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NUTRITIONAL STATUS AND CONSUMPTION OF ENERGY DRINKS AMONG GYM GOERS AND NON-GYM-GOERS IN LUANDA, ANGOLA

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ABSTRACT

Energy drinks, also consisting of carbohydrates and sugars, are known for their stimulating effects, both in improving muscle performance and psychostimulating effects, especially among physical activity practitioners and young people. Thus, the study sought to understand the relationship between the nutritional status and the consumption of energy drinks in individuals attending gyms and non-attending gyms in Luanda, Angola, through the inclusion of 204 male individuals, 102 for each group. The results showed that the most consumed drinks were coffee and the national energy drink "A", with a statistically significant association between the variables Body Mass Index (BMI) and age, p=0.002 in FG and p=0.001 in non-gym-goers, and between BMI and the time of consumption of energy drinks (p=0.01) in gym-goers, demonstrating that such variables seem to tend to change the nutritional pattern of individuals.

Key words: Energy drinks. Caffeine. Gyms. Nutrition.

RESUMO

Estado nutricional e consumo de bebidas energéticas entre frequentadores e não frequentadores de ginásios em Luanda, Angola

As bebidas energéticas, também constituídas por hidratos de carbono e açúcares, são conhecidas pelos seus efeitos estimulantes, tanto na melhoria do desempenho muscular como nos efeitos psicoestimulantes, principalmente entre os praticantes de atividade física e jovens. Assim, o estudo procurou compreender a relação entre o estado nutricional e o consumo de bebidas energéticas em indivíduos frequentadores e não frequentadores de ginásios em Luanda, Angola, através da inclusão de 204 indivíduos do sexo masculino, 102 para cada grupo. Os resultados mostraram que as bebidas mais consumidas foram o café e a bebida energética nacional "A", havendo uma associação estatisticamente significativa entre as variáveis Índice de Massa Corporal (IMC) e idade, p=0,002 nos frequentadores de ginásio e p=0,001 nos não frequentadores, e entre o IMC e o tempo de consumo de bebidas energéticas (p=0,01) nos frequentadores de ginásio, demonstrando que tais variáveis parecem tender a alterar o padrão nutricional dos indivíduos.

Palavras-chave: Bebida energética. Cafeína. Ginásio. Nutrição.

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INTRODUCTION

Energy drinks are considered brain stimulants because they contain substances capable of increasing cognitive ability and concentration by stimulating the brain regions responsible for such functions.

In recent decades, there has been a significant increase in the consumption of energy drinks by adolescents and athletes, to improve their intellectual and athletic performance through the components such as caffeine and taurine found in these drinks (Gutiérrez-Hellín, Varillas-Delgado, 2021).

University students tend to consume such substances to boost their academic performance (Morgan, et al., 2017) but, in general, their expected effects are decreased sleepiness, increased feelings of pleasure or well-being, euphoria, disinhibition, and increased physical vigor (Ferreira, et al., 2004), stimulate metabolism, decrease drowsiness, and the elimination of harmful contents from the body (Ballistreri, Corradi-Webster, 2008).

These drinks are often high in carbohydrates and sugars, with 60 to 90g per serving, exceeding the recommended daily intake for a 2000-calorie diet.

This can lead to obesity, diabetes, and tooth decay. Additionally, these drinks contain caffeine, taurine, ginseng, amino acids, glucuronic-lactone, flavorings, and colorings in smaller amounts, sometimes with added minerals and vitamins (McLellan, Lieberman, 2012).

Energy drinks containing caffeine, which is the main stimulating element, are classified as supplements. These drinks stimulate metabolism, promote calorie burning, and enhance physical performance by reducing sleep for some time and accelerating metabolism (Dossiê bebidas energéticas, 2012).

The International Society of Sports Nutrition (ISSN) has released a position paper based on a critical review of literature regarding the effects of energy drinks or energy shots on acute exercise performance, metabolism, cognition, and synergistic outcomes on exercise-related performance and training adaptations.

Caffeine and carbohydrates are the main contributors to the ergogenic effects of these drinks. Adequate consumption before exercise can improve aerobic and anaerobic performance, as well as mental focus and endurance during sports activities. However, the amount of caffeine and other nutrients should be considered to avoid adverse effects (Jagim, et al., 2023).

