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RESEARCH ARTICLE

EFFECT OF RESTRICTING SWEETENED CARBONATED BEVERAGES AND PROMOTING VEGETABLE CONSUMPTION IN PUBLIC SCHOOLS ON CALORIC INTAKE AND OBESITY RATE AMONG STUDENTS

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Abstract

Consumption of high-caloric sugar-sweetened beverages can promote childhood obesity and limit consumption of healthy foods. The Texas Public School Nutrition Policy is a mandate promoting healthy school environments by prohibiting sales of sweetened beverages and restricting portion sizes of high-fat foods. This study examined the possible effects of applying the Texas Public School Nutrition Policy in Saudi Arabian schools on students' caloric intake and obesity rates. The average weekly sweetened carbonated beverage, caloric, and vegetable consumption of 162,147 Saudi public school students were determined based on the literature. Thereafter, according to prior pre-/post-studies, the effect of the Texas Public School Nutrition Policy on students' food selection was estimated. This study found that the policy would decrease students' consumption of sweetened carbonated beverages during school days from 5.3 to 3.9 servings/week, increase vegetable intake from 4.25 to 4.7 servings/week, and decrease total average caloric intake from 1,871 to 1,792 kcal/week. Although the reduction in caloric consumption is small (79 kcal/week/student), this policy can be a general strategy for increasing physical activity, improving nutrition, and managing obesity and overweight among Saudi students.

Introduction:-

According to a systemic review, the prevalence of obesity and overweightness among children and adolescents in Saudi Arabia is 25–40% [1]. Obesity-related diseases, including type 2 diabetes mellitus, are increasing among obese children. Moreover, overweight/obese children are highly likely to become overweight/obese adults with an increased risk of obesity-related diseases [2].Consumption of high-calorie sugar-sweetened carbonated beverages has been implicated in promoting children's obesity and limiting the consumption of healthy foods such as vegetables [3-5]. Currently, there are 162,147 students attending public schools in the eastern province of Saudi Arabia. A cross-sectional study found that around 60% of school students eat their lunch at school [6].The average weekly consumption of sweetened carbonated beverages, total calories, and vegetables among Saudi students was estimated to be 7.42 servings/week, 2,619 kcal, and 5.95 servings/week, respectively [5].However, this study considered the consumption of food at home and at school, and food consumption at school may be lower than at home.

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The Texas Public School Nutrition Policy is an unfunded mandate designed to promote a healthy school environment. The policy has been applied to all school food environments, including snack bars and vending machines. The policy prohibits anyone from selling sweetened beverages in schools, at all times. In addition, it restricts the portion sizes of snacks and high-fat foods, as well as the fat content of all foods [7].

A pre/post study on the impact of Texas nutritional policy on the students' food selection found that the policy resulted in a significant decrease in sweetened carbonated beverages by 44% [8].Another pre/post study found a statistically significant decrease of 7% in the caloric intake post the policy implementation [6].A meta-analysis found that a school nutritional policy may increase vegetable consumption by 19% [9].

This paper analyzed the possible effects of applying the Texas Public School Nutrition Policy to public schools in Saudi Arabia. It was expected that applying this policy would lead to a decrease in students' caloric intake and sugar-sweetened carbonated beverage consumption and an increase in vegetable consumption, because it would limit the sources of sweetened beverages and leave space for other healthy choices such as fruits and vegetables.

Materials and Methods:-

A random sample of school children was recruited, aged 10 to 19 years, in Eastern province of Saudi Arabia. The study was conducted in elementary schools, using multi-stage probability proportional to size sampling technique to evaluate the consumptions of sweet products, carbonated beverages, and energy drinks among students. An ethical approval was obtained from a research review board, and the administrative permission was obtained from the Ministry of Education. This study was conducted in different provinces of Saudi Arabia; however, the author assumed that its results could be generalized to the Eastern Province as all the areas share the same governmental educational environment, regulations, and catering services. This may cause an overestimation of the average caloric consumption because younger children have few options to choose from, as their parents choose their food for them and they are expected to consume fewer calories from sweetened carbonated beverages. Therefore, the average estimate of sweetened carbonated beverage consumption was lower than that reported by the study. Based on this study, the author calculated the average daily consumption of vegetables and sweetened carbonated beverages and multiplied the result by five, representing the number of school days, to calculate the weekly average consumption in the school. Table 1 shows the weekly average consumption of sweetened carbonated beverages and vegetables in public schools in the Eastern Province of Saudi Arabia.

