Alarming High Levels of Energy Drinks Consumption among School Children in Hail, Northern of Saudi Arabia

"Mo'ez Al-Islam" Faris1,2*, Suneetha Epuru1, Saud Al-Shimmari1 and Egab Al-Shimmari1

1Department of Clinical Nutrition, College of Applied Medical Sciences, Hail University, Saudi Arabia
2Department of Clinical Nutrition and Dietetics, College of Health Sciences/Sharjah Institute for Medical Research (SIMR), University of Sharjah, Sharjah, UAE

Abstract: Saudi Arabia (KSA) is one among the countries for top energy drink markets. Amid growing controversies globally surrounding the increasing usage of energy drinks by children, it is felt important to understand how these trends are reflected in KSA. A cross-sectional survey was conducted to explore the trends of energy drink consumption among, and differences between, middle and secondary school children, and the associated socioeconomic and behavioral factors. Randomly selected 1006 male children from secondary and middle schools from Hail region in KSA were included in the study, using a self-administered validated questionnaire. Results revealed that about 60% of school children were current energy drink consumers. Secondary school children were significantly (P<0.001) higher than middle schoolers in terms of both frequency and quantity. Concomitantly, unhealthy dietary and lifestyle behaviors were reported in significantly higher proportions (P<0.001) among secondary school children. Home was the first place for exposure for majority of children while unreliable resources were the major sources of knowledge about energy drink composition and health effects. Poor knowledge concerning energy drink composition was reported. Taste and being energized were the major driving forces for energy drink consumption. Higher disposable income on hand and poor lifestyle behaviors were all significantly associated with energy drink consumption. It can be concluded that high proportion of energy drink consumption was reported among school children in Hail, with higher proportions in secondary than middle schools. This matter raises the significance of mounting awareness of community concerning the ingredients and potential hazards of energy drinks.

Keywords: Energy drinks, School children, Lifestyle Behaviors.

INTRODUCTION

Energy drinks are caffeine-ated beverages intended to enhance alertness and provide a burst of energy and represent the rapidly growing segment of beverage industry [1]. Caffeine is the chief bioactive ingredient in energy drinks, but they may also include small amounts of nutritional supplements such as vitamins or L-carnitine or taurine; herbal extracts; and additional stimulants such as Ginseng or Ginkgo biloba. Further, these drinks may or may not contain high doses of sugar or a sugar substitute [2].

Globally, recent studies report alarmingly raising trends in consumption of energy drinks among all age groups including children and adolescents [3-6]. Initially, energy drink industry was primarily targeting athletes and sports persons [1]. Today, however, with growing competition, the target populations for energy drinks were expanded in a drive to create niche markets with massive marketing strategies focusing on the stimulant and psychoactive properties of these beverages and cross promotional tactics directed towards adolescents and young adults between 16–35 years of age [7, 8]. Particularly, increasing popularity of energy drinks among children has generated considerable concern off late in researchers, physicians and parents, since children may be the most vulnerable group for experiencing adverse health consequences of caffeine consumption [4, 9, 10].

Caffeine, the most abundantly found legal stimulant in numerous products, is often consumed for a list of positive cognitive, physical and muscular impacts including increasing alertness, wakefulness, and feelings of energy; the ability to solve problems requiring reasoning and to make correct decisions; decreasing mental and muscular fatigue; enhancing physical, motor and cognitive performances and short-term memory [4, 11, 12]. However most of these researches have been done in adult populations. Safety of caffeine use in adolescents and children is largely unknown. Given the rising consumption trends of energy drinks in children and adolescents, it is therefore very important to understand the trends in energy drinks consumption and factors associated with these trends.

Energy drinks consumption and hence increased caffeine consumption among children and adolescents can be a worrying factor for many reasons. To begin with, there are very few studies conducted to understand neither pharmacological tolerance to caffeine nor its physiological and psychological effects.
at increased consumption levels in children [4, 5, 13]. Most importantly, childhood and adolescence are still periods of growth and development and any factors affecting their nutrition and sleep can have negative influence on them. To support this belief, there are limited studies available to indicate caffeine intake in children even at moderate amounts can create disturbances of sleep and promote poor lifestyle choices [7, 14, 15]. Further childhood is the critical period for establishment of eating behaviors because any faulty taste preferences formed during this period may continue into their later lives [16, 17].

Studies on the consumption of energy drinks in Kingdom of Saudi Arabia (KSA) are scarce, despite the fact it is a common sight to observe frequent consumption of these drinks in various community settings. This observation was further strengthened by the Global Energy Drinks Report (2012) [18], which unraveled that Saudi Arabia was ranked among the top ten countries for the consumption of energy drinks. Amongst the limited studies available from the kingdom, a study conducted on 600 secondary school girls in Western province found a 55.5% prevalence of energy drink consumption habit [19] while a study done on 412 college students from Eastern province indicated that 54.60% of males and 26.15% of females were habitual energy drink consumers [20]. However, in the Middle provinces, a study done by Al Buhairan et al. [21] indicated that the majority (66%) of 1719 intermediate and secondary school male and female students were not usual consumers for energy drinks indicating regional, age and gender differences in consumption patterns.