They have been growing in the industrial beverage market, and these same beverages are known for their multifunctional and physiological effects, in addition to their normal nutritional value (Heckman, Gonzalez de Mejia, 2010),

these beverages are commonly marketed to increase energy, alertness, and concentration, reduce fatigue, reduce the feeling of tiredness after physical exercise and lessen the feeling of pain (Glade, 2010).

In addition to the impact of isolated energy drink consumption on individual health, the consumption of energy drinks in conjunction with alcoholic beverages should be evaluated.

This is because this combination is found to prolong the duration of the excitatory effects of alcohol, which are commonly associated with risky behaviors, due to the marked adverse effects that affect both the neurological and cardiovascular systems (Curran, Marczinski, 2017; Martins, Coelho, Ferreira, 2019; Striley, Khan, 2014).

In Europe and North America, the consumption of energy drinks by young people has reached a prevalence of around 62%, whose consumption may be related to the high advertising for the development or expansion of the product (Visran, et al., 2016).

In Portugal, Lisbon, there are records of the prevalence of consumption of these drinks of 53.1% by young adolescents (Gaspar, 2014).

In the African region, there are records of consumption by young athletes from Uganda, where the prevalence of consumption has been 13.4% (Muwonge, et al., 2017).

In South Africa, it is the fastest-growing class of beverage, where advertising and markets have been the keys to its expansion in the market, with consumption prevalence at about 0,23% (Nicholas, et al., 2017).

In Angolan context, the consumption of energy drinks follows the expansion of the beverage sector among the fastest developing in the country (Jornal de Angola, 2019) at the same time that the marketing appealing to the consumption of such drinks grows, especially among individuals of the young population, which generated the need to carry out a study to analyze the nutritional status and the consumption of energy drinks in frequenters and non-attenders of gyms in Luanda (Angola).

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MATERIALS AND METHODS

Overall study design

A comparative, prospective, and descriptive study was carried out between gym-goers from four gyms in Luanda city (25 to 26 participants for each gym) and non-gym-goers, the latter, students from the 1st to the 5th year enrolled in the Human Sciences, Economics, and Engineering College of the Catholic University of Angola, whose sample calculation took into account the conditions of some studies (Morgan, et al., 2017) with a confidence level of 95% and a margin of error of 5%, with the sample N defined as 102 individuals for the group of gym-goers and 102 for the group of non-gym-goers.

The researcher chose the gyms and the Catholic University of Angola participants for convenience and location.

Male subjects aged 18 to 50 years were included in the study, based on the percentage of energy drink consumption in male subjects reported in the literature (Visran, et al., 2016).

The study was approved by the Human Research Ethics Committee of the Catholic University of Angola. Participants, both gym-goers and non-gym-goers, from national and foreign brands were included regardless of the type of energy drink they consumed.

Data collection and analysis

A multiple-choice questionnaire was administered to participants for data collection. Survey responses were coded and entered Microsoft Excel for analysis.

Questionnaires were given to study participants at gyms and at Catholic University of Angola, followed by anthropometric evaluations of all individuals.

Subjects were measured without shoes or adornments, using a tape measure on a flat wall and an electronic portable scale for height and weight, respectively.

Height and weight were measured to assess the nutritional status of young adults, and the Body Mass Index (BMI) was calculated using the formula: $\text{BMI} = \frac{\text{weight(wt)}}{\text{height (ht)}^2}$.

The results were classified according to the World Health Organization (WHO) classification for adult individuals, underweight (<18.5 kg/m^2); eutrophy (18.5 kg/m^2 to 24.9 kg/m^2); overweight (24.5 kg/m^2 to 29.9 kg/m^2); obesity I (30 to 34.9 kg/m^2); obesity II (35 to 39.9 kg/m^2); obesity III (≥40 kg/m^2).

All data obtained in this study were analyzed descriptively and inferentially, and a significance level of p≤0.05 was adopted.

RESULTS AND DISCUSSION

Sociodemographic Data

Most of the participants were between 18 and 33 years old, where gym-goers had a higher percentage of age compared to non-goers, whose median age was 30 and 23.42 for gym-goers and non-gym-goers, respectively.

Most of them were undergraduate or graduate students in higher education, and all participants were Angolan citizens and residents of Luanda, the capital of Angola.