The present study has a number of limitations. Caloric intake during the weekends is usually higher than during school days. Calculating the weekend caloric intake is beyond the scope of this analysis, which focuses on the impact of this policy on caloric consumption in school. Furthermore, students may compensate for the restriction on sweetened carbonated beverages in school by increasingly consuming of it after going home from school. This may lead to an overestimation of the benefits of this analysis. Another limitation is that although the data used in the present study are drawn from systematic analysis studies and pre- and post-implementation studies that all have strong internal validity, the applicability of these studies, which were carried out in Texas schools, to Saudi schools might be flawed. The students from Texas and Saudi Arabia have different educational and catering systems and may differ in their preferences and dietary habits. However, the consumption of high calorie-containing sweetened carbonated beverages has become a global commonality. A 100% administration compliance rate for this policy was assumed; however, if they did not comply well, the estimated impact of the policy would be less than that found in Texas and thus, the benefits of this analysis would be overestimated.

To address the uncertainty around the assumptions, the author performed a probability analysis for the weekly consumption of vegetables among students eating in the canteen. The weekly average ranged from 4.5 to 5.6 servings, an average of 5.1 servings. It was found that 53% of the students' weekly vegetable consumption ranged from 4.9 to 5.1 servings. Figure 1 shows the distribution of weekly vegetable consumption among students eating in the canteen.

