine receptors to facilitate vasodilatation, in addition to stimulation of endothelial cells to release nitric oxide. This activity facilitates further relaxation of smooth muscle cells in the vascular form (Lieberman et al., 2002).

Medical education is perceived as stressful. As excessive stress hampers students' performance, stress management is required for medical students. Stress causes definable physiological and mental responses within the body. For cognitive tasks and results, moderate stress is helpful, but insistently extraordinary strain could contribute to neuropsychiatric disorders such as anxiety and depression (Son, 2007). Caffeine is the greatest broadly used energizing, consuming 80% of the world's population and 90% of North American people daily. Even at low doses, caffeine leads to a significant increase in fire rates in areas that mediate sleep and mood, such as dorsal and middle weight nuclei and rough position (Hasher et al., 2002). Excessive quantities of caffeine can produce unwanted effects on mental function such as fatigue, nervousness, feeling angry, or depressed. Also, caffeine intakeis accompanied with physical dependency, which possibly will be revealed in decreased performance during withdrawal in some circumstances (O'Callaghan et al., 2018).

Regarding the physiological effects of caffeine, a study was conducted to raise cognizance of the neurophysiological possessions of caffeine over its biochemical conduits in the humanoid body. In short, the health benefits of caffeine improve sensitivity and help the human body against stress. Caffeine can handle with a predictablediminution in remembranceconcertin older personsthru the afternoon when the elderly experience a daily low point (Cappelletti et al., 2015).

Caffeine overdose causes harmful effects such as tachycardia, high blood pressure, nausea, vomiting, and gastritis. It is also known to be associated with irritation, insomnia, depression, and anxiety as well as seizures and stroke in some cases. In particular, in adolescents, caffeine accelerates aggression, reduces sleep hours, and increases daytime drowsiness and pain-relieving for headaches. Tolerance to some physiological effects of caffeine develops when caffeinated drinks are used upon a regular basis. Taking awayindicators often occur with the sudden exclusion of caffeine from the regimen. The frequency of withdrawal varies, as reported in survey studies and clinical trials from 4% to 100% (Sherman et al., 2016).

**Study rationale**

Up to our acquaintance, no proceeding study explaining the effect of caffeine on medical student’s performance during exams in the Northern Saudi Arabia region

**Study objectives**

The purpose of this research is to explore the consequence of caffeine on medical student’s performance during exams at Northern Border University (NBU), Saudi Arabia.

## 2. PARTICIPANTS AND METHODS

A cross-sectional analytical study was conducted targeting a number of 303 students designated by systematic random sampling technique from medical students of NBU, in Arar, Saudi Arabia, during the period from 1 November, 2020 to 31 May, 2021. Students were asked to fill a predesigned self-administered questionnaire, sent to them through the WhatsApp, Twitter, and/or Facebook messenger applications. The informed consent form was attached in association with the questionnaire to the social media. The questionnaire included questions about age, sex, marital status, study level year, GPA, consumption of caffeine, body weight, and height for calculation of BMI. The questionnaire also included questions about sources of caffeine; coffee, tea, chocolate, soda, or other sources and frequency of daily caffeine intake. Also, questions about the time of daily intake of the highest amount of caffeine, if caffeine increases the study hours, effect on performance during exams, and if there were unwanted effects related to caffeine consumption as dyspepsia and its effect on the BMI. There will be no clinical examination or blood tests to perform, results will be based on students' response only.

**Sampling**

The total number of medical students at Northern Border University was 674 students. We are going to include 303 students selected using systematic random sampling from all medical students of Northern Border University who accept to contribute in the research, during the study period after filling the informed written consent and complete the questionnaire. We will exclude all medical students who do not accept to contribute in the research, incomplete questionnaires or other participants from other universities or faculties.

**Statistical analysis**

The poised data was analysedby means of the (SPSS Inc. Chicago, IL, USA) variety 23. Descriptive indicators were done. Proportions specified for qualitative data. Significance designed by the $X^2$ test. P value was measured substantial if P more than 0.05.

**Ethical considerations**

Approval to conduct the researchwas got from the Research Ethics Committee of the Northern Border Universitywith decision letter number (13/42/H). The questionnaire contained a brief introduction explaining the aims and significance of the study. The questionnaire was anonymous, for participant's confidentiality, and the fileswasreservedsecurely.