A recent study on patterns of energy drink consumption among 1062 adolescents and young adults (867 males and 195 females) in Hail province, Northern part of the Kingdom exposed that 37% of the study population started drinking energy drinks from primary school itself while 44 % of them were currently consuming two or more cans per day [22]. Thus, it was hypothesized that the habit of energy drink consumption may begin very early in adolescents than expected in this population. Observations have suggested that it is easy for the young children in KSA to access and use energy drinks. However there are no available studies from the region to either indicate the prevalence of consumption of energy drinks in neither children nor reasons why they prefer energy drinks, and the influencing factors for their consumption. Therefore, the current study was planned to find out the prevalence of consumption trends of energy drinks amongst the middle and secondary school children in Hail city, and the socioeconomic and behavioral factors associated with it. Further, the study aimed at identifying the differences between the trends in energy drink consumption between middle and secondary schoolers, and to explore the degree to which energy drink consumption is linked to different lifestyle behaviors.

METHODS

Study Design and Objectives

This cross sectional survey was conducted during the 2013–2014 school year in the Province of Hail, which has a population of about 17,000 young children in middle (12- to 15-year olds) and secondary (16- to18- year olds) schools. The survey included a sample of 1006 male students randomly selected from twelve boy’s schools (6 middle and 6 secondary) out of 60 boy’s schools for the two levels. Approval for the study was obtained from the Ethical Committee of the University, and official permissions were obtained from the Education Authority in Hail Province prior to school visits. Informed verbal consent to the students’ participation was requested first from the school director, then from each student enrolled. None of the students refused, but a small number of class teachers denied due to time-management reasons. Those who were absent for various reasons (illness, skipping lessons etc.) on the day of the survey were the only non-respondent students. Participation was voluntary and no incentives were provided to participants. A short and brief explanation on the energy drinks was introduced to each class, and examples on brand names of energy drinks available in the local market were provided in order not to be confused with common soda colas or sport drinks available.

Study assessment tool was a questionnaire adopted from questionnaire developed by Attila and Cakir [23], and slight modifications were done to make it compatible with school children in the Saudi society based on pilot study during validation process. The self- administered questionnaire consisted of 30 multiple-choice questions. Briefly, respondents were asked for socio-demographic information (monthly income and expenditure and housing), the characteristics of their social groups (nature of family and residency sharing), and nutritional and lifestyle factors (eating breakfast, practicing physical activity, sleep and smoking habits and safety behaviors). Questions related to consumption of energy drinks
included frequency, reasons for consumption or non-consumption, knowledge about contents of energy drinks and sources of knowledge, social influences and preferences.

**Statistical Analysis**

Statistical analyses is presented in frequencies and percentage distributions for prevalence of energy drink consumption, socio economic, lifestyle and energy drink related behaviors among all study participants. Differences between middle and secondary school energy drinkers are presented using chi-square analysis. A chi-square analysis was also initially conducted to elucidate the relationship between socio-economic and behavioral variables and the consumption of energy drinks. Logistic regression analysis was finally applied for associations of energy drink consumption with socioeconomic and lifestyle behaviors emerging from the chi-square analysis as being associated with energy drink consumption. The covariates applied in the models were: monthly expenditure (<1000 vs. >1000 SR), no. of sleep hrs (<6hrs vs. >6hrs), smoking (non-smokers vs. current or past smokers), safety behaviors (safe vs. unsafe behaviors) and physical activity (regular vs. irregular). Excluded variables included family (nuclear vs. extended); parental home vs. others (shelters or friends); monthly parental income (<5000 vs. >5000 SR); mother education (primary/uneducated vs. middle school & above); father education (primary/uneducated vs. middle school & above); sleep patterns (regular vs. irregular); eating breakfast (regular vs. irregular). The statistical analyses were performed using SPSS software ver. 17, and a value of \( P<0.05 \) was considered statistically significant.

**RESULTS**

Table 1 shows the basic socio-demographic characteristics of study participants. Secondary school students represented slightly more than half of the study participants (54.4%) while middle schoolers were

<table>
<thead>
<tr>
<th>Table 1: Basic Socio-Demographic Characteristics of Study Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level</strong></td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Middle</td>
</tr>
<tr>
<td>Secondary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Nature of the household/family</strong></th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear family</td>
<td>762</td>
<td>75.7</td>
</tr>
<tr>
<td>Extended Family</td>
<td>244</td>
<td>24.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sharing the house with</strong></th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing with parents and siblings</td>
<td>989</td>
<td>98.3</td>
</tr>
<tr>
<td>Friends or shelters</td>
<td>17</td>
<td>1.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Average monthly income</strong></th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low:&lt; 5000 SR</td>
<td>376</td>
<td>37.4</td>
</tr>
<tr>
<td>Middle:5000 - 10000 SR</td>
<td>313</td>
<td>31.1</td>
</tr>
<tr>
<td>High: &gt;10000 SR</td>
<td>317</td>
<td>31.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Monthly personal expenditures</strong></th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1000 SR</td>
<td>813</td>
<td>80.8</td>
</tr>
<tr>
<td>1000-2000 SR</td>
<td>130</td>
<td>12.9</td>
</tr>
<tr>
<td>&gt;2000 SR</td>
<td>63</td>
<td>6.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Mother educational level</strong></th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uneducated</td>
<td>312</td>
<td>31.1</td>
</tr>
<tr>
<td>Primary school</td>
<td>172</td>
<td>15.1</td>
</tr>
<tr>
<td>Middle school</td>
<td>145</td>
<td>14.4</td>
</tr>
<tr>
<td>Secondary school</td>
<td>170</td>
<td>16.9</td>
</tr>
<tr>
<td>Higher education</td>
<td>207</td>
<td>20.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Father educational level</strong></th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uneducated</td>
<td>173</td>
<td>17.2</td>
</tr>
<tr>
<td>Primary school</td>
<td>177</td>
<td>17.6</td>
</tr>
<tr>
<td>Middle school</td>
<td>133</td>
<td>13.2</td>
</tr>
<tr>
<td>Secondary school</td>
<td>225</td>
<td>22.3</td>
</tr>
<tr>
<td>Higher education</td>
<td>289</td>
<td>28.7</td>
</tr>
</tbody>
</table>
around 45.6%. Nuclear family households were more common among study subjects (75.7%) and almost all children were living with their parents except for only 1.7% children who were living in other places than their parental homes. Only about 28.7 percent of fathers and 20.5 percent of mothers had higher education while one third of mothers were uneducated as compared to 17 percent of uneducated fathers.

