J. King Saud Univ., Vol. 18, *Science* (2), pp. 99-109, Riyadh (1426H./2005)

Determination of Content Levels of Some Food Additives in Beverages Consumed in Riyadh City

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(Received 4/2/1426H.; accepted for publication 3/3/1426H.)

Abstract. A rapid and simple UV spectrophotometric procedures were applied for the determination of the content levels of some food additives in 29 different beverage samples commercially available in Riyadh local markets. These analytical measurements were undertaken primarily to assess the compliance of content levels of the investigated food additives and their daily intake doses with the permissible levels. The results obtained from this study indicated that the average quantity levels of aspartame, caffeine and sodium benzoate in the analyzed beverages were 246.7 ppm, 18.99 ppm and 16.14 ppm, respectively. In addition, the concentrations of these food additives have been converted into the daily intake doses based on beverages consumption. It was estimated that the mean daily intakes of aspartame, caffeine and sodium benzoate by the adult population of Riyadh city through the consumption of the analyzed beverages were 92.5 mg, 6.3 mg and 6.46 mg, respectively. None of the analyzed beverage samples was found to violate the current legal limits practiced in the Saudi food regulations.

***Keywords*:** Food additives, Aspartame, Caffeine, Sodium benzoate, Daily intake, Beverages.

Introduction

Food additives play a vital role in the modern food industry, and are generally used for maintaining food quality and its characteristics as well as promoting food safety [1]. Nonetheless, food additives have been the subject of interest among consumers, health professionals, commercial and industrial agencies, alike because they are widely consumed in the diet by most segments of the population and can exert adverse health

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effects, especially for children and pregnant women. In fact, such food additives are subject to regulation, since excessive or inappropriate use of them may present food safety problems and can introduce a risk factor. For instance, a small group of people who have the hereditary disease phenylketonuria are sensitive to phenylalanine, one of the metabolites of aspartame artificial sweetener (subject of this study), thus, all products containing aspartame must be labeled in many countries [2]. In addition, it is well established that excessive intake and consumption of caffeine may cause many undesirable side effects.

Since the consumption of soft drinks and beverages is a widespread habit all around the world, hence, such foodstuff products considered of great importance economically and socially, alike. As it is the case with any food, the composition of soft drinks is regulated by legislations. Therefore, the determination of these food additive compounds in soft drinks for assurance of food safety and quality control is mandatory. Several analytical techniques for the determination of food additives in various foodstuff products can be found in the literature. Liquid chromatography (HPLC) [3-5], capillary electrophoresis [6-8], spectrophotometry [9-11] and voltammetric [12-14] techniques have been successfully used for this quantitative task.

In order to determine any potential risk from food additives ingestion, accurate analytical information and consumption data are required. Unfortunately, there are relatively few sources of published analytical information concerning the determination of the content levels of these food additives in foodstuff products consumed in Saudi Arabia. No doubt, with the analytical data generated by this study about the content levels of food additives in some consumed beverages, we hope to help in assessing the food safety status for some foodstuffs consumed by population group in Riyadh city.

Aim of the study: Considering the remarks mentioned above, this present research study has been aimed to assess the compliance of the concentration levels of some food additives in various commercial drink brands available from the local market in Riyadh city. The obtained analytical data combined with the estimated food consumption will be used to calculate approximately the average daily intake doses of these food additives through the consumption of foodstuff beverages.

Experimental

Instrumentation

Spectrophotometric measurements of the investigated food additives were carried out by means of a Perkin Elmer lambda 2S UV–Vis spectrometer (Perkin-Elmer, USA), using 1-cm quartz cell. The absorption bands of the aqueous food additive solutions were recorded over the wavelength 200-600 nm.