Concerning anthropometric data, most participants were found to be in eutrophic nutritional status, with gym-goers having the highest percentage of eutrophy and overweight, as opposed to non-gym-goers with a minimum percentage of underweight (Table 1).

Participants' BMI was assessed at the beginning of the study, and they were not followed up to check for changes in BMI throughout the study.

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Table 1 - Socio-demographic and anthropometric data of gym-goers and non-goers in Luanda, Angola.

	GYM-GOERS		NON-GYM-GOERS	
Variables	n = 102	%	n = 102	%
AGE				
18-33	76	74,50	97	95,09
34-50	26	25,50	5	4,90
SCHOOLING				
Primary education	3	2,94	0	0
Secondary education	27	26,47	0	0
Higher education	63	63,73	102	100
Post-graduation	8	7,84	0	0
WEIGHT (KG)				
49-80	74	72,54	95	93,13
81-114	28	27,45	7	6,86
HEIGHT (CM)				
160-177	68	66,66	75	73,52
178-192	34	33,33	27	26,47
BMI				
Low weight <18,5	1	0,98	11	10,78
Eutrophy 18,5-24,9	68	66,66	79	77,45
Overweight 25-29,9	27	26,47	8	7,84
Obesity I 30-34,9	5	4,90	2	1,96
Obesity II 35-39,9	1	0,98	2	1,96

World Health Organization (WHO, 1995).

In table 1, it can be observed that there is a majority representation of young adults who are the largest consumers of energy drinks.

These results corroborate the findings of a study conducted in Brazil on 200 young students, where there was a majority representation of young adults, reaching a percentage of 80,90% (Morgan, et al., 2017).

Regarding anthropometric data, the World Health Organization (WHO , 1995)classifies a healthy adult when it is between the values of 18,5-24,9 Kg/m^2 BMI.

According to the results obtained in this study, more than half of the gym-goers and non-gym-goers are within the normal weight standards for a healthy adult (Table 1).

These findings are similar to the findings of the study by (Deliens, et al., 2015) in university students who consumed energy drinks, in which the mean BMI was 21.8 kg/m^2.

Most consumed beverages

The study showed that both gym-goers and non-gym-goers consume drinks classified as energy drinks, regardless of whether they attend a gym or not, with coffee being the most consumed drink by both groups and then the most consumed drink was Energy Drink "A", being mostly consumed by gym-goers (Table 2).

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Table 2 - Drinks are most consumed by gym-goers and non-goers in Luanda, Angola.

	GYM-GOERS		NON-GYM-GOERS	
Variables	N = 102	%	N = 102	%
BEN "A"	28	27,45	16	15,69
BEN "B"	2	1,96	1	0,98
EIB "A"	10	9,80	3	2,94
Booster®	1	0,98	2	1,96
Coffee	28	27,45	31	30,39
Black tea	3	2,94	13	12,75
Green tea	16	15,69	25	24,54
Coca-Cola®	1	0,98	3	2,94
No answer	10	9,80	6	5,88
Pura Sport®	2	1,96	2	1,96
Way protein®	1	0,98	0	0

BEN: National brand energy drink. BEI: Imported brand energy drink The letters in quotation marks * ("A", "B" and "C"): correspond to the brand names of the national and imported energy drinks mentioned by the study participants.

These results corroborate the findings in the literature (Bezerra, Alencar, 2018; Mahoney, et al., 2018) in which the percentage of coffee consumption in one of the studies was 61.1%, while the consumption of energy drinks was 39.4%.

The main reasons for coffee consumption are the promotion of alertness and the taste of the drink (Ágoston, et al., 2017).

Analyzing the label of the most consumed beverages by the study participants, it was possible to observe the highest presence and concentration of caffeine, carbohydrates, and calories.

However, it was not possible to provide a more detailed description of the quantities of the components of the formulas, such as vitamins and amino acids (Table 3).

Table 3 - Nutritional composition of the most consumed energy drinks by gym-goers and non-goers in Luanda, Angola.

