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EVALUATION OF ENERGY DRINK INTAKE IN SELECTED STUDENT GROUPS

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ABSTRACT

Background. Energy drinks are intended for people who work hard, both physically and mentally, particularly young people engaged in an active lifestyle.

Objective. To assess the intake of energy drinks in a student group, during examinations and throughout an academic year.

Materials and methods. A survey was performed on 92 students attending the Faculty of Human Nutrition and Consumer Sciences (Warsaw University of Life Sciences - WULS) and those from the Faculty of Physical Education (University of Physical Education - UPE) in Warsaw.

Results. Students consumed many more energy drinks during examinations (1424±1577 ml/week) than during the academic year (441±579 ml/week). About 30% more subjects from UPE drank such drinks, throughout both examinations and the academic year, compared to those from WULS. On average, most students drunk less than one can per day. During exams, only 49% students consumed an average of less than 125 ml of energy drinks per day, (WULS; 55% and UPE; 46%), whereas this rose to 84% during the academic year (WULS; 91% and UPA; 80%). The most popular brands were Tiger, Red Bull and Burn.

Conclusions. It is important that due care and attention is exercised in consuming high amounts of energy drinks as they contain bioactive substances, including caffeine, inositol, taurine, glucuronolactone and vitamins of the group B. These all have specific effects on the body and can be a cause for concern if their intake is high.

Key words: *energy drinks, intake, students*

STRESZCZENIE

Wprowadzenie. Napoje energetyzujące przeznaczone są dla osób intensywnie pracujących fizycznie i umysłowo, w tym dla ludzi młodych, prowadzących aktywny tryb życia.

Cel badań. Przedmiotem pracy była ocena spożycia napojów energetyzujących przez studentów w okresie sesji egzaminacyjnej oraz w czasie roku akademickiego.

Materiał i metody. W badaniu wzięło udział 92 studentów Wydziału Nauk o Żywieniu Człowieka (SGGW) oraz Wydziału Wychowania Fizycznego (AWF) w Warszawie. W pracy wykorzystano metodę sondażu diagnostycznego, a materiał do badań zebrano za pomocą autorskiej ankiety.

Wyniki. Stwierdzono znacznie wyższe spożycie napojów energetyzujących w czasie sesji egzaminacyjnej (1424±1577 ml/tydzień) w porównaniu do konsumpcji podczas roku akademickiego (441±579 ml/tydzień). O około 30% więcej studentów AWF niż studentów SGGW piło napoje energetyzujące zarówno w czasie sesji jak i poza nią. Większość studentów spożywała średnio mniej niż 125 ml napojów energetyzujących na dobę. W czasie sesji było to jedynie 49% badanych (SGGW 55%; AWF 46%), zaś poza nią 84% (SGGW 91%; AWF 80%). Do najczęściej wybieranych marek należał ,,Tiger", ,,Red Bull" oraz ,,Burn".

Wnioski. Należy zwracać uwagę na ilości spożywanych napojów energetyzujących, gdyż zawarte w nich substancje bioaktywne, do których należą kofeina, inozytol, tauryna, glukuronolakton oraz witaminy z grupy B mogą wywoływać określony wpływ na organizm, w zależności od ilości ich spożycia.

Słowa kluczowe: *napoje energetyzujące, spożycie, studenci*

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INRODUCTION

Energy drinks are one of the most popularly consumed types of 'functional products'. They contain bioactive substances such as caffeine, taurine, inositol, glucuronolactone and B group vitamins. These substances enhance performance of certain bodily functions, improve cognitiveness, shorten reaction times and stimulate the body to prepare for intensive physical and mental effort [6, 16]. The result of combining moderate doses of such key substances, (eg. caffeine and taurine), in a 250 ml energy drink, increases attention span, reaction to stimuli and the visual processing rate depending on whether glucose has been added or withheld [1, 19].