The economic level of study participants was almost evenly distributed over the three classes (high-, middle-, and low-socioeconomic classes) as defined by their parental monthly income. In addition students were also asked to report their average monthly income that they usually spend for their personal needs and privatess expenses rather than official fees and governmental expenses. The study results suggest that majority students spent less than 1000 SR as monthly personal expenditure while around 20% of students informed that they spend 1000 and above SR monthly as personal expenditure. As the study population were school children, all the participants were dependent on others (parents or guardians) for their monthly expenses.

Personal lifestyle habits of the study participants that may be associated with energy drinks consumption are reported in Table 2. As it was shown in the table, irregular sleeping habit was reported by about 36% of the study participants. About half of the study participants had normal sleep duration of 6-8 hours, while about 20% of the respondents reported a sleeping pattern of less than 6 hours a day. The majority of the school students were non-smokers while about 18% reported having current or past smoking habit. About two thirds of the study participants were either not regularly practicing physical exercises or not practicing at all. Irregular eating habit of breakfast was reported by around half of the study participants.

Although legally not allowed, driving cars by secondary school students is not very uncommon in Hail. Not using the safety belt while driving car was reported by about half of the secondary students enrolled in the study. Other risky behaviors such as driving car very fast was reported by 13% of the study population. A small percentage of this group reported that they indulge in practices like carrying weapons and practice violence or got exposed to violence.

| Table 2: Distribution of Energy Drink Consumption and Personal Daily Habits among the Study Participants |
|----------------------------------------------------------|------------------------------|-------------------|-------------------|
| **Habit** | **Response** | **Count** | **Percentage** |
| Nature of sleeping | Normal/Regular | 647 | 64.3 |
| | Abnormal/irregular | 359 | 35.7 |
| Sleeping hours | <6 hr. | 199 | 19.8 |
| | 6-8 hr. | 479 | 47.6 |
| | >8 hr. | 328 | 32.6 |
| Smoking status | Non-smoker | 823 | 81.8 |
| | Previous Smoker | 49 | 4.9 |
| | Smoker now | 134 | 13.3 |
| Safety behaviors (n=547 for secondary school students only) | Not using safety belt while driving car | 263 | 48.1 |
| | Driving car very fast | 71 | 13.0 |
| | Carrying weapons and guns | 20 | 3.6 |
| | Practicing violence or exposed to violence | 11 | 2.0 |
| | None of the above | 182 | 33.3 |
| Practicing physical exercises | Regularly practiced | 367 | 36.5 |
| | Not Regularly practiced | 457 | 45.4 |
| | Not practiced | 182 | 18.1 |
| Eating breakfast meal | Regularly eaten | 503 | 50.0 |
| | Not regularly eaten | 415 | 41.3 |
| | Not eaten | 88 | 8.7 |

*Driving a car is restricted for secondary school students, as it is not very uncommon among Saudi people.*
### Table 3: Energy Drink Consumption and its Related Behaviors and Knowledge among Study Participants

