Youth receiving orthodontic care are not immune to poor diet and overweight: a call for dental providers to participate in prevention efforts

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Abstract

Objectives: While obesity is common in the US, disparities exist. Orthodontic samples are assumed to be more affluent than the general population and not in need of assistance in developing or maintaining healthy lifestyles. This paper evaluates the need of the orthodontic population for intervention by examining diet and weight status of an orthodontic patient sample and describes a role for dental clinicians in obesity prevention efforts.

Methods: 552 patients age 8-14 years, 54% female, 51% non-Hispanic white, 26% Hispanic were recruited from orthodontic practices in Southern California to participate in a randomized controlled trial of clinician-delivered health promotion. Height, weight, demographics, and diet were recorded. Chi-Square analyses were used to test for differences at baseline by gender, age, ethnicity, and income.

Results: 13% of the sample was overweight and 9% was obese. Males had a higher rate of obesity than females. Lower income youth had a higher rate than higher income youth. Hispanic youth had a higher rate than non-Hispanic white youth. Failure to meet national dietary guidelines was common, differing significantly by demographic group.

Conclusions: Within a sample not typically thought of as needing assistance, nearly 25% were overweight or obese and the majority failed to meet dietary recommendations. While most patients could benefit from intervention, male, Hispanic, and lower income groups were in greatest need of assistance. Dental providers, who see youth frequently and already discuss nutrition in the context of oral health, have the opportunity to contribute to obesity prevention.

Background

Between the 1970s and 2012, obesity rates increased from 4% to 18% among children ages 6-11 years and from 6% to 21% among adolescents ages 12-19 years [1,2]. Although some evidence suggests that obesity levels may be plateauing or improving among subsets of the US population, [2] obesity continues to be a major health concern, contributing to increased morbidity, premature mortality, and economic costs, and to decreased quality of life [3]. Obese children are at greater risk of hypertension, dyslipidemia, impaired glucose tolerance, insulin-resistance, type-2 diabetes, sleep apnea and asthma [3]. Childhood obesity increases the risk of obesity in adulthood [3] and is associated with reduced life expectancy [4].

While in the US obesity is now common across race, gender, socioeconomic status (SES), and age, disparities exist. In 2011-2012, non-Hispanic white youth had a higher rate of obesity than non-
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Diet is an important contributor to weight. The Department of Health and Human Services’ and US Department of Agriculture’s Dietary Guidelines recommend caloric balance, consuming nutrient-dense foods and beverages such as vegetables, fruits, whole grains, and low-fat or non-fat milk, and limiting sodium, solid fats, added sugars, and refined grains that contribute too many calories of little nutrient value [9]. Few individuals meet dietary guidelines [9,10]. Excess caloric consumption, [11] sugar-sweetened beverages (SSBs), [12] and fast food intake [13] have been linked to increased obesity. Greater consumption of high fiber foods, fruits and vegetables have been linked to reduced obesity [9]. Disparities in the consumption of foods and beverages have been found among racial/ethnic and SES groups [14]. In general, lower income individuals and non-Hispanic black individuals have poorer dietary intake [14].

Clinician promotion of health behaviors can contribute importantly to reversing obesity trends and improving patient diets. Physician-based interventions can improve physical activity (PA), sedentary activity, and nutrition behaviors, and can result in weight loss and reduced waist circumference [15-17]. A tobacco prevention study with orthodontist-delivered health messages reduced tobacco use [18]. Orthodontic and pediatric dental providers are ideal clinicians to target health behaviors of children and adolescents due to the proportion of patients who are youth [19] and the frequency with which patients are seen [20]. While healthy children might see a physician annually, they might see a pediatric dentist two or more times a year or an orthodontist six or more times a year, offering repeated opportunities for prevention efforts. Nutrition advice in the context of oral health and care for orthodontic appliances is often already provided and aligns with nutrition advice for optimal total body health [20-22]. The addition of general nutrition advice is encouraged by the American Academy of Pediatric Dentistry and the American Dental Association [21,23].

As the cost of orthodontic treatment is frequently paid out-of-pocket, with little insurance coverage for the majority of patients, [19] the inability of some individuals to pay raises the concern that the orthodontic population may have higher incomes than the general population, and do not represent a group in need of assistance. This paper questions this argument by examining weight status and dietary behaviors of an orthodontic patient sample.

