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Khalid Aldubayan [1] and Mary Murimi [2]

[1]Community Health Sciences Department – Clinical Nutrition, College of Applied Medical Sciences, King Saud University, Saudi Arabia. [2]Department of Nutritional Sciences, College of Human Sciences, Texas Tech University, United States of America. (Correspondence to: Khalid Aldubayan: kaldubayan@ksu.edu.sa).

Abstract

Background: An evidence-based school nutrition policy that helps increase the availability and accessibility of healthy foods is needed in the Kingdom of Saudi Arabia.

Aims: This study investigated the compliance of selected schools with Saudi nutrition policy and assessed the nutritional value of food offered in such schools using the Institute of Medicine (IOM) standards.

Methods: A total of 76 boys public high schools were randomly selected from four areas in Riyadh, Saudi Arabia. Principals and canteen managers were interviewed using validated questionnaires. Schools were observed using a food checklist.

Results: Meals offered in Saudis schools come prepackaged with minimal cooking in schools. From a calorie perspective, there was not a significant difference between the food allowed and food not allowed. For the Saudi policy, 94.7% of the schools scored in between category 2 and 3 (moderate compliance). For the IOM standards, 96.1% of the schools scored in category 1 (low alignment).

Conclusions: While the Saudi policy is clear on what should not be served in school cafeterias, it fails to provide guidance on what must be served to improve the nutritional value of meals provided.

Keywords: Nutrition; school meals; breakfast; Institute of Medicine, policy

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Introduction

Childhood obesity is considered a pandemic in high-income as well as certain low-and middle-income countries. In the United States of America, the prevalence of obesity was 16.9% (38.1 million) among the youth (1). According to a Saudi national survey (n=19 317 children aged 5–18 years), the prevalence of overweight, obesity, and morbid obesity was 23.1%, 9.3% and 2%, respectively (2). In Riyadh, two cross-sectional studies showed that the proportion of obese children rose steadily from 3.4% in 1988 to 24.5% in 2005 (3). During that period, the mean BMI increased from 16.5 to 18.0 kg/m², and fat percentage jumped from 13.2 to 19.7% (3). Obese children are more likely to be obese during adulthood, and this increases the risk of health complications, such as cardiovascular diseases and metabolic syndrome, at an early age (4). Cardiovascular diseases were the leading cause of death among males and females in Saudi Arabia from 1990 until 2010 (5).

According to the World Health Organization (WHO) (2015), the primary cause of overweight and obesity is a lifestyle that leads to energy imbalance between calories consumed and calories expended (6). For example, consuming energy-dense foods, which are high in fat and sugar, and performing low physical activity could lead to obesity. Studies conducted in different regions of Saudi Arabia found a trend among adolescents of skipping breakfast and consuming more foods high in sugar and fat rather than fiber and nutrient-dense foods such as fruits and vegetables (7–12). In Riyadh (Central Region) a study showed that the mean frequency intake

per week of fruits and vegetables among adolescents aged 14–19 were 2.82 and 3.79 respectively (8). In addition, the mean frequency intake per week of sugar-sweetened drinks and sweets were 4.74 and 3.62 (9).

Moreover, according to WHO (2015), the high availability and accessibility of energy-dense foods with lack of supportive policies increase the consumption of these foods (10). In Saudi Arabia, the Ministry of Education (MoE) established the “Regulations of Health Conditions for School Canteens” in 2004 and updated the regulations in 2013 (11). This policy falls under the responsibilities of the General Administration of School Health (12). One of the five chapters is concerned with food offered in school canteens (13) and contains a list of banned food items, namely: confectioneries, chocolates, chips, soda, sport drinks, sweetened beverages, all meat products, and fried foods (14). We are not aware of other studies examining the effectiveness of the Saudi policy regarding this chapter on students’ weight and eating habits. It is believed that a lack of detail concerning the nutritional content of food that should be offered as detailed by the Saudi canteen policy could allow offering food that is high in fat and sugar.

Having school nutrition policies that help increase the availability and accessibility of healthy foods is required. These policies could help in creating healthy school environments by providing healthy food choices. In the United States, several studies demonstrated the importance of a school nutrition policy that decreases the availability of energy-dense foods and increases the availability of healthy foods (13–17). The Institute of Medicine (IOM) school nutrition standards were used in this study since they offer recommendations for increasing the availability of nutritious foods and decreasing the availability of energy-dense foods in the United States (18). A review article that collected data from the Centers for Disease Control and Prevention (CDC) showed that schools in US states with policies more closely aligned with the IOM standards had low availability of the following foods: chocolate, candy, soda, sports drinks, and caffeinated foods or beverages (19).

The purpose of this study is threefold: first, to investigate the compliance of randomly selected boys’ public high schools with the Saudi policy chapter “Meals and beverages offered in school canteens”; second, to assess the nutritional content of food offered as breakfast in Saudi boys’ public high schools based on IOM school nutrition standards; and third, to determine the differences between schools’ alignment scores and their location and report if they are adopting the Saudi policy.