Drinking energy drinks has been shown to make drivers less sleepy, (those driving for prolonged periods), and more focused [10, 13]. Energy drinks containing, amongst other ingredients, taurine, glucuronolactone, caffeine have been found to significantly improve human performance like reaction time, concentration, memory and alertness as well as improving mood [1, 15, 19]. When drunk before physical exercise, they improve endurance and efficacy [7]. Studies have shown that drinking one 250 ml can of energy drinks will significantly increase both aerobic and anaerobic respiration which may be linked to the concomitant rise in blood glucose and increased tolerance to pain [1, 12]. It is recognised that both caffeine and taurine improve physical performance, however those energy drinks without glucose but containing the aforementioned biostimulants have in fact no stimulant effects [5]. As yet it is still unclear which of the ingredients actually cause the stimulating effect. Studies to date suggest that a combination of glucose and caffeine or caffeine and taurine may synergistically significantly improve concentration [4, 8, 14].

Excessive consumption of energy drinks, together with their inappropriate use may constitute a health hazard, especially in children, youth and pregnant women [6, 16]. A risk assessment should therefore be planned/carried out to determine the actions/interactions of all active ingredients found in energy drinks [17]. These drinks are targeted for people doing physically demanding tasks, those requiring much mental effort and for vehicle drivers. The main consumers are however young people that pursue and active lifestyle [6]. For this reason the current study was therefore focused on students consuming such products.

MATERIAL AND METHODS

A survey was performed in 2011, using a questionnaire, on 48 students attending the Faculty of Human Nutrition and Consumer Sciences (Warsaw University of Life Sciences - WULS) and likewise 44 from the Faculty of Physical Education (University of Physical Education - UPE) in Warsaw; average age being 24±1 years. Women made up 50% of the former and 57% of the latter. Questions included what product brands were consumed and how often. The 'Statistica 9' software package was used to perform the *Shapiro-Wilk* test for normality, whilst qualitative and quantitative variables were respectively analysed for statistical significance by the Chi^2 and *Kruskal-Wallis* tests. In all cases $p \leq 0.05$ was adopted as the critical value showing significance.

RESULTS

Over half the subjects (62%) drank energy drinks during exams (Table 1), of whom 79.5% were from the UPE and 45.8% from WULS, $p<0.05$. The overall figure decreased by 3.3% during term time, where students from WULS showed no change whereas those from UPE drank 6.8% less; differences being not significant. On average, WULS subjects drank significantly less fluid volume from energy drinks (1150 mls), than those from UPE (1590 mls) during the exams week ie. 37% difference (Table 2). In contrast, subjects drank significantly less during term time, on average 441 mls/week compared to the exam period, of whom those from UPE drank 532 mls/week, and those from WULS drank 308 mls/week; differences being significant.

Table 1. Percentage of people consuming energy drinks in tested periods

Intake of energy drinks	Subjects			*p**
	Total n=92 n (%)	WULF[1] n=48 n (%)	UPE[2] n=44 n (%)	
Exams time				
Yes	57 (62.0)	22 (45.8)	35 (79.5)	<0.001**
No	35 (38.0)	26 (54.2)	9 (20.5)	
Term time				
Yes	54 (58.7)	22 (45.8)	32 (72.7)	0.01**
No	38 (41.3)	26 (54.2)	12 (27.3)	
*p**	0.59	1.00	0.63	

[1]Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences;
[2]Faculty of Physical Education, University of Physical Education;
**Chi*-square test (in relation to time or school);
** Differences statistically significant

Almost half the subjects drank less than 125 mls during exams (Table 3); this being respectively 54.55 and 45.8% for WULS and UPE. Nevertheless, during exams one third of subjects drank 125-350 mls of energy drinks/24 hrs (WULS: 31.8% and UPE: 28.5%). Stu-

Table 2. Weekly intake of energy drinks in tested periods

Volume (ml/week)	Subjects			*p**
Exams time				
	Total n=57	WULF[1] n=22	UPE[2] n=35	
Mean ± SD	1424 ± 1577	1159 ± 923	1590 ± 1870	0.96
Range	63-9000	63-3500	63-9000	
Median	1000	1000	1000	
Term time				
	Total n=54	WULF[1] n=22	UPE[2] n=32	
Mean ± SD	441 ± 579	308 ± 399	532 ± 666	0.35
Range	63-2250	63-1625	63-2250	
Median	204	125	250	
*p**	<0.001**	<0.001**	<0.001**	

[1]Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences;
[2]Faculty of Physical Education, University of Physical Education;
* *Kruskal–Wallis* test (In relation to time or school);
**Differences statistically significant

dents drinking between 350-750 mls/25 hrs constituted 13.75 and 20% respectively from WULS and UPE whilst those drinking more than 750 mls daily were overall 5.7% of the students.