## 3. RESULTS

Table 1 illustrates the sex, age group, marital status, BMI, Study level, GPA and consumption of caffeine among the studied students. 82.5% of the sample was females, 62.0% aged 21 – 23 years, 88.4% were singles. As regards the GPA, 50.1% were in the category B, 29.6% C, 13.7% A and 6.6% D. more than half (58.7%) had normal BMI, 19.2% were overweight and 7.6% were obese. Our study found that the percentage of consumption of caffeine was 92.2% (figure 1).

**Table 1** sex, age group, Marital status, BMI, Study level, GPA and consumption of caffeineamong the studied students, NBU, Arar, KSA, 2020(N=395).

| Variables | Frequency (N=395) | Percent |
|---|---|---|
| Sex | | |
| Male | 69 | 17.5 |
| Female | 326 | 82.5 |
| Age groups | | |
| 17 – 20 years | 123 | 31.1 |
| 21 – 23 years | 245 | 62.0 |
| 24 – 28 years | 27 | 6.8 |
| Marital status | | |
| Single | 349 | 88.4 |
| Married | 46 | 11.6 |
| Study level | | |
| M1 | 64 | 16.2 |
| M2 | 59 | 14.9 |
| M3 | 55 | 13.9 |
| M4 | 122 | 30.9 |
| M5 | 95 | 24.1 |
| GPA | | |
| A | 54 | 13.7 |
| B | 198 | 50.1 |
| C | 117 | 29.6 |
| D or lower | 26 | 6.6 |
| Body Mass Index (BMI) | | |
| Underweight | 57 | 14.4 |

| | | |
|---|---|---|
| Normal | 232 | 58.7 |
| Overweight | 76 | 19.2 |
| Obese | 30 | 7.6 |
| Consumption of caffeine | | |
| Yes | 364 | 92.2 |
| No | 31 | 7.8 |

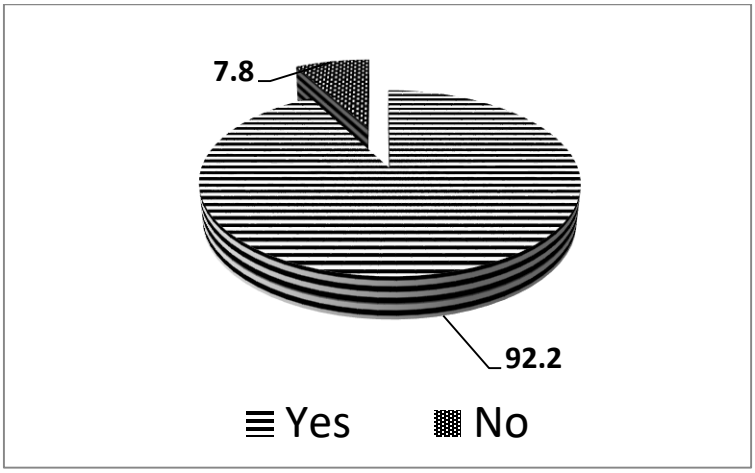


**Figure 1** percentage of caffeine consumption among the studied students

**Table 2** Knowledge and practice of caffeine consumers (N=364).

| Variables | Frequency (N=364) | Percent |
|---|---|---|
| Source of caffeine | | |
| Coffee | 325 | 89.3 |
| Tea | 160 | 44.0 |
| Chocolate | 198 | 54.4 |
| Soda | 109 | 29.9 |
| Other sources | 56 | 15.4 |
| Regularity of day-to-day caffeine drinking | | |
| 1 | 39 | 10.7 |
| 2 | 104 | 28.6 |
| 3 | 109 | 29.9 |
| 4 | 50 | 28.6, 13.7, 17.0 |
| 5 | 62 | 17.0 |
| Time of daily highest amount of caffeine | | |
| Morning | 121 | 33.2 |
| Afternoon | 4 | 1.1 |
| Early evening | 93 | 25.5 |
| Late evening | 146 | 40.1 |
| Caffeine increases your GPA. | | |
| Agree | 223 | 61.3 |
| Neutral | 108 | 29.7 |
| Disagree | 33 | 9.1 |
| Caffeine increases your study hours. | | |
| Agree | 218 | 59.9 |
| Neutral | 102 | 28.0 |