Methods

Healthy Smiles: An Orthodontist Program, is an NIH-funded, randomized, controlled trial for 8-16 year old orthodontic patients. Orthodontic practices in San Diego, Orange and Riverside Counties in Southern California, US or in Baja California, Mexico were recruited to deliver either a physical activity and nutrition program or a tobacco use prevention program to their patients. This report uses baseline data solely from patients in US offices, who were 8-14 years old at recruitment. All study procedures were approved by the San Diego State University Institutional Review Board.

Geographically eligible orthodontists were identified from the American Association of Orthodontist membership listing and online searches. About 7% (n=24) of identified offices participated in the study. Reasons for not participating included unsuccessful contact; ineligibility due to retirement, practicing too few days a week or belonging to a shared practice; and refusals. Participating offices notified patients of the research study by letter. Patients allowing contact by the study were screened for study inclusion, and were excluded if they were not 8-14 years old, had less than 1 year remaining in treatment, had plans to move within a year, were unable to care for themselves, had been diagnosed with an eating disorder or severe depression, had been prohibited by a physician from engaging in regular PA, or participated in organized sports or PA 3 or more times per week for 9 or more months of the past year. Of 2,761 US families contacted, 1,913 (69%) were screened, 835 (30%) qualified, and 552 (20%) completed the study consent process and enrolled between 2010 and 2013.

Upon parent and child consent, research staff measured participants’ weight and height. The child’s parent/guardian completed a self-administered questionnaire of demographics. The child completed a self-administered 7-day dietary recall. Additional prior day dietary recalls were collected via computer-assisted telephone interviews. Only the first day of recalls at baseline was included in this analysis, guided by California Health Interview Survey (CHIS) methodology [24].

Demographic group comparisons were made between: females versus males; youth ages 8-11 years (children) versus 12-14 years (adolescents); non-Hispanic white versus Hispanic youth; and youth of lower versus higher income. Ethnic comparisons were made only between non-Hispanic white and Hispanic youth, since the small sample sizes for other groups afforded insufficient statistical power. Participants of other races/ethnicities were included in all other analyses. Family income was measured as less than $20,000 a year, $20,000-$69,999, $70,000-$134,999, and over $135,000. For these analyses, families with income less than $70,000 a year are described as lower income.

Weight and height were measured using a digital scale and portable stadiometer until 2 consecutive measures were within 0.1 kilograms and 0.5 centimeters of each other to improve reliability. The 2 weight and 2 height measures were averaged for Body Mass Index (BMI) computation. BMI was calculated and age and gender-specific percentiles determined. Participants were then assigned a weight category (obese, overweight, normal weight, underweight) as defined by the Centers for Disease Control and Prevention [25].

Dietary questions for the prior day and 7-day dietary recalls were taken from the 2005 and 2007 CHIS and assessed fruit, vegetable, milk, soda or other SSBs, and sweets consumption on the prior day, and fast food consumption during the prior week [24]. Prior day questions were formatted as: “Yesterday, how many servings (glasses/
cartons/cans) of _____ did you eat (drink)?” Per CHIS methodology, interviewers described a serving as “whatever it means to you.” Fast food consumption was assessed by: “Last week, how many times did you eat fast food?” Children reported their own intake with parent/guardian confirmation of servings eaten. Variables were dichotomized according to dietary guidelines and publicly available CHIS summaries and also to constrain skewness [24].

Analyses were performed using SPSS version 22 (IBM, Inc, Armonk, NY). Chi-Square tests were used to test for statistical differences in weight categorizations and diet among demographic groups. Logistic regression was used to test independent effect of predictors of weight status.

Results

Mean age was 12.0 years (SD 1.7) and 44% of participants were classified as ‘children’. Fifty-four percent were female. Fifty-one percent were non-Hispanic white, 26% Hispanic, 7% Asian/Pacific Islander, 2% Black or African American, 7% multi-racial, 3% reported being non-Hispanic white without reporting ethnicity, and 4% were of unknown race or ethnicity. The family income distribution was 5% earning less than $20,000 a year, 25% between $20,000 and $69,999, 47% between $70,000 and $134,999, and 24% over $135,000.

About 13% of the sample was overweight and 9% was obese, for a total of 22% who were either overweight or obese. Table 1 shows that in the full, lower income, and child samples males had significantly higher rates of obesity than females (<p>.05). Hispanic males were more overweight/obese compared with Hispanic females (<p>.05). Lower income youth (both genders combined and males alone) had a higher rate of obesity and overweight/obesity than higher income youth (<p>.05). Hispanic youth (both genders combined and males alone) had a higher rate of obesity and overweight/obesity than non-Hispanic white youth (<p>.05).