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Response</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you drink energy drinks?</td>
<td>Yes</td>
<td>606</td>
<td>60.2</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>400</td>
<td>39.8</td>
</tr>
<tr>
<td>If drinking energy drink, why?</td>
<td>Like its taste</td>
<td>488</td>
<td>59.6</td>
</tr>
<tr>
<td></td>
<td>To be more active and energized</td>
<td>122</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>To improve my physical and mental activities</td>
<td>37</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>To mix it with other drinks</td>
<td>31</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>To be awake for longer time</td>
<td>69</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>To improve my academic and studying performance</td>
<td>19</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>To mimic others (famous persons, friends and colleagues)</td>
<td>19</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>For courtesy and compliment with others</td>
<td>31</td>
<td>3.8</td>
</tr>
<tr>
<td>Timing when first tried energy drinks</td>
<td>Before primary school</td>
<td>71</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>During primary school</td>
<td>171</td>
<td>28.2</td>
</tr>
<tr>
<td></td>
<td>During middle school</td>
<td>178</td>
<td>29.4</td>
</tr>
<tr>
<td></td>
<td>During secondary school</td>
<td>26</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>Do not remember</td>
<td>160</td>
<td>26.4</td>
</tr>
<tr>
<td>Place where the first trial of using energy drinks was</td>
<td>In my home</td>
<td>152</td>
<td>25.1</td>
</tr>
<tr>
<td>(n=606)</td>
<td>In recreational places</td>
<td>73</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td>In the street</td>
<td>153</td>
<td>25.3</td>
</tr>
<tr>
<td></td>
<td>In the coffee shop</td>
<td>42</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>In the student dormitory</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>In other places</td>
<td>30</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Do not remember</td>
<td>153</td>
<td>25.3</td>
</tr>
<tr>
<td>Companion when first tried energy drinks</td>
<td>Friend or classmates</td>
<td>200</td>
<td>33.0</td>
</tr>
<tr>
<td>(n=606)</td>
<td>Family member</td>
<td>53</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>No body</td>
<td>200</td>
<td>33.0</td>
</tr>
<tr>
<td></td>
<td>Do not remember</td>
<td>153</td>
<td>25.3</td>
</tr>
<tr>
<td>Places in which energy drinks are taken usually (multiple choices, up to</td>
<td>House/home</td>
<td>322</td>
<td>35.3</td>
</tr>
<tr>
<td>three choices)* (number of responses=911)</td>
<td>Coffee shop</td>
<td>126</td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td>Recreational places</td>
<td>196</td>
<td>21.5</td>
</tr>
<tr>
<td></td>
<td>Car</td>
<td>232</td>
<td>25.5</td>
</tr>
<tr>
<td></td>
<td>College/school</td>
<td>35</td>
<td>3.8</td>
</tr>
<tr>
<td>Time periods during which energy drinks are mostly taken (n=589)</td>
<td>Examination periods</td>
<td>101</td>
<td>17.1</td>
</tr>
<tr>
<td></td>
<td>Vacations</td>
<td>141</td>
<td>23.9</td>
</tr>
<tr>
<td></td>
<td>Car driving/travelling by car</td>
<td>88</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>When tasks and jobs are overcrowded</td>
<td>11</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>No special time period</td>
<td>248</td>
<td>42.2</td>
</tr>
<tr>
<td>Intake of energy drinks in relation to regular meals (n=597)</td>
<td>Before meals</td>
<td>91</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>After meals</td>
<td>154</td>
<td>25.8</td>
</tr>
<tr>
<td></td>
<td>With meals</td>
<td>120</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>Without meals</td>
<td>232</td>
<td>38.9</td>
</tr>
<tr>
<td>You prefer drinking energy drinks with: (n=587)</td>
<td>Fast foods</td>
<td>147</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>Home dishes</td>
<td>64</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Chocolates</td>
<td>181</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td>Potato chips</td>
<td>41</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>Solely without any food</td>
<td>154</td>
<td>26.2</td>
</tr>
</tbody>
</table>
Energy drink consumption and its related behaviors among study participants are shown in Table 3. About two thirds of the school children enrolled in the present study answered "Yes" when asked whether they are

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Response</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>For energy drinkers, how many cans do you drink a day? (n=582)</td>
<td>&gt; two cans/day</td>
<td>88</td>
<td>15.1</td>
</tr>
<tr>
<td></td>
<td>Two cans/day</td>
<td>79</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>One can/day</td>
<td>236</td>
<td>40.5</td>
</tr>
<tr>
<td></td>
<td>&lt; one can</td>
<td>179</td>
<td>30.8</td>
</tr>
<tr>
<td>For drinkers, the most commonly used energy drinks are (up to 3 types can be chosen)* (number of responses=1215)</td>
<td>Red Bull</td>
<td>194</td>
<td>16.0</td>
</tr>
<tr>
<td></td>
<td>Power Horse</td>
<td>109</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>Bison</td>
<td>235</td>
<td>19.3</td>
</tr>
<tr>
<td></td>
<td>Bugzy</td>
<td>203</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>Code Red</td>
<td>333</td>
<td>27.4</td>
</tr>
<tr>
<td></td>
<td>Pepsi Cola X Energy</td>
<td>75</td>
<td>6.2</td>
</tr>
<tr>
<td></td>
<td>Other types</td>
<td>41</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Not determined</td>
<td>25</td>
<td>2.1</td>
</tr>
<tr>
<td>Physiological changes reported by drinkers after taking energy drinks* (number of responses=715)</td>
<td>Changes in cardiac activity and heart beating</td>
<td>135</td>
<td>18.9</td>
</tr>
<tr>
<td></td>
<td>Reduced sleeping hours</td>
<td>169</td>
<td>23.6</td>
</tr>
<tr>
<td></td>
<td>Becoming energized and activated</td>
<td>119</td>
<td>16.6</td>
</tr>
<tr>
<td></td>
<td>Body provided with water and electrolytes, feeling of being hydrated</td>
<td>28</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>No any beneficial effects</td>
<td>86</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td>Becoming addicted</td>
<td>76</td>
<td>10.6</td>
</tr>
<tr>
<td></td>
<td>Becoming obese</td>
<td>29</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Depressed and frustrated</td>
<td>11</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Increased blood sugar</td>
<td>20</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Gastric irritation and ulceration</td>
<td>14</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Brain activity while limbs idle</td>
<td>22</td>
<td>3.2</td>
</tr>
<tr>
<td>I know that energy drinks contain (more than one answer allowed) ** (number of responses=1793)</td>
<td>Sugar</td>
<td>708</td>
<td>39.5</td>
</tr>
<tr>
<td></td>
<td>Caffeine</td>
<td>376</td>
<td>21.0</td>
</tr>
<tr>
<td></td>
<td>Water and minerals</td>
<td>95</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Carbon dioxide and other gasses</td>
<td>112</td>
<td>6.2</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>161</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>Taurine</td>
<td>34</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Protein</td>
<td>51</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Alcohol (diethyl ether)</td>
<td>82</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Nicotine</td>
<td>33</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Hormones and activating substances</td>
<td>141</td>
<td>7.9</td>
</tr>
<tr>
<td>Sources of knowledge about energy drinks (up to three major sources)* (number of responses=1399)</td>
<td>School colleagues and partners</td>
<td>273</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>Friends</td>
<td>576</td>
<td>41.2</td>
</tr>
<tr>
<td></td>
<td>Social networks</td>
<td>146</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Viewed mass media (TV)</td>
<td>118</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>Written media (newspapers and magazines)</td>
<td>57</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>General, non-scientific, websites</td>
<td>39</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Scientific journals, academic books and websites</td>
<td>27</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Food labels on energy drinks cans</td>
<td>163</td>
<td>11.6</td>
</tr>
</tbody>
</table>