| | | |
|---|---|---|
| Disagree | 44 | 12.1 |
| Reason for daily intake | | |
| Maintain being awake during classes | 108 | 29.7 |
| Increase focus | 149 | 40.9 |
| Morning energy | 104 | 28.6 |
| What effect do you think caffeine has on body weight? | | |
| Increase | 144 | 39.6 |
| Decrease | 220 | 60.4 |
| Do you usually have breakfast prior to classes? | | |
| Yes | 144 | 39.6 |
| No | 220 | 60.4 |
| Do you have any untoward effects related to caffeine consumption? | | |
| Yes | 160 | 44.0 |
| No | 204 | 56.0 |
| If yes, what is the most common one? | | |
| Diarrhea | 21 | 5.8 |
| Tachycardia | 61 | 16.8 |
| Dizziness | 27 | 7.4 |
| Gastric pain | 51 | 14.0 |

Table 2 shows the Knowledge and practice of caffeine consumers. From the table it is clear that, the most common source was coffee 89.3% followed by chocolate 54.4%, tea 44%, soda 29.9% and other sources 15.4%. The frequency of daily caffeine intake 29.9% take caffeine 3 time daily, 28.6% 2 time daily, 13.7% 4 time daily and 17.0%3 time daily. As regards reason for daily intake, we found that, 40.9% take caffeine to increase focus, 29,7% take it to maintain being awake during classes and 28.6% reported morning energy as a reason for daily intake. Regards the time of daily highest amount of caffeine; 40.1% take caffeine at late evening, more than half of cases 61.3% agreed that caffeine increases his/her GPA, 59.9% agreed that caffeine increases study hours, The majority 60.4% think that caffeine decreases body weight, 44% had untoward effects related to caffeine consumption from them 16.8% had tachycardia and 14% had gastric pain (figure 2 – 4).