Methods

Sample and procedures

In this study, 76 public high schools were randomly and evenly selected from four areas in

Riyadh (19 north, 19 south, 19 east, and 19 west). In each area, simple randomization methods were used in the selection of the 19 schools to avoid sampling and non-coverage errors. This study included only boys' public high schools in Riyadh, Saudi Arabia. The sample size was measured with 95% confidence level and with ± 5% margin of error. According to the Saudi Central Department of Statistics and Information (CDSI) (2015), there are 120 boys' public high schools in Riyadh city (20). Our sample size represents 63.3% of the total population.

Two research assistants were trained by principle investigators on the protocol of data collection. Both the school principal or representative and canteen managers were interviewed to investigate the compliance of their school with the Saudi policy regarding "Meals and beverages offered in school canteens." Our observations were used to assess the type of foods offered in the selected boys' public high schools in Riyadh; this information was used to estimate nutritional content of the foods such as calories, fat, saturated fat, trans-fat, sugar, sodium, and caffeine by using IOM school nutrition standards (18,21).

Measurements

The following scoring system was used: 0 indicated that the school did not meet the standards' requirement, and 1 indicated that it did meet the requirement. Schools were categorized into quartiles based on their compliance with the Saudi policy. The banned food list consists of eight items: confectioneries, chocolates, chips, soft drinks, energy drinks, sweetened drinks, meat products, and fried foods (8). The possible total scores ranged from 0 to 8, with 0 representing a low compliance score and 8 representing a high compliance score. The total possible scoring range in each quartile was:

Quartile 1 (compliance score from 0 to 2), which is equivalent to 0–25.0%

Quartile 2 (compliance score from 3 to 4), which is equivalent to 25.1–50.0%

Quartile 3 (compliance score from 5 to 6), which is equivalent to 50.1–75.0%

Quartile 4 (compliance score from 7 to 8), which is equivalent to 75.1–100.0%

For assessing the nutritional compositions of food offered in the selected schools using IOM standards, the CDC's scoring system was used (18), which ranges from 0–2, with 0 indicating the food item did not meet the standards' requirement, 1 indicating that the food item partially met the standards' requirement, and 2 indicating that the food item met the standards' requirement. The IOM standards consist of 13 elements: four Standards for Nutritive Food Components, two Standards for Nonnutritive Food Components, five Standards for the School Day, and two Standards for the After-School Setting (21). Four IOM standards (marketing, allowing, and providing foods or beverages for high school students after school, and comparing à la carte entrée items with the National School Lunch Program [NSLP]), are not relevant to the Saudi school system and were excluded in our study. Breakfast and lunch meals are usually offered in US schools (22), whereas only breakfast is usually offered in Saudi schools (8,23). The nine selected relevant standards consist of 21 variables (18). The possible total scores ranged from 0 to 42, with 0 representing a low alignment score and 42 representing a high alignment score. The total possible scoring range in each quartile was:

Quartile 1 (alignment score from 0 to 10.5), which is equivalent to 0-25.0%

Quartile 2 (alignment score from 10.51 to 21), which is equivalent to 25.1-50.0%

Quartile 3 (alignment score from 21.01 to 31.5), which is equivalent to 50.1-75.0%

Quartile 4 (alignment score from 31.51 to 42), which is equivalent to 75.1-100.0%

The questionnaires for both the schools' principals and canteen managers were designed to measure the schools' compliance with the Saudi school nutrition policy regarding "Meals and beverages offered in school canteens." In these questionnaires, some questions were adopted from validated questionnaires used in a previous study (24). These questionnaires were validated by experts in nutrition, policy evaluation, research design, and statistics (consensual validity). In our study, observational notes and food check list were designed to assess the nutritional compositions of food offered in the selected schools. Food items offered in schools were analyzed based on the manufacturer food labels. Permission to conduct data from public Saudi schools was granted from the Saudi Ministry of Education (reference no. 3496858). The Human Research Protection Program (HRPP) at Texas Tech University ethically approved this study (registration no. 504382).

Data Analysis

Data were statistically analyzed by SPSS statistics 22 software. The homogeneity of the demographic data among schools' location (North, South, West, and East) was tested. The primary study goal was to measure the differences between schools' compliance and alignment scores among schools' area and the schools' principals report if they adopted the Saudi policy (adopting schools vs. non-adopting schools). A t-test was used to measure any significant difference between means of the two groups, while One Way ANOVA was used to test significant difference among means of more than two groups. The significance power and effect size of the difference between schools' compliance and alignment scores among schools' area were also measured. A chi-square test of independence was run to examine the relation between schools' locations and their alignment score categories for each of the IOM standards. Differences were considered statistically significant when P

Results

A total of 152 participants were interviewed from 76 boys' public high schools; half of those were school principals and half were canteen managers. Most school principals ranged in age from 30 to 40 years (42.1%) or from 41 to 50 (51.4%). A bachelor's degree was the highest educational level for slightly more than three quarters (78.9%) of the school principals. 21.1% of the school principals had ≥ 5 years' experience of working as principals, 46.1% of them had between 5 to 10 years' experience, and 23.7% of them had between 11 to 15 years' experience. Younger school principals were more likely to be in the Northern and Southern regions of Riyadh χ^2 (15, N = 76) = 23.801, P Table 1.