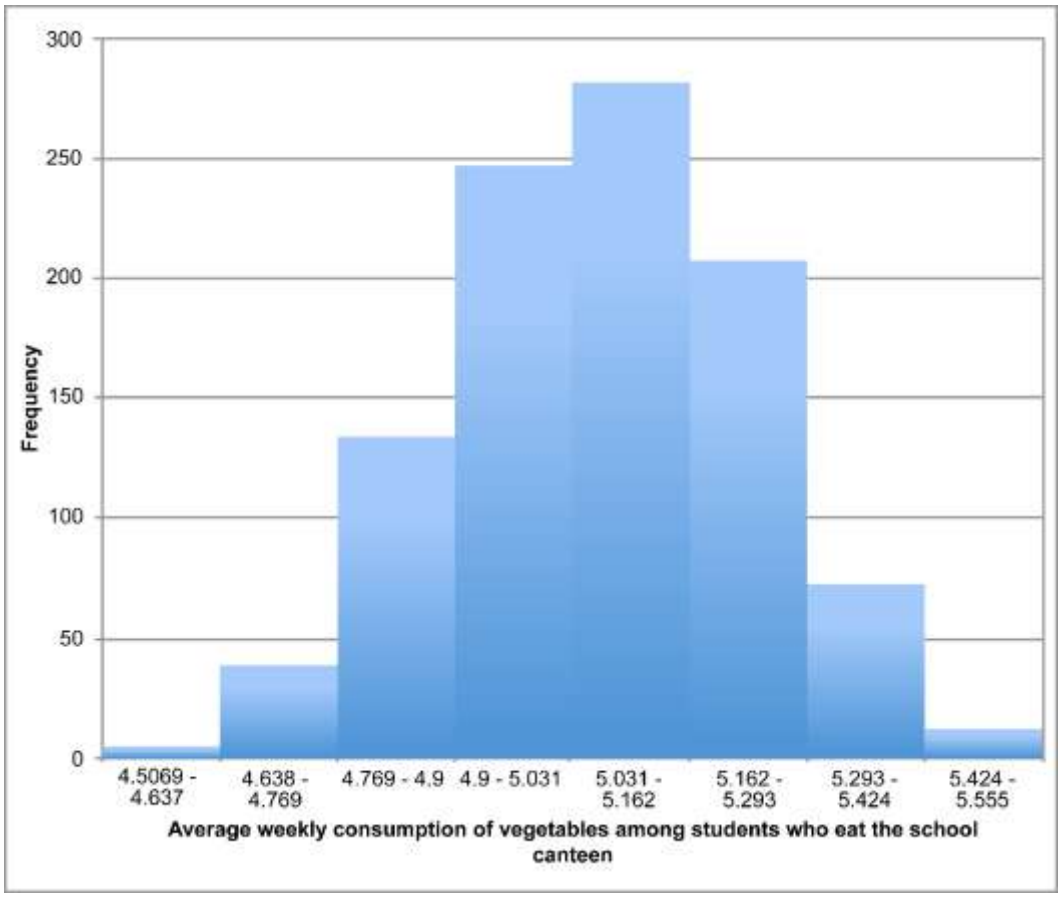

Figure 1:- Distribution of average weekly consumption of vegetables among students eating in the school canteen.

Results:-

Table 1 presents the age distribution of participated school children. The sample was comprised of 725 children. The mean age of school children was 14.5 years, ranging between 10-19 years old.

Table 1:- Age distribution of the school children, who participated, in percentage.

I Age Distribution	n	Percentage
10-12	180	24%
13-15	271	27.3%
17-19	274	27.7

Table 2 shows that 10.5% of the children never or rarely consumed sweets products during the week, and about 63.4% of the children reported consuming sweets products weekly. Approximately 56.3% of the children consumed soft drinks weekly; whereas, 15.4% were daily consumers. Weekly consumption of energy drinks were reported by 21.9% of the children, and by 4.2% as daily users. Weekly consumption of vegetables per serving were reported by 31.7% of the children, with 1.4% as daily users.

Table 2:- Distributions of sweets products, soft and energy drinks consumption among school children.

Food types	n	%
Sweets products consumption		
Never	76	10.5
Weekly/Not everyday	460	63.4
1-2 times a day	170	23.4
3 times or more a day	19	2.7
Total	725	100

Carbonated beverages consumption		
Never	193	26.6
Weekly/Not everyday	408	56.3
1-2 times a day	112	15.4
3 times or more a day	12	1.7
Total	725	100
Energy drinks consumption		
Never	535	73.8
Weekly/Not everyday	159	21.9
1-2 times a day	30	4.2
3 times or more a day	1	0.1
Total	725	100
Consumption of Vegetables		
Never	480	66.2
Weekly/Not everyday	230	31.7
1-2 times a day	10	1.4
3 times or more a day	5	0.7
Total	725	100

Table 3 shows that after the implementation of Texas school children nutrition policy the rate of vegetable consumption rose to 50.7% among school children weekly, about 23% of the students consuming vegetables daily. The daily consumption of carbonated beverages decreased to 10.1% of the children.

Table 3:- Expected Consumption of Distributions of sweets products, soft drinks, energy drinks and Vegetables consumption among school children after the policy.

Food types	**n**	**%**
Sweets products consumption		
Never	319	44
Weekly/Not everyday	239	33
1-2 times a day	109	15
3 times or more a day	58	8
Total	725	100
Carbonated beverages consumption		
Never	510	70.3
Weekly/Not everyday	137	18.9
1-2 times a day	73	10.1
3 times or more a day	5	0.7
Total	725	100
Energy drinks consumption		
Never	663	91.4
Weekly/Not everyday	37	5.2
1-2 times a day	25	3.4
3 times or more a day	0	0
Total	725	100
Consumption of Vegetables		
Never	46	6.3
Weekly/Not everyday	368	50.7
1-2 times a day	167	23
3 times or more a day	144	20
Total	725	100