Reagents and samples

All chemicals used were of analytical reagent grade and used without further purification. Standard aqueous solutions of aspartame, caffeine and sodium benzoate were prepared from chemicals purchased from Sigma and Riedel-De Haen products. Food additives stock solutions of 1×10^{-2} mol l^{-1} were prepared by dissolving the appropriate amount of these food additives in distilled water using 25 ml volumetric flask. The stock solutions were stored in dark, and standard solutions with lower concentration levels were prepared daily by diluting the stock solution with distilled water. Soft drinks, beverages with added fruit juices and energy drink samples were purchased from local markets. The total of 29 beverage samples investigated in this study were categorized as: soft drinks (15), beverages with added fruit juice (9) and energy drinks (5).

Procedure

Test solutions of aspartame containing 3-30 ppm were prepared and their absorption spectra after reaction with ninhydrin reagent was measured within the visible range 500-700 nm. Similarly, standard solutions were also prepared for caffeine and sodium benzoate over the concentration range 1.94-9.7 ppm and 10-50 ppm, respectively and their ultra-violet spectra was measured over the 220-320 nm range.

The purchased beverage samples were subjected to mild clean-up procedures such as filtration and degassing. All investigated foodstuff samples were analyzed directly without any further preparation steps such as extraction or concentration. Part of each test sample was introduced to the spectrophotometric cell (usually after appropriate dilution) and the molecular absorption was measured at the maximum wavelength for each food additive. In order to conduct the necessary statistical evaluations, all quantitative measurements were repeated five times. Soft drinks mostly consisted of carbonated water, sugar, colorants, citric acid, and other food additives such as flavors and preservatives. Beverages with added fruit juice contained the previous ingredients in addition to concentrated syrups, Vitamin C and pectin and other additives.

Results and Discussion

Characterisation of the absorption spectra

a) Aspartame: For the spectrophotometric analysis of aspartame artificial sweetener, the analytical procedure reported in the literature was adopted [15] with slight modification regarding the organic solvents used for the extraction process, as suggested by Nobrega *et al.* [16]. The applied quantitative method was based on the reaction of aspartame with ninhydrin reagent, which gave a blue product (Ruhemann`s purple). The selectivity of the method was improved via the extraction with methanol-isopropanol (1:1) mixture.

The obtained blue product resulted exhibited two intensive absorption bands both within the visible range at λ_1 = 408 nm and λ_2 = 572 nm. Due to the possible interference from several synthetic food dyes, commonly present in beverages and absorbed around 450 nm, thus it was recommended that the second absorption bands at higher wavelength value (i.e. at 572 nm), should be selected for absorbance measurements [15]. The monitored absorbance intensity was appeared to be evidently dependent on the aspartame concentration. A linear relationship between absorbance and the analyte concentration over the range 1.0×10^{-5}-1.2×10^{-4} mol l^{-1} (2.94-35.3 ppm). The least-square treatment of this calibration graph with 6 measurements, yielded the following regression equation:

$$A = 0.112 + 0.08 \times 10^{5}\ C\ (\text{mol l}^{-1}) \qquad r = 0.999, \quad n = 6$$

where A, is the molecular absorbance, C, is aspartame concentration and r, is the correlation coefficient.

Before the applied spectrophotometric procedure could provide useful analytical information, it was necessary to demonstrate that it is capable of providing acceptable analytical results. In actual fact, the analytical performance of the applied method can by verified via the evaluation of its precision and accuracy characteristic. The accuracy of the analytical procedure was verified through estimating the recovery of known amount of aspartame (14.7 ppm) spiked into a commercial soft drink, which did not originally contain any aspartame sweetener agent. The value of the recovery test obtained by the standard addition approach (to minimize any matrix interferences) has a mean of 97.7% with ± 0.55% standard deviation value. The accuracy of these analytical results were assessed by the t-test statistical approach. The critical value of t-test at the 95% confidence level is 2.8. Since the calculated t-test value (0.41) is less than the critical value, the null hypotheses is retained. There is no statistical evidence that the mean of the analyzed data differ significantly from the known added quantity of aspartame. Furthermore, the precision of the applied analytical method was estimated from the reproducibility of 10 successive measurements of 15 ppm aspartame standard solution. The precision of the method in terms of the relative standard deviation (RSD%) was 0.7%.