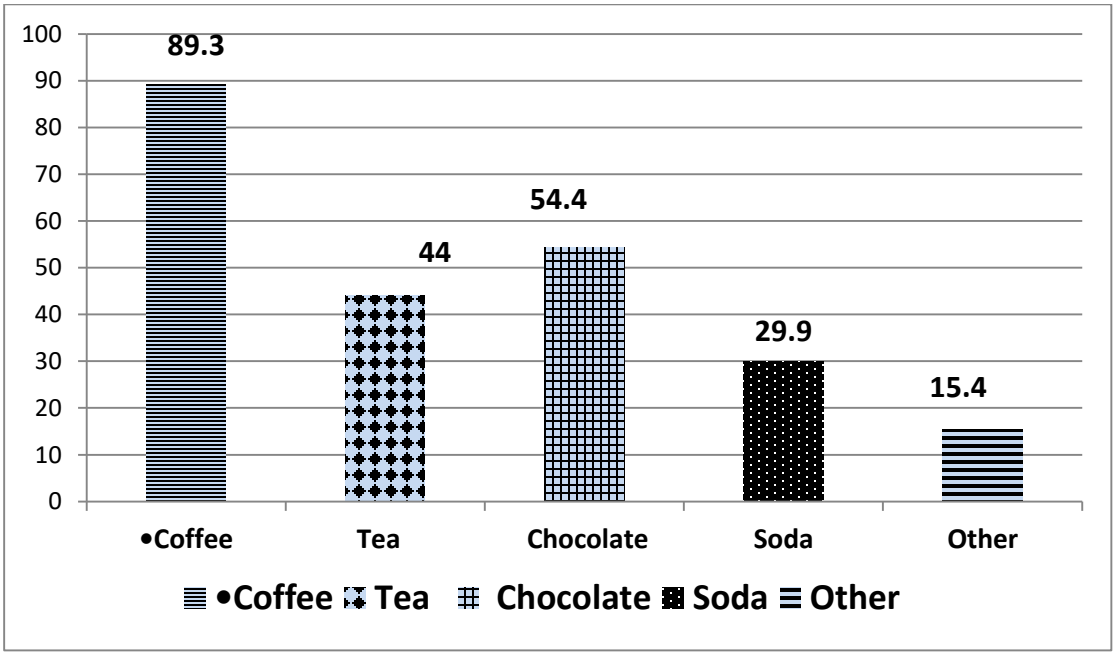


**Figure 2** Source of caffeine among the studied students (There is overlapping)

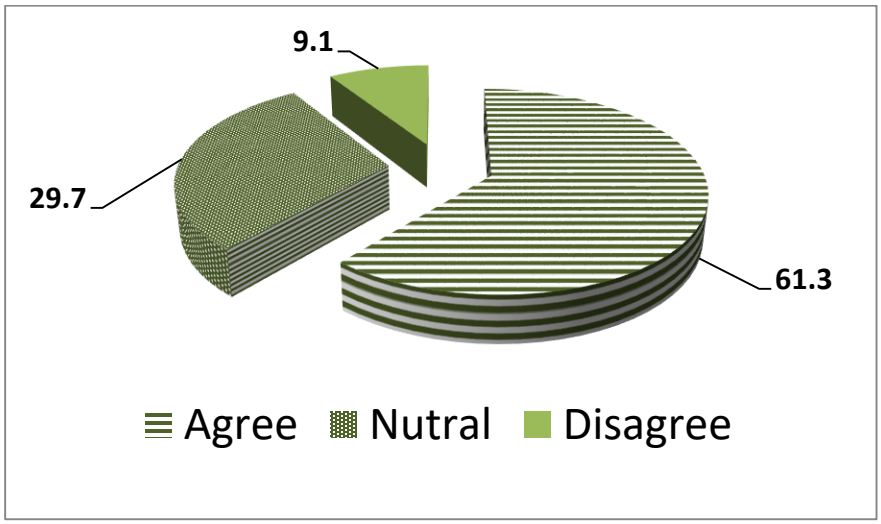


**Figure 3** caffeine consumption increases GPA of the studied students

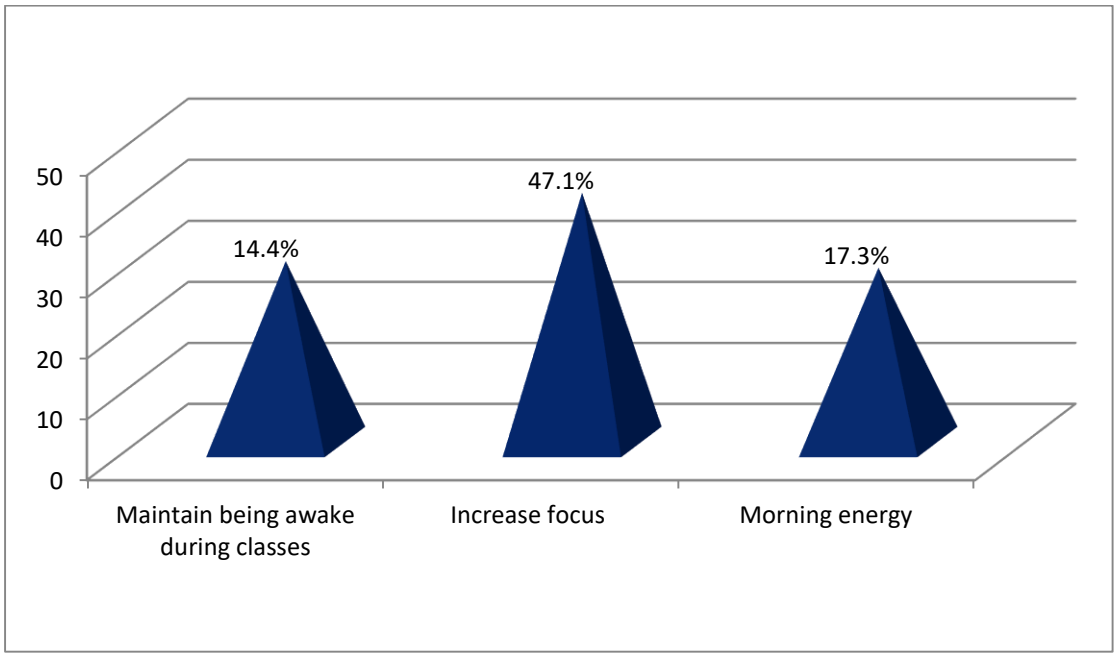


**Figure 4** Reason for daily intake of caffaiene among the studied students

Table 3 illustrates the relationship between caffeine consumption and sex, age, marital status, BMI, study level and GPA, our study found that there was no significant relationship concerning caffeine drinking and sex, age, marital status, BMI, study level and GPA (P> 0.05).