Throughout term time, a large majority of subjects drank less than 125 mls/24 hrs of energy drinks (WULS: 90.9% and UPE: 80%), the remaining students drinking between 125-350 mls/24 hrs; there were no instances noted of moderate or high level drinking. Differences between student groups were not significant. The most popular energy drink consumed during exams was 'Tiger', (>50%), followed by 'Red Bull' and then 'Burn' (47%) (Figure 1), whilst during term time half drank 'Tiger' or 'Red Bull' and half drank 'Burn'.

Table 3. Evaluation of daily intake of energy drinks in tested periods

Volume[3]	Subjects			*p**
Exams time				
	Total n=57 n (%)	WULF[1] n=22 n (%)	UPE[2] n=35 n (%)	
Very low (<125 ml/day)	28 (49.2)	12 (54.5)	16 (45.8)	0.27
Low (125-350 ml/day)	17 (29.8)	7 (31.8)	10 (28.5)	
Moderate (350-750 ml/day)	10 (17.5)	3 (13.7)	7 (20.0)	
High (≥750 ml/day)	2 (3.5)	0 (0.0)	2 (5.7)	
Term time				
	Total n=54 n (%)	WULF[1] n=22 n (%)	UPE[2] n=32 n (%)	
Very low (<125 ml/day)	48 (84.3)	20 (90.9)	28 (80.0)	0.28
Low (125-350 ml/day)	9 (15.7)	2 (9.1)	7 (20.0)	
Moderate (350-750 ml/day)	0 (0.0)	0 (0.0)	0 (0.0)	
High (≥750 ml/day)	0 (0.0)	0 (0.0)	0 (0.0)	
*p**	<0.001**	0.002**	<0.001**	

[1]Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences;
[2]Faculty of Physical Education, University of Physical Education;
[3]Divided according to Scientific Committee on Food (2003), self-modified;
**Chi* [2] test (in relation to time or school);
**Differences statistically significant

DISCUSSION

The finding that over half the students drank energy drinks is consistent with an Argentine study conducted by *Ballistreri* and *Corradi-Webster* [3] on physical education students attending the Rosario University. A somewhat smaller result was observed by the study of *Atilla* and *Cakir* [2] amongst medical students at the