b) Caffeine: In order to establish the spectrophotometric determination of caffeine, the wavelength was studied within the interval 220–320 nm using a 3.88 ppm caffeine standard solution. The obtained results gave an absorption spectrum, which was characterised by a single intensive absorption band located in the UV range at λ_{max} = 276 nm. It was observed that as the concentration of caffeine was varied over the range from 2.5×10^{-6} to 3.6×10^{-4} mol l^{-1} (0.5-70 ppm), it was accompanied by a proportional enhancement in the monitored absorption intensity over such wide concentration range. The calibration equation was calculated by least-squares method from nine measurements and it has the form:

$$A = -0.032 + 1.01 \times 10^{4}\ C\ (\text{mol l}^{-1}) \qquad r = 0.999, \quad n = 9$$

In addition, the analytical utility of the employed quantitative method was also investigated in similar manner to that previously discussed for the spectrometric analysis of aspartame artificial sweetener. The recovery of the used procedure, which reflects the accuracy of the analytical method, was evaluated by analyzing caffeine-free drink sample spiked with 9.7 ppm caffeine. The mean recovery of five measurements obtained by standard addition approach was found to be 97.66% with standard deviation of ±0.3%. The mean of the obtained results was found to be not significantly different from the value of added caffeine concentration, since the calculated t-test value (2.6) was less than the tabulated t-test value (4.6) at 99% confidence level. The analytical precision of the spectrophotometric method was assessed from the reproducibility of 10 determinations of 10 ppm caffeine solution and a relative standard deviation of 0.1 RSD% was calculated.

c) Sodium benzoate: The absorption spectrum of benzoic acid standard solution (29 ppm) indicated that the acidic form of this food preservative was characterized by a single UV absorption band at λ_{max} = 224 nm. It was observed that the increase in concentration of benzoic acid over the range 2.8×10^{-5}-4.44×10^{-4} $moll^{-1}$ (4-64 ppm), is accompanied by a proportional enhancement in the monitored absorption intensity. The calibration equation was calculated by least-squares method and it has the form:

$$A = 0.101 + 0.073\times10^{5}\ C\ (mol\ l^{-1})\quad r = 0.999,\quad n = 6$$

The validity and accuracy of the used UV spectrometric method was further explored through recovery studies, which involve artificially spiking a soft drink sample with the target analyte (e.g. 10 ppm sodium benzoate) and predicting its content. The mean sodium benzoate recovery of five replicates was 94.1% with standard deviation of ± 0.96% (with a calculated t-test value of 1.98 less than the tabulated value of 2.78 at 95% confidence level, the t-test statistical evaluation was valid). The reproducibility of 10 measurements of 20 ppm sodium benzoate test sample was 0.54 RDS%.

Practical determination of the studied food additive in commercial drink samples

Different kinds of beverages brands, including regular and diet cola, carbonated refreshment drinks, beverages with added fruit juices, energy drinks and preservatives-free canned fruit juices were purchased from different local supermarkets and 29 samples were analyzed in quintuplicate (n = 5) using the indicated spectrophotometric method. Once sample bottles were open, the drinks were degassed, homogenized and filtered. In all cases, five aliquots of each drink sample were placed in the spectrophotometric cell after adequate dilution. In order to reduce the interference effects particularly that expected with fruit juices, all analytical determinations were carried out by the standard addition approach.

a) Aspartame: The soft drink brands currently manufactured and marketed in Riyadh city can be initially classified into two categories: soft drinks with labelled aspartame content and that with unidentified and anonymous quantity of this artificial sweetener. Table 1 gives the results for the spectrophotometric determination of aspartame contents in several carbonated soft drinks with claimed aspartame content levels. As can be seen from this table, the obtained results of aspartame concentrations compared favorably with the labelled values. On the other hand, the determined contents of aspartame sweetener additive in other soft drink products, which did not designated its actual concentration, are summarized in Table 2. Anyhow, the obtained concentration levels of aspartame in all these analyzed samples were found to vary from 78.2 ppm (in Diet Lemon 2) to 551 ppm (in Diet Lemon 1). The mean aspartame concentration level was found to be 246.7 ppm.