**Table 3** The relationship between caffeine consumption and sex, age, marital status, BMI, study level and GPA.

| Variables | | Caffeine Consumption | | Total | P-value |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Sex | Male | 2 | 67 | 69 | 0.066* |
| | | 2.9% | 97.1% | 100.0% | |
| | Female | 29 | 297 | 326 | |
| | | 8.9% | 91.1% | 100.0% | |
| Age Groups | 17 – 20 years | 11 | 112 | 123 | 0.281 |
| | | 8.9% | 91.1% | 100.0% | |

| | | | | | |
|---|---|---|---|---|---|
| | 21 – 23 years | 20 | 225 | 245 | |
| | | 8.2% | 91.8% | 100.0% | |
| | 24 – 28 years | 0 | 27 | 27 | |
| | | 0.0% | 100.0% | 100.0% | |
| Marital Status | Single | 28 | 321 | 349 | 0.500* |
| | | 8.0% | 92.0% | 100.0% | |
| | Married | 3 | 43 | 46 | |
| | | 6.5% | 93.5% | 100.0% | |
| Body Mass Index (BMI) | Underweight | 3 | 54 | 57 | 0.259 |
| | | 5.3% | 94.7% | 100.0% | |
| | Normal | 20 | 212 | 232 | |
| | | 8.6% | 91.4% | 100.0% | |
| | Overweight | 8 | 68 | 76 | |
| | | 10.5% | 89.5% | 100.0% | |
| | Obese | 0 | 30 | 30 | |
| | | 0.0% | 100.0% | 100.0% | |
| Study level | M1 | 2 | 62 | 64 | 0.064 |
| | | 3.1% | 96.9% | 100.0% | |
| | M2 | 9 | 50 | 59 | |
| | | 15.3% | 84.7% | 100.0% | |
| | M3 | 4 | 51 | 55 | |
| | | 7.3% | 92.7% | 100.0% | |
| | M4 | 12 | 110 | 122 | |
| | | 9.8% | 90.2% | 100.0% | |
| | M5 | 4 | 91 | 95 | |
| | | 4.2% | 95.8% | 100.0% | |
| GPA | A | 2 | 52 | 54 | 0.331 |
| | | 3.7% | 96.3% | 100.0% | |
| | B | 15 | 183 | 198 | |
| | | 7.6% | 92.4% | 100.0% | |
| | C | 10 | 107 | 117 | |
| | | 8.5% | 91.5% | 100.0% | |
| | D or lower | 4 | 22 | 26 | |
| | | 15.4% | 84.6% | 100.0% | |

## 4. DISCUSSION

Caffeine is the utmostbroadlyconsumed drug in the world (Sherman et al., 2016). Caffeine is a mildly psychoactive substance that is widely consumed. According to data from nationwide illustrative groups, around 89 percent of American people drink caffeinated goods, with no variation in the frequency of consumption between men and women (Fulgoni et al., 2015). Caffeine use in stumpy to reasonable levels is typically harmless, but in sensitive personalities, greater dosages might raise the hazard of undesirable health effects such as circulatory difficulties and perinatal impediments and consequences (Higdon et al., 2006). Caffeine generating increased wellbeing, happiness, energy, alertness, and sociability, on the other hand, among habitual caffeine users, abrupt cessation may result in time-limited withdrawal symptoms such as headache (Juliano & Griffiths, 2004). This is across sectional study was conducted among 395 of the students of Northern Border University, KSA. The study aimed to discuss effect of caffeine on university student's performance during exams in Northern Border University, Saudi Arabia. In the USA, > 90% of adult persons drinks it habitually, besides, amongst them, normal ingesting is > 200 mg of caffeine/day (Frary et al., 2008). Extra caffeine than is delimited in two 6-ounce saucers of coffee or five 12-ouncedismisses of soft beverages (Meredith et al., 2013).