*Due to multiple answer-questions, percentage is from the total number of responses not from total participants. Therefore, total number of responses may exceed the total number of drinker or non-drinker participants.

**Components listed are according to what is known not what is actually present.
"ever energy drink consumers" or not. The three major forces driving them for using energy drinks were: taste, feeling to be activated and energized, and to keep themselves awake for longer periods of time.

For the energy drink consumers, home and streets were the most common places for first acquaintance with energy drinks followed by recreational places and coffee shops. Collectively, less than two thirds of the school children who were consuming energy drinks started drinking them while they were still in the primary and middle schools. Around one third of the study population tried on their own on their first experiment with energy drinks while another one third tried in the presence of their friends or classmates. Usual places for energy drinks consumption were reported as home followed by cars, recreational places and coffee shops. A small percentage of children (3.8 %) reported their usual place of drinking was school campus. When asking for the most common time periods during which energy drinks were drank, 42% reported that there was no definite time period, followed by vacations (23.9%), examinations (17.1 %) and car travel (14.9 %). Regarding the intake of energy drinks with meals, 39% reported that don’t follow any specific rules for clubbing meal consumption with drinking energy drinks. Meanwhile, about 31% of respondents reported that they do prefer drinking energy drinks with chocolates while a quarter of energy drink consumers reported their preference to drink while eating fast foods (Table 3).

Energy drinkers preferred various brands according to their taste preferences. The major physiological effects reported by energy drink consumers were as follows: reduced sleeping hours (23.6 %), changes in cardiac activity and heart beating (18.9 %), and becoming energized and activated (16.6 %). Around one tenth of the study population reported addiction as the major effect of drinking energy drinks.

We also tried to assess the knowledge level of the study population on the composition of energy drinks. The major sources of knowledge pertaining energy drink composition and health implications include friends (41.2 %), school colleagues (19.5 %), food labels on energy cans (11.6 %) and social networks (10.4 %) of responses. Two thirds of the responses regarding composition of energy drinks were about caffeine and sugar, while other components like taurine was identified by only a very small percentage of respondents. Surprisingly some responses even suggested the presence of ethanol, recreational hormones and chemicals, along with nicotine as components of energy drinks suggesting that these children probably would be consuming energy drinks looking for alternates for sensual products.

As the study tries to find out the difference in trends of energy drink consumption between middle and secondary school children, Table 4 presents these trends. Results indicate that secondary children have 1.3 odd’s of higher chance for consumption of energy drinks as compared to middle school children. Nevertheless a 54 .2 % "yes” among middle schoolers for energy drink consumption is still a worrying factor given the long term consequences like addiction, sleeplessness and impact on growth.

Table 5 compares the differences between middle and secondary children for energy drink related behaviors among “ever energy drinkers”. Secondary school children consuming 2 or more than 2 energy drink cans per day (34.6 %) were higher in proportions significantly as compared to middle school children (20.4 %). Noticeably a total of 59.5 % of middle school children and 62. 3 % secondary school children admitted that their habit of consuming energy drinks was either before or during or immediately after meals which may impact their meal intake or increased calories or both. There was no statistical difference between middle and secondary school children for their daily, weekly or monthly consumption; and for their preference of drinking energy drinks in combination with other foods like fast foods, home foods, chocolates, or potato chips. However the daily consumption of energy drinks has increased from 33.6

Table 4: Difference between Middle and School Children Regarding Energy Drink Consumption

<table>
<thead>
<tr>
<th></th>
<th>Do you drink energy drinks?</th>
<th>Chi-Square</th>
<th>Odds Ratio (95 % CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>School Middle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>249</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>54.2</td>
<td>45.8</td>
<td></td>
</tr>
<tr>
<td>School Secondary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>357</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>65.3</td>
<td>34.7</td>
<td></td>
</tr>
<tr>
<td>Chi-Square</td>
<td>12.646 **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odds Ratio (95 % CI)</td>
<td>1.317 (1.131- 1.533)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**P<0.001 Chi-Square difference comparing secondary to middle school students.
% among middle schoolers to 41.8 % among secondary school students.