Table 1. UV spectrometric analysis of aspartame in beverages with labelled aspartame contents

Soft drinks	Claimed content (ppm)	Analyzed content (ppm)	% Recovery	Daily intakes (mg)
Diet Cola 1	350	339.8 ± 0.8	97.1%	127.4
Diet Cola 2	79	81.44 ±1.4	%103.1	30.54
Diet Lemon 1	550	551 ±0.8	%100.2	206.6
Diet Lemon 2	79	78.2 ±1.6	%98.99	29.33

Table 2. Determination of aspartame content levels in soft drink samples

Soft drinks	Aspartame content (ppm)	Daily intakes (mg)
Diet Cola 3	344.5 ± 0.2	129.25
Diet Lemon 3	127.2 ±2.1	47.75
Diet Lemon 4	190.2 ±2.4	71.38
Diet Strawberry	260.8±0.8	97.8

b) Caffeine: The concentrations of caffeine food additive (flavor enhancer) in what so called energy drinks collected from local supermarkets are noticeably higher than their counterpart concentration levels in the refreshment soft drinks. The calculated analytical results in Table 3 and Table 4 demonstrate the caffeine content levels in energy drinks and carbonated soft drinks, respectively. The caffeine contents in energy drink samples ranged from 22.64 ppm to 34.96 ppm. The minimum caffeine content level was observed in Drink 4 sample, while Drink 2 sample showed the highest caffeine content. The mean of caffeine quantity in the analyzed energy drinks was found to be in the level of 28.23 ppm. However, the analyzed carbonated soft drink samples contained much lower caffeine contents since its mean concentration level of 9.76 ppm is virtually one third the average caffeine content observed in energy drinks. The analyzed samples in the carbonated soft drink group showed caffeine content in the range of 2.8 - 12.76 ppm.

Table 3. Analytical results of caffeine contents in the energy drink samples

Energy drinks	Caffeine content (ppm)	Daily intakes (mg)
Drink 1	26.4 ± 0.1	9.9
Drink 2	34.96 ±0.03	13.13
Drink 3	24.3 ±0.2	9.13

Drink 4	22.64±0.04	8.5
Drink 5	32.84±0.11	12.31

Table 4. Caffeine content levels in the carbonated soft drink

Soft drinks	Caffeine content (ppm)	Daily intakes (mg)
Regular Cola 1	8.58 ± 0.04	3.25
Regular Cola 2	11.89 ±0.07	4.5
Regular Cola 3	8.84±0.02	3.38
Regular Cola 4	2.84±0.02	1.07
Diet Cola 1	12.76±0.03	4.79
Diet Cola 2	11.77±0.08	4.41
Lemon Cola	11.62±0.07	4.38

All over the world, the caffeine contents in soft drinks varies according to the type of the brand, yet its average content in soft drinks is approximately 18 mg per six ounce (i.e. 100 ppm) [17]. In fact, the US Food and Drug Administration (FDA) limits the maximum caffeine amount in carbonated beverages to 6 mg/oz (72 mg/355 ml). Therefore, caffeine content level allowed in soft drinks is up to 200 ppm [18]. Clearly, the caffeine mean content level in the analyzed beverage samples manufactured and marketed in Riyadh city, is well below the above food industry guidelines.

c) Sodium benzoate: The mean concentrations with standard deviations of sodium benzoate food preservative in various beverages with added fruit juices are given in Table 5. As can be shown from this table, the concentration levels of this preservative agent were found to vary from 9.5 ppm (in beverages with added juice of Orange 2 and Lemon 1) to 26.4 ppm (in Lemon 2). The sodium benzoate mean content was found to be 16.14 ppm. According to the food regulations issued by the Saudi Arabian Standards Organization, the content of sodium benzoate food preservative in beverages should not exceed 0.1% of the product total weight [19]. All the analyzed beverage samples contained sodium benzoate at percentage levels far below (10-fold less) the maximum permitted by the Saudi food legislations (see Table 5).