Our study found that consumption of caffeine was 92.2%. Similar to our results, a cross-sectional survey in Makkah region from different hospitals in Makkah region includes Makkah, Jeddah and Taif Cities which included 437 medical interns reported that the

total percentage of caffeine consumers was 86.9% of all participants (Bardisi et al., 2016). Another cross-sectional survey of caffeine consumption conducted among 1787 participants found that the majority 84% of participants stated spending foodstuffs encompassing caffeine ≥1 time/week (Knapik et al., 2017). In North-eastern Thailand, another study was carried out among 1,321 out of 3,332 working-age participants; the results showed that 39.6% of the working-age population consumed caffeine (Polsripradist et al., 2016). In the UAE, a prevalence study was steered on 403 randomly chosen people found that more than 98.5% of the study participants were caffeine consumers (Hammami et al., 2018). Another study conducted among university student reported; 66.5% students consume caffeine on daily basis (Nasir et al., 2018).

According to relation between Caffeine consumption and sex, age, marital status, BMI, study level and GPA, our study found that there was no substantial relation between ingesting of caffeine and sex, age, marital status, BMI, study level and GPA (P> 0.05). Another study showed that features autonomously linked with caffeine consumption comprised elder age, society other than dark, tobacco use, less aerobic drill, and fewer slumber. Advanced coffee drinking was autonomously related to female sex, older age, advanced edification level (Knapik et al., 2017). Another study reported that there was no statistical significance between males and females' patterns of consumption (Hammami et al., 2018).

Caffeine use is frequent among children and adolescents, with soda, tea, and coffee being the most popular sources of caffeine, as well as energy drinks in older teenagers (Ahluwalia et al., 2015; Burrows et al., 2013). However, our study reported; the most common source was coffee 89.3% followed by chocolate 54.4%, tea 44%, soda 29.9% and other sources 15.4%. In contrast to our findings, another study reported; Sodas (56%), coffee (45%), teas (36%), and energy drinks were the most popular caffeinated beverages (27%) (Knapik et al., 2017). Comparable to our figures additional study stated that the most common source was coffee (74.7%), other sources reported; energy drinks (66.2%), chocolate milk or drinks and cocoa drinks (51.6 to 55.8%), cola carbonated soft drinks (48.4%), and tea (28.8%) (Polsripradist et al., 2016). However, results from another study showed that tea was most commonly consumed caffeinated product (33.8%) followed by soft drinks (28.6%), coffee (22.5%) and energy drinks (14.3%) (Nasir et al., 2018). As regards reason for daily intake, our found that 40.9% take caffeine to increase focus, 29.7% take it to maintain being awake during classes and 28.6% reported morning energy as a reason for daily intake. Another study reported; most of the subjects consumed caffeine for the purpose of to be more awake (29.8%), to cure headache (20.8%), satisfy craving (16.7%), for taste (17.9%), to be more active (13.7%) (Nasir et al., 2018).

Regarding to Knowledge and practice of caffeine consumers, our study reported; as frequency of daily caffeine intake 29.9% take caffeine 3 time daily, 40.1% take caffeine at late evening as a time of daily highest amount of caffeine, more than half of cases 61.3% agreed that caffeine increases your GPA, 59.9% agreed that Caffeine increases study hours, The majority 60.4% think that caffeine decreases body weight, 44% had untoward effects related to caffeine consumption from them 16.8% had tachycardia and 14% had gastric pain. Another study found that (77.4%) consumers believed that caffeine enhance performance, 63.4% believed caffeine is harmful to health, 84.7% think that caffeine is addictive, 26% believed caffeine can disturbed coordination and 28.8% believed caffeine help to lose weight which was similar to our findings (Nasir et al., 2018).

## 5. CONCLUSION AND RECOMMENDATIONS

Our study found that the almost all studied students of NBU consume caffeine products. The most common source was coffee. Most of the students agreed that caffeine increases study hours and increases his/her GPA. So, we recommend health education to those students to be independent on any substance even caffeine products, also we recommend other large scale researches regarding this issue all-over the KSA.

**Acknowledgement**

We thank the participants who were all contributed samples to the study.

**Author Contributions**

We certify, as authors, that we have participated sufficiently in the intellectual content, conception and design of this work or the analysis and interpretation of the data (when applicable), as well as the writing of the manuscript, to take public responsibility for it and have agreed to have our name listed as a contributor. All persons who have made substantial contributions to the work reported in the manuscript.

**Informed consent**

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

**Ethical approval**

Approval to conduct the research was got from the Research Ethics Committee of the Northern Border University with decision letter number (13/42/H).

**Funding**

This study has not received any external funding.

**Conflicts of interest**

The authors declare that there are no conflicts of interests.

**Data and materials availability**

All data associated with this study are present in the paper.

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