	EIB-"A"	BEN-"A"	BEN-"B"
Volume (mL)	250	230	350
Caffeine (mg/100 mL)	32	32	32
Carbohydrates (mg/100mL)	11	11	11
Taurine (mg/100 mL)	400	0	0
Glucuronic-lactone (mg/100 mL)	0	0	0
Riboflavin (vitamin B2)	0	0	0
Niacin (vitamin B3) (mg/100 mL)	0	0	0
Pantothenic acid (vitamin B5) (mg/100 mL)	2	0	2
Pyridoxine (vitamin B6) (mg/100 mL)	0	2,6	2
Cyanocobalamin (vitamin B12) (µg/100 mL)	2	2,6	2
Calories (kcal)	46	47	47
Guarana extract	0	26	0

Source: Energy drink packaging label. BEN: National brand energy drink. BEI: Imported brand energy drinks The letters in quotation marks * ("A", "B" and "C"): correspond to the brand names of the national and imported energy drinks mentioned by the study participants.

These data obtained from the labels of the packages of the beverages analyzed refer to the guidelines described in Ordinance No. 868 of 3 Nov. 1998 of the Secretariat of Sanitary Surveillance of the Ministry of Health, in the Official Gazette of the Federative Republic of Brazil, Executive Branch (1998) (Portaria n° 868, de 3 de nov. de 1998 da Secretaria de Vigilância Sanitária do Ministério da Saúde. Diário Oficial da República Federativa do Brasil, Poder Executivo, , 1998) which regulates the recommended quantities to produce energy drinks, identifying them as ready-to-drink liquid compounds.

An analysis by micellar electrokinetic chromatography on 10 brands of energy drinks

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and the concentration of caffeine ranged from 22.0 mg/100 mL to 29.9 mg/100 mL, for taurine from 338.2 mg/100 mL to 489.4 mg/100 mL (Cangani, et al., 2014).

Considering the 95% confidence interval, it was found that almost all the brands analyzed had caffeine content lower than that declared on the label, while only one brand had taurine content below the declared.

Table 3 also shows the absence of concentration values for some B vitamins (B2, B3) and the labels do not show concentration values for two of the main stimulant components of energy drinks, namely taurine and glucuronic lactone.

These drinks, when analyzed for their composition, have average parameters of carbohydrate mixtures equal to 11 mg/dl, taurine of 400 mg/dl, caffeine of 32 mg/dl, glucuronic-lactone of 240 mg/dl, inositol of 20 mg/dl and B-complex vitamins at 100% of the daily requirement (Dossiê bebidas energéticas, 2012).

The comparison between the nutritional values found on the packaging of the most consumed energy drinks in the study, concerning the recommended consumption standards, these drinks present their values within the expected standards (FAO-OMS, 1997-2019).

Until the legislation regulating the maximum tolerated residue limits in Angola is approved, laboratories apply the internationally recommended rules on maximum tolerated residue limits, namely: the Codex Alimentarius defined by the Food and Agriculture Organization of the United Nations and the World Health Organization (FAO/WHO) and international conventions and treaties, as well as the ordinary legislation in force on the matter.

National Energy Drink "A" and National Energy Drink "B" are energy drinks originating in Angola, and there is a predilection for the consumption of Energy Drink "A" by young Angolan adults over other brands of drinks, both national and foreign (Table 2).

Such drinks contain on their packaging information on their nutritional composition, except for the concentration values of taurine.

Angola does not yet have legislation regulating the composition of the elements that make up energy drinks, but laboratory analyses are carried out to assess the concentrations of the substances found in these drinks.

Consumption time

Regarding the time of consumption, both groups of participants have been using these drinks for more than a year, and only a small minority of participants in both groups had been using them for six months (Table 4).

These results corroborate the findings of a study conducted on young university students in Brazil, where 67.1% of those who consumed energy drinks started using them before entering college, but this study did not delimit the time of consumption by months but by academic year (Morgan, et al., 2017).

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Table 4 - Time of consumption of energy drinks, level of knowledge about beneficial and harmful effects and side effects experienced by gym-goers and non-goers in Luanda, Angola.