Table 5. Results for the spectrophotometric determination of sodium benzoate in the tested beverages

Beverages	Sodium benzoate content (ppm)	Preservative percentage %	Daily intakes (mg)
Orange 1	16.4 ± 0.46	0.0016%	6.56
Orange 2	9.5 ±0.23	0.001%	3.8
Orange 3	24.12±0.08	0.0024%	9.65
Orange 4	18.6±0.44	0.0017%	7.44
Lemon 1	9.5±0.23	0.001%	3.8
Lemon 2	26.4±0.16	0.0026%	10.56
Lemon 3	13.26±0.86	0.0013%	5.3

Strawberry	12.7±0.06	0.0012%	5.08
Mandren	11.43±0.06	0.0012%	4.57
Diet Cola	19.5±0.25	0.002%	7.8

On the other hand, the applied spectrophotometric method was also employed to assess the integrity and credibility of some preservative free beverages (products whose labels claimed that they were free from added chemical preservatives). In all the selected beverage samples with such claim, sodium benzoate food preservative was not detected. These extra analyzed foodstuff samples are beverages containing the following added juices: Orange, Apple 1, Apple 2, Mango, Pineapple or Passion fruit.

Estimation of the daily intakes of these food additives

Rationally, the daily intakes of these investigated food additives through beverages consumption rely mainly on both the content levels of these food additives in the drinks and the amounts consumed of these drinks. Due to the fact that the amounts of the consumed foodstuffs depends on the food habits in particular population group, and in order to estimate the daily intake of these food additive in Saudi Arabia, the following assumptions have been put forward: On average, two to three bottles of the drink are consumed daily by every adult person. However, the size of the drink bottle varied considerably (125 ml-330 ml), hence, daily consumption rate of 400 ml of the drink and also an average adult body weight of 70 kg were also assumed. For the sake of simplicity, the estimated daily intake of these food additives is solely due to the consumption of beverages and contributions from other foodstuffs such as tea, coffee and as alternative source for caffeine or other table-top artificial sweeteners substitute to aspartame, are not considered.

a) Aspartame: Table 1 and Table 2 show the average aspartame contents and the estimated daily intake of this artificial sweetener through consuming 400 ml of beverages per day. The intakes of aspartame synthetic sweetener from the studied beverage samples are relatively low and only one third of the analyzed foodstuff products contribute in the intake of aspartame quantities by more than 100 mg per day. According to the food regulations of Saudi Arabian Standards Organization [20] and joint FAO/WHO expert committee on food additives [21], the maximum permissible daily intakes (PDI) for aspartame artificial sweetener is 40 mg/kg body weight. Hence, the maximum PDI value of aspartame for average adult person with 70 kg body mass is 2800 mg per day. The average aspartame daily intakes from the consumption of studied beverages is 92.5 mg, which is significantly well below the recommended tolerable level legislated in the Saudi food industry regulations.

b) Caffeine: In a similar manner, the daily intakes of caffeine through the consumption of soft drinks and energy beverages was calculated in view of the previous assumptions such as an average of 400 ml of drink was consumed daily and the average adult body weight is 70 kg. Tables 3 and 4 illustrate the estimated values of caffeine daily intakes through the consumption of the indicated foodstuff products. As expected, the data presented in these tables indicates an elevated caffeine intake doses through the consumption of energy drinks in comparison to the consumption of the carbonated fizzy drinks. The mean values of caffeine daily intakes were 8.9 mg and 3.7 mg through the ingestion of energy drinks and soft drinks, respectively. According to the International Food Information Council, the consumption level of caffeine for adults in the U.S. is approximately 200 mg per day [22]. This may indicate that the contribution from beverages in the intake of caffeine is less than or around 5% for most of the energy drinks and 2% for most of the soft drinks.