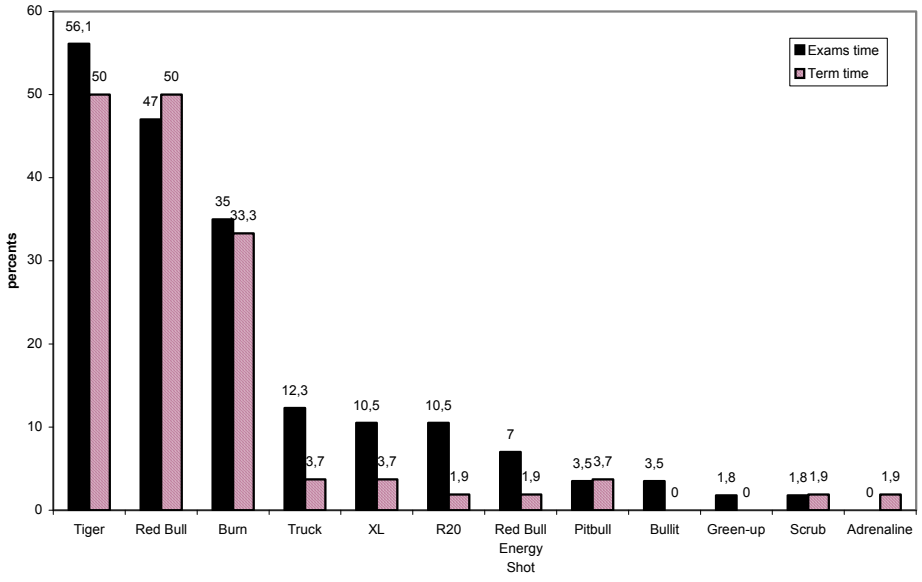

Figure 1. Energy drinks bands consumed by students in tested periods

University of Ankara, whereas more students consumed energy drinks who were studying physical education (84.1%). A similar outcome was demonstrated in a study by *Niedzwiecka* and *Janik* [11] on students from the Academy of Physical Education in Warsaw. The main consumers of energy drinks are children, adolescents and young adults, which was confirmed by a study undertaken in Eire and Northern Ireland by a 'Stimulant Drinks Committee'; with 51% and 37% respectively of subjects drinking occasionally, aged 11-35 yrs whilst 10% and 11% did so regularly.

Significantly more students from UPE drank during exams than term time (79.5% vs 72.7%), however less than half (45.8%) of the WULS students drank during both periods of time. These results may have arisen from the UPE students being more physically active, who wish to increase their fitness and performance levels, thus to help obtain better sports rankings. A study by *Lagowska* et al. [9], carried out on students aged 15-20 yrs showed that energy drinks are most frequently consumed by those engaged in moderate physical exercise compared to students that do low levels. It was suggested that this former group recognise that certain foodstuffs, targeted at physically active people, can improve physical and mental performance, however they were unaware of the nutritional differences between energy drinks and isotonic ones [9].

The present study found that energy drink consumption increases 3-fold during exams compared to term time. Both student groups drank on average 1424 mls/week, which calculated per day was 203 mls, (ie. nearly a one 250 ml can). Almost half the subjects (49.2%) drank on average less than 125 mls/24 hrs during exams, however this increased to 84.2% for term time. As already mentioned, it was also seen that consumption rates of 125-350 mls/24 hrs and >350mls/24 hrs occurred in 29.8% and 15.7% students respectively. This intake represents around 40-112 mg caffeine, 300-840 mg glucuronolactone and 500-1400 mg taurine. Furthermore, some students drank more; 350-750 mls/24 hrs by 17.5% and 3.5% students drank >750 mls/24 hrs. The latter represents an intake of >240 mg caffeine, 1800 mg glucuronolactone and 300 mg taurine. The study by *Atilla* and *Cakir* [2], previously alluded to, on medical students in Ankara, showed that a large majority (89.7%) drank less than 1 can/24 hrs, 5.5% drank 1 can, 3.4% 2 cans and 1,4% >2 cans. According to the Irish 'Stimulant Drinks Committee', the average consumption of energy drinks in persons aged 11-35 yrs is around 3 cans/week (750 mls), but the maximum consumption noted was 8 cans (2000 mls) which was drunk all in one go; such a large intake level constitutes a health risk, particularly for those hyper-sensitive to caffeine [17]. This has been confirmed by a fatality arising from an Irish 18 year old youth during a basketball match caused by heart failure, most probably due to excessive drinking of energy drinks. This incident then prompted a risk assessment of all energy drinks on the Irish market. Another incident described was that of a female 16 year old volleyball player in whom orthostatic intolerance was found arising from reversible postural tachycardia caused by excessive drinking of energy drinks (4-5 cans daily) [17, 18].

Overall, the most frequently consumed brand was 'Tiger' (56.1%), where 50% drank this during term time. "Red Bull' was bought by 50% of subjects during both time periods, whereas one third bought 'Burn'. Similar results were observed in the *Attilla* and *Cakir* study [2], with the exception of 'Tiger' (being mainly available only on the Polish market); subjects most frequently drinking "Red Bull' (51.7%) and 'Burn' (20%).

CONCLUSIONS

1. Energy drinks were consumed by a larger majority of students attending the Faculty of Physical Education, both during term time and exams, which can be linked to a greater physical activity compared to students from the Faculty of Human Nutrition and Consumer Sciences.
2. Students from both Faculties drank 3 times more energy drinks during exams than at term time.