	GYM-GOERS		NON-GYM-GOERS	
CONSUMPTION TIME	n = 102	%	n = 102	%
Less than six months	9	8,82	8	7,84
Six months	5	4,90	5	4,90
One year	7	6,86	5	4,90
More than a year	73	71,57	73	71,57
No answer	8	7,84	11	10,78
BENEFITS				
I know	65	63,72	35	34,31
I don't know	37	36,27	67	65,68
HARMFULNESS				
I know	54	52,94	33	32,35
I don't know	48	47,06	69	67,64
SIDE EFFECTS				
Insomnia	6	5,88	8	7,84
Nausea	0	0	3	2,94
Tachycardia	8	7,84	3	2,94
Dizziness	3	2,94	3	2,94
Other	7	6,86	2	1,96
Nothing	78	76,47	83	81,37

Regarding the level of knowledge of the benefits and harms that the consumption of energy drinks can bring to health, the results of this study showed that gym-goers have more knowledge about the benefits and harms compared to non-gym-goers (Table 4).

Findings indicate that less than 70% of the respondents had adequate knowledge about the physiological effects (beneficial or adverse) of energy drink consumption (Casuccio, et al., 2015) this percentage or finding corroborates the results of this study.

Consumption of caffeinated beverages improves subjective perception of muscle-building power during exercise and less overall fatigue the next morning after ingestion.

However, it is clear that there are health risks associated with the consumption of energy drinks, due to their high content of caffeine and other substances, which when consumed in excess can cause negative effects on human health, such as insomnia, nervousness, and hyperactivity, over an unknown long-term period (Ali, et al., 2015; Gutiérrez-Hellín, Varillas-Delgado, 2021; Salineiro, et al., 2014).

Also in Table 4, despite the reported presence of side effects experienced by some study participants (both groups), such as insomnia tachycardia nausea, and dizziness after consuming energy drinks, most participants did not experience any kind of side effect after taking energy drinks (Table 4).

Some manufacturers claim that these drinks are safe and many of their consumers also perceive them this way. They claim that their components and concentrations are duly approved by legislation, even though nowadays there is a lot of literature talking about the toxicity of these drinks and the indiscriminate use by young people (Manrique, et al., 2018).

When simple linear regression was performed between BMI and the other variables, the results showed a statistically significant association only for gym-goers between BMI and coffee consumption, age of participants, consumption of energy drink "A" and time of energy drink consumption. For non-gym-goers, there was only a statistical association between the BMI variable and the age of the participants (Table 5).

Table 5 - Simple linear regression between BMI and other variables of gym-goers and non-goers in Luanda, Angola.

	GYM-GOERS	NON-GYM-GOERS
Variables	p-value	p-value
Coffee	0,02	0,49
Age	0,002	0,001
BEN "A"	0,05	0,26
Consumption time	0,01	0,11

Values of p≤0.05 are considered statistically significant according to the chi-square test. BEN: National brand energy drink. The letter in quotation marks *("A"): corresponds to the brand name of the national energy drink mentioned by the study participants.

Although most participants were nutritionally healthy, age and frequency of energy drink consumption were linked to higher BMI in both groups, potentially due to factors such as increased food consumption, sedentary lifestyle, and unhealthy habits (Table 1).

Future studies should test actual substance concentrations in Angola's energy drinks. Health legislation provides for measuring reference values before production, but not monitoring post-manufacture.

CONCLUSION

The consumption of beverages is a multifaceted phenomenon influenced by various factors, the primary influencers driving the consumption of these beverages were personal preference and media influence, with friends also exerting an influence, especially among gym-goers (FG).

Associations were observed between Body Mass Index (BMI) and the consumption of coffee, age, and Speed among FG (p=0.02, p=0.002, and p=0.05, respectively). Conversely, for non-gym-goers (NFG), there was a correlation between BMI and age (p=0.001).

The study encountered data collection challenges as some young individuals declined to participate in the questionnaire, potentially introducing bias.

Moreover, there was resistance to the consumption of energy drinks in Angola, impacting the participation of young individuals. In summary, this study underscores the necessity for further research into energy drink consumption in African countries due to the limited availability of information. The existing literature predominantly centers on the adverse health effects and composition of these beverages since their global market introduction.

CONFLICTS OF INTEREST

We declare no conflicts of interest between the parties involved in the study. There is no interest in advertising the brands we mention in this study and there is no involvement with industries producing energy, isotonic, or sports drinks.

AUTHORS' DECLARATION OF CONTRIBUTION

Lúcia de Fátima Chavito Massanga contributed to data collection and analysis, bibliography compilation, and text editing.

Marli Stela Santana contributed to the design, development, and implementation of the research and supervision of the work.

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