c) Sodium benzoate: The World Health Organization (WHO) recommended that the maximum acceptable limit per day for sodium benzoate food preservative is 5 mg/kg body weight [21]. The results obtained for the estimated daily intake doses of sodium benzoate though the consumption of beverages with added fruit juices, are exhibited in Table 5. According to this analytical data, the average daily intake of sodium benzoate through the consumption of these foodstuff sample is 6.46 mg per day. This average of the daily intake value is considerably less than the WHO acceptable limit of 350 mg per day for average adult with 70 kg body weight.

Conclusion

Although the number of drink samples analyzed is still small, the data presented in this study gave a preliminarily outline about the content levels in foodstuff beverages frequently consumed by Riyadh inhabitants. Based on these analytical data, it seems that the content levels of the studied food additives are within or even significantly lower than the maximum authorized levels. While our previous study concerning the determination of the content levels of some artificial food colors added to beverage consumed by children in Riyadh city [23] indicated that some of the analyzed beverage samples contained food dye at content levels exceed and violate the Saudi food regulations. However, none of the analyzed beverage samples in this current study disobey the authorized legislation limits in force in Saudi Arabian food regulations regarding the permitted content levels for aspartame, caffeine and sodium benzoate.

Acknowledgments. Financial support from the College of Science Research Center is gratefully acknowledged.

References

[1] Branen, A.L. (Ed.). *Food Additives*. New York: Marcel Dekker, Inc., 1990.
[2] Newsome, R. In: Altschul, A.M. (Ed.), *Low-Calorie Foods Handbook*. New York: Marcel Dekker, 1993, p. 139.
[3] Tfouni, S.A.V. and Toledo, M.C.F. "Determination of Benzoic and Sorbic Acids in Brazillia Food." *Food Control*, 13 (2002), 117-123.
[4] Kazimierz, W. and Katarzyna, W. "Determination of Aspartame and Phenylalanine in Diet Drinks by HPLC." *J. Chromatog. A*, 773 (1997), 163-168.

[5] Aresta, A., Palmisano, F. and Zambonin, C.G. "Simultaneous Determination of Caffeine and .. in Human Milk by Liquid Chromatography." *Food Chem*. In press, corrected proof, available online December (2004).

[6] Dong, Y. "Capillary Electrophoresis in Food Analysis." *Trends in Food Sci*. *Tech*., 10 (1999), 87-93.

[7] Frazier, R.A., Inns, E.L., Dossi, N., Ames, J.M. and Nursten, H.E. "Development of a Capillary Electrophoresis Method for the Simultaneous Analysis of Artificial Sweeteners." *J. Chromatog. A*, 876 (2000), 213-220.

[8] Sabah, S. and Scriba, G.K.E. "Determination of Aspartame and Its Degradation by Capillary Electrophoresis." *J. Pharma. Biomed. Anal.*, 16 (1998), 1089-1096.

[9] Sena, M.M. and Poopi, R.J. "Simultaneous Spectrophotometric Determination of Acetylsalicylic Acid, Paracetamol and Caffeine." *J. Pharma. Biomed. Anal*., 34 (2004), 27-34.

[10] Filho, F.O., Marcolino, L.H. and Pereira, A.V. "Solid-phase Reactor with Cu (II) Phosphate for Flow Injection Spectrophotometric Determination of Aspartame." *Anal. Chim. Acta*, 384 (1999), 167-174.

[11] Nobrega, J.A., Filho, F.O. and Vieria, L.C. "Spectrophotometric Resolution of Ternary Mixtures of .. and Sodium Benzoate in Syrups." *Anal. Chim. Acta*, 526 (2004), 83-94.

[12] Zen, J.M. and Ting, Y.S. "Simultaneous Determination of Caffeine and Acetaminophen .. by Square Wave Voltammetry." *Anal. Chim. Acta*, 342 (1997), 175-180.