Table 6 indicates that there were significant differences for lifestyle behaviors between middle and secondary children among “ever energy drinkers”. Skipping or not regularly eating breakfast, abnormal/irregular sleeping, smoking and lower practicing for physical activity were reported in significantly higher proportions ($P<0.001$) among secondary school children as compared to middle school children.

Table 7 presents logistic regression model for associations of energy drink consumption with socioeconomic and lifestyle behaviors. Only monthly expenditure ($<1000$ vs. $>1000$ SAR), no. of sleep hrs ($<6hrs$ vs. $>6hrs$), smoking (non-smokers vs. current or past smokers), safety behaviors (safe vis. unsafe behaviors) and physical activity (regular vs. irregular) were included in the model since chi-square analysis has indicated non-significant associations for remaining variables like family (nuclear vs. extended); parental home vs. others (shelters or friends); monthly parental income ($<5000$ vs. $>5000$ SAR); mother education (primary/uneducated vs. middle school & above); father education (primary/uneducated vs. middle school & above); sleep patterns (regular vs. irregular); eating breakfast (regular vs. irregular). Although family income was not associated, higher disposable income on hand was significantly associated with energy drink consumption. Similarly poor lifestyle behaviors like smoking, sleeping less than 6 hrs, low physical activity and unsafe behaviors (not using safety belt while driving or driving fast or carrying weapons) were all significantly associated with energy drink consumption.

Table 8 presents the results of additional analysis done to find out the differences in lifestyle behaviors between daily vs. occasional energy drink consumers.
Table 6: Differences between Secondary and Middle School Energy Drinks Consumers Enrolled in the Study Regarding the Dietary and Lifestyle Behaviors

<table>
<thead>
<tr>
<th>School</th>
<th>Count</th>
<th>%</th>
<th>Count</th>
<th>%</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eating breakfast meal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularly eaten</td>
<td>134</td>
<td>53.8</td>
<td>137</td>
<td>38.4</td>
<td></td>
</tr>
<tr>
<td>Not regularly eaten</td>
<td>91</td>
<td>36.5</td>
<td>179</td>
<td>50.1</td>
<td></td>
</tr>
<tr>
<td>Not eaten</td>
<td>24</td>
<td>9.6</td>
<td>41</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>249</td>
<td>100</td>
<td>357</td>
<td>100</td>
<td>14.370**</td>
</tr>
<tr>
<td><strong>Practicing physical exercises</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularly practiced</td>
<td>109</td>
<td>43.8</td>
<td>84</td>
<td>23.5</td>
<td></td>
</tr>
<tr>
<td>Not Regularly practiced</td>
<td>112</td>
<td>45.0</td>
<td>185</td>
<td>51.8</td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>28</td>
<td>11.2</td>
<td>88</td>
<td>24.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>249</td>
<td>100</td>
<td>357</td>
<td>100</td>
<td>34.050**</td>
</tr>
<tr>
<td><strong>Nature of sleeping</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal/Regular</td>
<td>168</td>
<td>67.5</td>
<td>183</td>
<td>51.3</td>
<td></td>
</tr>
<tr>
<td>Abnormal/irregular</td>
<td>81</td>
<td>32.5</td>
<td>174</td>
<td>48.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>249</td>
<td>100</td>
<td>357</td>
<td>100</td>
<td>15.813**</td>
</tr>
<tr>
<td><strong>No. of Sleeping hrs.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 hrs</td>
<td>54</td>
<td>21.7</td>
<td>81</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>6-8 hrs</td>
<td>110</td>
<td>44.2</td>
<td>141</td>
<td>39.5</td>
<td></td>
</tr>
<tr>
<td>&gt; 8hrs</td>
<td>85</td>
<td>34.1</td>
<td>135</td>
<td>37.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>249</td>
<td>100</td>
<td>357</td>
<td>100</td>
<td>1.389</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-smoker</td>
<td>215</td>
<td>86.3</td>
<td>241</td>
<td>67.5</td>
<td></td>
</tr>
<tr>
<td>Previous Smoker</td>
<td>18</td>
<td>7.2</td>
<td>23</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>Smoker now</td>
<td>16</td>
<td>6.4</td>
<td>93</td>
<td>26.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>249</td>
<td>100</td>
<td>357</td>
<td>100</td>
<td>38.461**</td>
</tr>
</tbody>
</table>