Discussion:-

The current cross-sectional questionnaire survey was conducted with the aim of assessing the consumption of sweets, soft-carbonated energy drinks, and vegetables along with their correlation

among Saudi school children. This study revealed that consumption of energy drinks at an early age is highly concerning. The consumption of energy drinks may increase the possibility of caffeine overdose and toxicity among children and teenagers. In this study, weekly and daily consumers of energy drinks were reported to be 21.9% of total school children. The results of this study provided an evidence that the consumption of energy drinks is common among younger population in Saudi Arabia. Similarly, it has been reported that 45% of school children, aged 12 to 19 years, consumed energy drinks in Saudi Arabia. At the same time, it has been reported that the frequent consumption of energy drinks was reported by 16% of the students among high school students. In a review study, the consumption of energy drinks was reported to be 30–50% by adolescents and young adults. It may strongly indicate thatthe consumptionof energy drinks tends to increase as the age increases, which highlighted the importance of this study and the need to tackle unhealthy behavior among school children. Such findings would serve as a baseline for future studies related to energy drinks consumption among children in Saudi Arabia. The most common reasons for consuming energy drinks were friends, taste, curiosity, boosting energy, and advertisement. The findings have also indicated higher consumption of sweets products and sweetened-carbonated soft drinks among children, suggesting a trend towards sugar-rich foods among children.

In this study, it was evident that sweet products and sweetened carbonated beverages were regularly consumed by most Saudi children. In line with that, it has been reported that unhealthy dietary choices; such as, sweet food consumption and sweetened beverages were most often consumed among school children in Saudi Arabia. Also, it has been described that carbonated drinks are the major types of sweetened beverages, consumed by the school children. However, it has been reported that there was a negative relationship between sweetened beverage consumption and vegetables, which suggested future research to investigate vegetable consumption and its determinates among Saudi population. There is a co-occurrence of multiple poor dietary behaviors, which may increase the risk of chronic diseases and poor health outcomes.

Strategies to improve children's dietary behaviors, at both, the school and home environment, need be implemented. School-based nutrition education can make a vital contribution to healthy eating. Schools are particularly suitable for nutrition education, because they reach most children, on a regular basis, for a number of years. Therefore, progressive changes within the academic environment or educational processes may lead to the application of healthy behaviors. It has been evaluated that productive policies along with the supportive environment is associated with healthy food choices. Thus, school policies promoting healthy food choices and healthier behaviors choices are required in Saudi Arabia. To have a greater impact on children's dietary behaviors, any program implemented should include parents and family component. Parents can influence their children dietary behaviors accordingly. They are the decision makers, and can be seen as role models for their children; therefore, they should be included in any healthy lifestyle program targeting children. Numerous nutritional and behavioral studies have suggested that parental modeling and home-environment, such as availability and accessibility factors, are associated with children nutritional behaviors.

Thus, interventions, including all the members of the family, are necessary to make a greater impact in improving children's dietary behaviors.

Conclusions:-

The Texas Public School Nutrition Policy may decrease students' consumption of sweetened carbonated beverages while increasing their average vegetable consumption. The average serving of sweetened carbonated beverage decreased to 18.9% weekly among all the students. The weekly average vegetable consumption increased to 50.7% servings among all the students. However, adding this nutritional policy as a general strategy to increase students' physical activity and improve nutrition at home may help to decrease the rate of obesity and overweightness among school children in the Eastern Province Schools can play a significant role in enhancing students' knowledge regarding the importance of healthy diet, and influence their nutritional behaviors. Thus, Saudi Ministry of Education should play an active role in developing and promoting healthier dietary behaviors through comprehensive school-based intervention programs. Further in-depth descriptive studies are needed to provide greater comprehensive understanding of children's dietary behaviors and their correlates.

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Institutional Review Board Statement:
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Informed Consent Statement:
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Data Availability Statement:
Not applicable.

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Conflicts of Interest:
The author declare no conflict of interest.

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