[13] Fung, Y.S. and Mo, S.Y. "Application of Square-wave Voltammetry for the Determination of Ascorbic Acid in Soft Drinks and Fruit Juices." *Anal. Chim. Acta*, 261 (1992), 375-380.

[14] Kilmartin, P.A. and Hsu, C.F. "Characterization of Polyphenols in Green and Black Teas, and in Coffee, Using Cyclic Voltammetry." *Food Chem*., 82 (2003), 501-512.

[15] Lau, O.W., Luk, S.F. and Chan, W.M. "Spectrophotometric Determination of Aspartame in Soft Drinks with Ninhydrin as Reagent." *Analyst*, 113 (1988), 765-768.

[16] Nobrega, J.A., Filho, F.O. and Vieria, L.C. "Flow Injection Determination of Aspartame in Dietary Products." *Analyst*, 119 (1994), 2101-2104.

[17] Barone, J.J. and Roberts, H. "Human Consumption of Caffeine." In: P.B. Dews (Ed.), *Caffeine*. New York: Springer-Verlag, 1984.

[18] Ref: National Soft Drink Association (1999). *What's in Soft Drinks: Caffeine in Soft Drinks*. Available: http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=5037&_plusSign=%2B&_targetURL=schttp%253A%252F%252Fwww.nsda.org%252FWhatsIn%252Fcaffeinecontent.html

[19] *Non-alcoholic Soft Drinks*. Gulf Standards (No. 18), pp. 3-4 (1984).

[20] *Permitted Sweeteners in Foodstuffs*, Gulf Standards (No. 995), pp. 1-3 (1998).

[21] Summary of Evaluations Performed by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) 1956–1997 (first through forty-ninth meetings), FAO & WHO (1999).

[22] Roberts, H. *Caffeine Consumption*. Paper presented at a meeting of the American Academy of Paediatric Clinical Pharmacology Session. New Orleans (1991).

[23] Alghamdi, A.H., Alghamdi, A.F. and Alwarthan, A.A. "Spectrophotometric Analysis of Artificial Food Colors in Commercial Drinks Consumed by Children." *J. Saudi Chem. Soc*., Submitted (2005).

تقدير مستوى ا توى لبعض مضافات الأغذية ا شروبات ا ستهلكة مدينة الرياض

أ د بن حامد الغامدي و علي بن فلاح الغامدي
و عبد الر ن بن عبد ا الورثان

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المملكة العربية السعودية

(قدم للنشر في ١٤٢٦/٢/٤هـ ؛ قبل للنشر في ١٤٢٦/٣/٣هـ)

ملخص البحث. تم تطبيق طرق تحليل طيفية سهلة وسريعة لتقدير محتوى بعض مضافات الأغذية في ٢٩ عينة مشروبات مختلفة متوفرة تجاريا في الأسواق المحلية بمدينة الرياض. هذه القياسات التحليلية تم إجرائها بشكل أساسي لتقييم مدى موافقة مستوى المحتوى لهذه المضافات الغذائية وجرعات الاستهلاك اليومي لها مع الحدود المسموح بها. النتائج المتحصل عليها من هذه الدراسة تبين أن متوسط كمية الأسبارتيم والكافيين وبنزوات الصوديوم في المشروبات المحللة كانت ٢٤٦,٧ و ١٨,٩٩ و ١٦,١٤ (جزء من المليون) على التوالي. عند تحويل تراكيز هذه المواد المضافة للجرعات المستهلكة يوميا اعتمادا على متوسط الاستهلاك لها وجد بأن متوسط الاستهلاك اليومي المستنتج للأسبارتيم والكافيين وبنزوات الصوديوم كان ٩٢,٥ و ٦,٣ و ٦,٤٥ مليجرام على التوالي. جميع عينات المشروبات المحللة وجدت متوافقة مع الحدود القانونية للأنظمة الغذائية المطبقة في المملكة.