**P<0.001 Chi-Square difference comparing secondary to middle school students.**

Table 7: Logistic Model Regression for Energy Drink Users vs. Non Users

<table>
<thead>
<tr>
<th>Variables in Model</th>
<th>Beta</th>
<th>S.E.</th>
<th>P  (WaldTest)</th>
<th>Odd’s Ratio</th>
<th>95.0% Confidence Interval for Odd’s Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Expenditure (&lt;1000 vs. &gt;1000 SR)</td>
<td>-0.653</td>
<td>0.245</td>
<td>0.008</td>
<td>0.520</td>
<td>0.322-0.841</td>
</tr>
<tr>
<td>Sleep hrs (6hrs vs. &gt;6 hrs)</td>
<td>0.786</td>
<td>0.260</td>
<td>0.003</td>
<td>2.194</td>
<td>1.318-3.653</td>
</tr>
<tr>
<td>Smoking (Non smokers vs. Current Smokers.)</td>
<td>-0.900</td>
<td>0.244</td>
<td>&lt;0.000</td>
<td>0.406</td>
<td>0.252-0.655</td>
</tr>
<tr>
<td>Safety behaviors(Safe vs. unsafe)</td>
<td>-0.723</td>
<td>0.195</td>
<td>&lt;0.000</td>
<td>0.485</td>
<td>.331-0.712</td>
</tr>
<tr>
<td>Physical Activity (Regular vs. irregular)</td>
<td>-0.479</td>
<td>0.028</td>
<td>0.021</td>
<td>0.620</td>
<td>0.412-0.932</td>
</tr>
<tr>
<td>Constant</td>
<td>1.802</td>
<td>0.757</td>
<td>0.017</td>
<td>6.059</td>
<td></td>
</tr>
</tbody>
</table>

(weekly or monthly) and those who take 2 or more cans vs. less than 2 cans. Lifestyle behaviors included eating breakfast (regular vs. irregular & not eating), physical activity (regular vs. irregular & not practicing), sleep patterns (regular vs. irregular), safety behaviors (safe vs. unsafe behaviors) and smoking (non-smokers vs. current or past smokers). The results show that daily energy drink consumption in children was strongly associated with smoking (OR 2.243) and irregular sleep (OR 1.616); drinking 2 or more cans per day was strongly associated with smoking (OR 1.422), poor breakfast (OR 1.161), unsafe behaviors (OR 1.200) and irregular sleep (OR 1.254).

**DISCUSSION**

In the last decade, the consumption of energy drinks has grown exponentially, with aggressive
advertising and marketing strategies primarily targeting adolescents and young adults [3-6]. This trend is expected to continue as new and niche products with clever and aggressive marketing campaign about improved and long lasting energy boost and stimulatory properties are entering in fierce competitive markets. Children and young people are easily swayed towards these attractive advertising and peer pressures. The ease of access with which these drinks are available to adolescents and to even children because of largely unregulated markets for energy drinks is also a growing concern [1, 3, 4].

The potential health risks of increased exposure to energy drinks in young children and adolescents are only recently gaining research scientists interest. Few limited studies published expose energy drinks as a possible significant threat to public health in case of young children [5-7]. The fact that the KSA is ranked amongst the top energy drink consuming countries in the world [18] emphasizes the importance of conducting such a research to explore the extent to which the practice of energy drink consumption is popular and common among young children.

The present study results indicate precariously high prevalence of energy drink consumption habit (60.2 %) among the participants. Many factors could be possible reasons for this alarming high levels of energy drink intake, including the relatively low price of energy drinks (1-2 SR/can= 0.27-0.54 USD/can) concomitant with the high economic levels of people in KSA, the lack of governmental and school educational programs explaining the negative health implication of these drinks, and the lack of parental educational role regarding energy drink hazards. The study results were also strongly suggestive of the role played by dispensable income in the hands of children as one major contributing factor for energy drink habit.

Table 8: Differences in Lifestyle Behaviors between Daily vs. Occasional Energy Drink Consumers (Weekly or Monthly) and those who Take Two or More Cans vs. Less than Two Cans

<table>
<thead>
<tr>
<th></th>
<th>Energy Drink Consumption (%)</th>
<th>Daily vs. Occasionally</th>
<th>2 or more Cans vs. &lt; 2 Cans when Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daily</td>
<td>Occasionally</td>
</tr>
<tr>
<td></td>
<td></td>
<td>46.6</td>
<td>40.0</td>
</tr>
<tr>
<td>Eating breakfast meal</td>
<td></td>
<td>53.4</td>
<td>60.0</td>
</tr>
<tr>
<td></td>
<td>Chi Square</td>
<td>2.543</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Odds Ratio (95 % CI)</td>
<td>1.309 (0.939-1.824)</td>
<td></td>
</tr>
<tr>
<td>Practicing physical exercises</td>
<td></td>
<td>33.0</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67.0</td>
<td>70.0</td>
</tr>
<tr>
<td></td>
<td>Chi Square</td>
<td>0.589</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Odds Ratio (95 % CI)</td>
<td>1.148 (0.806-1.636)</td>
<td></td>
</tr>
<tr>
<td>Nature of sleeping</td>
<td></td>
<td>61.8</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>38.2</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>Chi Square</td>
<td>8.145*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Odds Ratio (95 % CI)</td>
<td>1.616 (1.161-2.250)</td>
<td></td>
</tr>
<tr>
<td>Safety Behaviours</td>
<td></td>
<td>31.1</td>
<td>24.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>68.9</td>
<td>75.7</td>
</tr>
<tr>
<td></td>
<td>Chi Square</td>
<td>1.990</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Odds Ratio (95 % CI)</td>
<td>1.400 (0.876-2.235)</td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td>81.7</td>
<td>66.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18.3</td>
<td>33.5</td>
</tr>
<tr>
<td></td>
<td>Chi Square</td>
<td>18.064**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Odds Ratio (95 % CI)</td>
<td>2.243 (1.538-3.271)</td>
<td></td>
</tr>
</tbody>
</table>

*P<0.01.
**P<0.001.
The major concern point is the exposure of energy drinks from very young ages. Around 40% of energy drink consumers of study population have tried it before or during primary school and altogether around 70% of energy drinkers have tried by middle school. These results bring to our notice that energy drinks consumption habit, albeit, is not just very high among the study population but has begun very early too in their lives. In particular, the proportion of students with energy drink consumption habit increased considerably as they age, growing significantly from 54.2% among the middle schoolers to 65.3% among the secondary schoolers. We also found that daily usage proportions also increased from 33.6% among the middle schoolers to 41.8% among the secondary schoolers. These findings are similar to the other studies which reported increasing prevalence of energy drink consumption among school children in general and a linear trend in usage of energy drinks with increasing age [9,13, 24-26].