REFERENCES

1. *Alford C., Cox H., Wescott R.*: The effects of Red Bull Energy Drink on human performance and mood. Amino Acids 2001, 21, 139–150.
2. *Atilla S., Cakir B.*: Energy-drink consumption in college students and associated factors. Nutrition 2011, 27, 316–322.
3. *Ballistreri M.C., Corradi-Webster C.M.*: Consumption of energy drinks among physical education students. Rev. Latino-Am Enfermagem 2008, 16, 558-64.
4. *Bichler A., Swenson A., Harris M.A.*: A combination of caffeine and taurine has no effect on short term memory but induces changes in heart rate and mean arterial blood pressure. Amino Acids 2006, 31, 471–476.
5. *Candow D.G., Kleisinger A.K., Grenier S., Dorsch K D.:* Effect of sugar-free Red Bull energy drink on high-intensity run time-to-exhaustion in young adults. *J Strength Cond Res* 2009, 23, 1271-1275.
6. *Hoffman M., Świderski F.:* Napoje energetyzujące i ich składniki funkcjonalne. Przem Spoż 2008, 10, 8-13.
7. *Ivy J.L., Kammer L., Ding Z., Wang B., Bernard J.R., Liao Y.H., Hwang J.:* Improved cycling time-trial performance after ingestion of a caffeine energy drink. Int J Sport Nutr Exerc Metabol 2009, 19, 61-78.

8. *Jay M.S., Petrilli M.R., Ferguson A.S., Dawson D., Lamond N.*: The suitability of a caffeinated energy drink for night-shift workers. Physiol Behav 2006, 87, 925–931.
9. *Łagowska K., Woźniewicz M., Jeszka J.*: Porównanie nawyków żywieniowych młodzieży z uwzględnieniem płci oraz poziomu aktywności fizycznej. Rocz Panstw Zakl Hig 2011, 62, 335-342.
10. *Mets M.A.J., Ketzer S., Blom C., Gerven M.H., Willigenburg G.M.H., Olivier B., Verste J.C.*: Positive effects of Red Bull Energy Drink on driving performance during prolonged driving. Psychopharmacol 2011, 214, 737–745.
11. *Niedźwiecka–Kącik D., Janik A.*: Konsumpcja napojów energetycznych i energetyzujących przez studentów Akademii Wychowania Fizycznego i Politechniki Warszawskiej oraz ich wiedza na temat tych napojów. Hand Wew 2006, 6, 249-254.
12. *Ragsdale F.R., Gronli D.T., Batool N., Haight N., Mehaffey A., McMahon E.C., Nalli T.W., Mannello C.M., Sell C.J., McCann P.J., Kastello G.M., Hooks T., Wilson T.*: Effect of Red Bull energy drink on cardiovascular and renal function. Amino Acids 2010, 38, 1193–1200.
13. *Reyner L.A., Horne J.A.*: Efficacy of a functional energy drinks in counteracting driver sleepiness. Physiol Behav 2002, 75, 331-335.
14. *Scholey B.A., Kennedy D.O.*: Cognitive and physiological effects of an "energy drink": an evaluation of the whole drink and of glucose, caffeine and herbal flavouring fractions, Psychopharmacol 2004, 176, 320–330.
15. *Seidl R., Peyrl A., Nicham R., Houser E.*: A taurine and caffeine-containing drink stimulates cognitive performance and well-being, Amino Acids 2000, 19, 635-642.
16. *Sikora E.:* Napoje energetyzujące - korzyści i zagrożenia. Przem Ferm Owoc-Warzyw 2008, 3, 28.
17. Stimulant Drinks Committee: Opinion of the Scientific Committee on Food on Additional information on energy drinks, 2001, http://ec.europa.eu/food/fs/sc/scf/out169_en.pdf, 10.06.2011.
18. *Terlizzi R., Rocchi C., Serra M., Solieri L., Cortelli P.*: Reversible postural tachycardia syndrome due to inadvertent overuse of Red Bull. Clin Auton Res 2008, 18, 221–223.
19. *Warburton D.M., Bersellini E., Sweeney E.*: An evaluation of a caffeinated taurine drink on mood, memory and information processing in healthy volunteers without caffeine abstinence. Psychopharmacol 2001, 158, 322–328.

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