Figure 1 illustrates weight status by four race/ethnicity-income combinations. Figure 1 shows that obesity rates for the lower income group were nearly double the higher income group rates, for both non-Hispanic white (12% vs. 7%, respectively), and Hispanic participants (22% vs. 12%). Obesity rates for Hispanic participants were nearly double the non-Hispanic white participant rate, for both low-income (22% vs. 12%, respectively) and high-income participants (12% vs. 7%). The graph in Figure 1 shows similar relationships, though a bit less pronounced, for overweight/obese status.

Table 1. Weight status by income, age and ethnicity; and by gender within those categories.

| Sample Size | Obese | Overweight or Obese | Overweight or obese, 95% Confidence Intervals | Obese, 95% Confidence Intervals |
|-------------|-------|---------------------|-----------------------------------------------|---------------------------------|
|             | %     |                     |                                               |                                 |
| Full Sample | n=551 | 9.1                 | 7.0-11.8                                       | 21.6                            | 18.4-25.2 |
| Male        | n=252 | 12.3*               | 8.8-16.9                                       | 25.0                            | 20.1-30.7 |
| Female      | n=299 | 6.4                 | 4.1-9.7                                        | 18.7                            | 14.7-23.5 |
| Higher Income | n=526 | 6.7                 | 4.5-10.0                                       | 18.7                            | 14.9-23.3 |
| Male        | n=145 | 9.0                 | 5.3-14.7                                       | 21.4                            | 15.5-28.8 |
| Female      | n=181 | 5.0                 | 2.6-9.2                                        | 16.6                            | 11.9-22.7 |
| Lower Income | n=137 | 14.6**              | 9.7-21.5                                       | 28.5**                          | 21.6-36.5 |
| Male        | n=64  | 21.9††              | 13.5-33.4                                      | 35.9††                          | 25.3-48.2 |
| Female      | n=73  | 8.2                 | 3.8-16.8                                       | 21.9                            | 14.0-32.7 |
| Child 8-11  | n=240 | 10.8                | 7.5-15.4                                       | 20.8                            | 16.2-26.4 |
| Male        | n=117 | 14.5*               | 9.3-22.0                                       | 23.1                            | 16.4-31.5 |
| Female      | n=123 | 7.3                 | 3.9-13.3                                       | 18.7                            | 12.8-26.5 |
| Adolescent 12-14 | n=311 | 7.7                | 5.2-11.2                                       | 22.2                            | 17.9-27.1 |
| Male        | n=135 | 10.4                | 6.3-16.7                                       | 26.7                            | 19.9-34.7 |
| Female      | n=176 | 5.7                 | 3.1-10.1                                       | 18.8                            | 13.7-25.2 |
| Non-Hispanic white | n=282 | 7.8         | 5.2-11.5                                       | 19.1                            | 15.0-24.1 |
| Male        | n=140 | 10.0                | 6.1-16.1                                       | 20.0                            | 14.2-27.4 |
| Female      | n=142 | 5.6                 | 2.9-10.7                                       | 18.3                            | 12.8-25.5 |
| Hispanic | n=142 | 16.2**              | 11.0-23.1                                      | 31.8**                          | 24.0-39.0 |
| Male        | n=67  | 22.4                | 14.1-33.7                                      | 41.8**                          | 30.7-53.7 |
| Female      | n=75  | 10.7                | 5.5-19.7                                       | 21.3                            | 13.6-31.9 |

*Indicates significant difference between genders, p<0.05
**Indicates significant difference between demographic groups, p<0.05
† Indicates significant difference between demographic groups, separately by gender, p<0.05

Given that lower income was moderately correlated with Hispanic race/ethnicity (r=.324, p<0.001), we used logistic regression to investigate whether the effects of race/ethnicity and income on weight were independent. A model was run with weight status as the dependent variable and with race/ethnicity and income as predictors, and then run again adding their interaction term. Race/ethnicity and income demonstrated near-significant (p=.067 and .054, respectively) independent contributions to obesity, while for overweight/obese, race/ethnicity (p=.016) emerged as a significant predictor, controlling for income (p=.125). Being Hispanic increased the odds of overweight/obesity nearly twofold (odds ratio=1.92; 95% CI=1.13, 3.25). There was no significant race/ethnicity-income interaction for either measure of weight status.