Home is the place for both first acquaintance as well as usual consumption place for energy drinks for majority study population. Energy drinks are available in attractive cans which almost look similar to soda or cola cans making it difficult for small children to notice the differences between them. They are also easy for small hands to hold and taste like soda or soft drinks. The presence of energy drinks in easily accessible places at homes and cars therefore is the major route for unintentional exposure for children in KSA. Together with the picture of parents, siblings and friends consuming them everywhere in Saudi Arabia can confuse the young children to mistake energy drinks as safe drinks. The study population seems to be neither aware about the components of energy drinks properly nor have access to reliable sources of knowledge about energy drinks. Only one third of the study population was even aware of major components like caffeine and sugar presence in the energy drinks. They are dependent on their friends and school mates for the knowledge about energy drinks who themselves may have very poor knowledge about the consequences of energy drink consumption over a period of time.

Energy drinks, unlike sport drinks contain caffeine as a major stimulant, besides may also contain a variety of other active ingredients such as taurine, ginseng, guarana, and B vitamins. Sugar is also a major component of many of these drinks. They claim to increase energy, improve performance and even promote weight loss [11, 12] which can all appeal to children. In KSA, energy drinks are marketed with limited regulations which were updated recently [26]. However energy drinks are still easily accessible to children because of their ubiquitous presence in the environments surrounding them. In addition in the wake of today’s rush and run life children and adolescents are attracted to energy drinks for staying more active and energized, enjoying the taste, stay awake for a longer time and/or to improve the physical and mental activities [1, 27, 28]. In the current study also children have quoted similar reasons in variable degrees as reasons for preferring energy drinks. The most common reason cited was for taste (59.6%) followed by to remain active and energized (14.9%). Other findings from our study support the premise that a small percentage of students prefer to use energy drinks during examinations and to improve academic performance although there is no published literature supporting energy drinks positive role in boosting academic performance even among young adults [29, 30].

The study results give enough hints to worry about the consequences of possible caffeine consumption in young children by identifying changes in cardiac activity and heart beating, reduced sleeping hours and addiction as major physiological effects reported by energy drink consumers. In addition middle and secondary school stages are part of critical phases of growth and development. Any possible insults on nutrition profile and sleep patterns can irreversibly affect growth and development during these stages. A previous study by Al Hazzaa and his colleagues [31] suggested energy drinks consumption among Saudi adolescents was positively correlated with screen setting (TV and PC use), eating fast foods, sugar-sweetened beverages, French fries and potato chips, cake and donuts, and sweets. In the present study also around half of the energy drinks consumers preferred to take them during or after meal timings or with fast foods and chocolates which may impact their meal intake or increased calories or both. In addition energy drinks intake during meal timings may replace water and other nutritious drinks. The possible net effects of these behaviors on children’s growth and development need to be further explored. However a report by Rush et al. [32] need a mention in this context which speculated that the cumulative effects of high intakes of caffeine and table sugar from energy drinks may lead to obesity in young adults.

In general many poor lifestyle behaviors were admitted by the study population. Poor lifestyle behaviors like smoking, sleeping less than 6 hrs, low physical activity and unsafe behaviors (not using safety
drinks are also important at this juncture to motivate programs highlighting negative health effects of energy making their access difficult to children. Awareness further tighten the regulations related to energy drinks physiological effects. Government of KSA needs to possible effects on health compromising behaviors and caffeine through these various sources and their others, it may be beneficial to focus on actual intake of brands of energy drinks and potential sources of that children are exposed from early ages to different potential public health effects of energy drinks. Given the current study is the first study on the prevalence of energy drink consumption among children in the Northern part of Saudi Arabia. Nevertheless, this study has several limitations, thefore most being a cross-sectional study limiting the causal inference for the findings. Second, lack of female subjects and primary school children limited comparative analysis. Further lack of measurement of actual caffeine intake could be a limiting factor in understanding its direct effects on physiological effects and tolerance level in children. Future studies possibly exploring these factors are required.

CONCLUSION

It can be concluded that our hypothesis is right, and energy drinks are consumed in alarmingly high proportions by middle and secondary school children in KSA. Energy drink consumption is associated with many health compromising behaviors among the study population. High disposable income on hands of children is one major determinant affecting the consumption of energy drinks. Home is the primary source for unintentional first exposure for majority study population. Educational and awareness programs should be designed and implemented by government including various stakeholders like schools, parents, media etc. to raise the level of awareness about deleterious health implications of energy drinks in young children.

REFERENCES


Alarming High Levels of Energy Drinks Consumption

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