For the Saudi school nutrition policy, 44.7% (25) of the schools scored in category 2, 50% (38) of the schools scored in category 3, and 5.3% (4) of the schools scored in category 4. There is no significant correlation between the schools' compliance with the Saudi policy regarding "Meals and beverages offered in school canteens" and demographical variables. There were no significant differences between schools' locations and schools' compliance scores with the Saudi policy regarding the banned foods list, F (3, 72) = 1.296, P = 0.282. There was no statistically significant difference between adopting schools (5.25 ± 1.42) and non-adopting schools (4.67 ± 1.11) in regards to their compliance scores with banned foods list in the Saudi policy, t(74) = 1.578, P = 0.119. This result was reported from t test with assumed equal variance, Levene's F (1, 74) = 0.941, P = 0.335.

For the IOM standards, 96.1% (73) of the schools scored in category 1, and 3.9% (3) of the schools scored in category 2. There is no significant correlation between the alignment scores to the IOM standards and the demographical variables. There were significant differences between schools' locations and schools' alignment scores to the IOM school nutrition standards, F (3, 39.555) = 4.245, P = 0.011 (see Table 2). This significant result was reported from Welch test because of unequal variances, Levene's F (3, 72) = 4.209, P = 0.008. According to the Tukey post hoc test, schools located in the East of Riyadh had significantly higher alignment

scores to the IOM standards compared to schools located north of Riyadh (1 ± .363 scores, P = 0.036) and schools located south of Riyadh (1 ± .363 scores, P = 0.036). Schools in the east of Riyadh were more diligent in prohibiting carbonated, fortified, and flavoured waters, χ^2 (3, N = 76) = 12.179, P Table 3). There was no statistically significant difference between adopting schools (8.75 ± 1.21) and non-adopting schools (9.06 ± 1.18) with regards to their alignment scores to IOM school nutrition standards, t(74) = -0.838, P = 0.405. This result was reported from t test with assumed equal variance, Levene's F(1, 74) = 0.312, P = 0.578.

The significance power of Welch test was calculated based on the sample size in each group and their effect sizes. The effect sizes were measured based on the means and standard deviation differences between the groups according to school locations. The effect size (Cohen's d) of schools located east of Riyadh compared to schools located north of Riyadh was 1.0115. This effect size and sample size, equal to 19 in each group, yield power equal to 0.86, which is acceptably high. In addition, the effect size (Cohen's d) of schools located east of Riyadh compared to schools located south of Riyadh was 0.825. This effect size and sample size, equal to 19 in each group, yield power equal to 0.697, which is also acceptably high. Moreover, the normality of the schools' alignment scores to IOM standards was statistically tested by Shapiro-Wilk test. The results showed that the schools alignment scores to IOM standards were significantly normal, W(76) = .873, P = 0.000.

Concerning food offered in schools, all 76 schools offered prepackaged food, namely: cheese puffs, apple puffs, plain croissant, cheese croissant, and zaatar croissant (roasted thyme with sesame seeds). These prepacked foods contain more energy, fat, and saturated fat than what is recommended by IOM standards (see Table 4). Compared to a sample of commonly banned foods in the Saudi policy, these prepacked foods provide similar total calories and percentage of total calories from fat per portion as packaged (see Table 5). This comparison did not look at other nutrients.

Eleven schools indicated that they prepared fried foods such as fried potatoes and while two schools reported preparing 100% fresh fruit juices. Three of the 76 schools had vending machines that carried some or all of the following: bottled plain water, whole fat milk, flavoured whole fat milk, artificially flavoured drinks, chips, candies, prepackaged cakes, and chocolate bars. Although bottled water was available for sale in all schools, 63 schools had working water fountains. Cakes and muffins were available in 75 schools, confectionaries were available in 73 schools, and biscuits and cookies were available in 71 schools. Chips were available in 40 schools, which is slightly above half of the selected schools. None of the 76 schools carried fruits or vegetables.

Discussion

The results showed that the compliance score of most of the selected schools in Riyadh (94.7%) with the requirements of the Saudi policy regarding “Meals and beverages offered in school canteens” ranged from 25% to 75%. These results indicated moderate compliance of boys’ public high schools in Riyadh to the Saudi policy. Although no percentage was reported, a similar trend was found in the Gulf region. According to the World Cancer Research Fund (2015), the compliance of Kuwaiti public schools with banned foods monitored by the Kuwaiti Ministry of Education was not high (26).

The results also showed that the alignment of the majority of the selected schools in Riyadh (96.1%) met