Dietary intake at baseline is presented in Table 2 and 3. There were significant gender differences for consumption of sweets, SSBs and milk. A larger proportion of females consumed more than 1 serving of sweets per day compared to males among the non-Hispanic white sample (<p>.05). A larger proportion of males drank more than 1 SSB per day than females among the full and higher income samples (<p>.05), a trend that repeated across all demographic groups except the lower income sample. A larger proportion of males drank 2 or more glasses of milk per day than females among the full, higher income and non-Hispanic white samples (<p>.05). There were no significant differences between genders in consumption of fruits and vegetables, fruits only, or fast food.

A larger proportion of children drank 2 or more glasses of milk per day compared to adolescents (<p>.05). When analyzing genders separately, a larger proportion of male children drank 2 or more glasses of milk per day compared to adolescent males and a smaller proportion
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ate fast food more than once per week (p<.05). A larger proportion of lower income youth drank more than 1 SSB per day than higher income youth and a smaller proportion consumed 2 or more servings of fruit per day (p<.05). When analyzing genders separately, a smaller proportion of lower income males consumed 2 or more servings of fruit per day compared to higher income males and a smaller proportion of...
lower income females drank more than 1 SSB per day compared to higher income females (p<.05). No other food or drink categories differed significantly between demographic groups.

Discussion

Although a larger proportion of the orthodontic sample were of a healthier weight status than US youth, almost a quarter were overweight or obese, putting them at increased risk of adult excess weight, morbidity and premature mortality, and indicating a need for intervention. Mirroring patterns across the state and nation, male, Hispanic, and low-income patients had higher rates of obesity. Moreover, our results suggest that even among child orthodontic patients—a group perceived as generally more privileged than average—disparities in risk of excess weight may persist for Hispanics and those of lower income.

Of the food categories evaluated, fruit and vegetable consumption was furthest from intake recommendations, indicating a specific dietary target for future interventions. A larger proportion consumed adequate fruits compared to fruits and vegetables combined, but still fell short of recommendations. Results also indicated fast food as a possible target of intervention. Fast food consumption has previously been linked to obesity [9,13]. Few youth consumed excess SSBs; however, 42% drank at least 1 SSB per day, similar to what has been reported in the literature. As SSBs have been linked to both obesity [9,12] and oral health, a better target might be only occasional consumption. A larger proportion of youth consumed sweets (such as cookies and candies) than SSBs. A small amount of “discretionary calories” are allowed per dietary guidelines, [9] and consumption of 1 small SSB or sweet might fall within those guidelines. However, youth must be cautious not to over-consume discretionary calories, a tendency that has been indicated in the literature, [9] making added sugars another target of intervention among orthodontic patients.

While few differences in dietary intake between demographic groups reached significance, the differences that did reach significance were in the expected direction and are supported by the literature among non-orthodontic samples. No ethnic dietary differences reached significance, due to smaller sample sizes when categorized by race/ethnicity. Results suggest that lower income youth would benefit from dietary intervention, and that adolescents may be more in need of intervention than younger children. These results also suggest that both genders would benefit from intervention, possibly with emphasis on different aspects of nutrition. The low consumption of milk by both genders raises concerns about adequate calcium consumption, needed during this critical period of bone and tooth development [27,28]. Calcium was likely consumed through other sources not assessed, but adequacy remains a concern as milk is one of the primary sources of calcium intake in children [29].

Ecological models of behavior suggest that intervention is needed at multiple levels to impact health behaviors and outcomes. Ideally, youth would hear health messages repeated at home, school, and in the community, and these messages would be supported by local, state, and federal policies. Supportive health messages and policies from multiple sources are required to counter negative influences from industries supporting sedentary behaviors and unhealthful eating. Clinicians have the opportunity to contribute to this health model at the community level. If health care professionals of all types repeated the same health messages, youth might hear the messages multiple times each year, from physicians, dentists, and other clinicians. For youth receiving orthodontic treatment, frequency of health messages could reach 10 or more repetitions a year, creating a supportive social environment for health. A past tobacco prevention trial, [18] where orthodontists delivered brief prevention messages to their patients, demonstrated a dose effect, supporting the notion that brief, frequent intervention can be an effective health promotion tool and that collectively, clinicians have the opportunity to improve patient risk profile and contribute to chronic disease prevention.

At baseline, all participants were undergoing orthodontic care. The diets of our orthodontic sample may not typify diets of the larger population. Dental appliances make consumption of hard, sticky, or chewy foods ill-advisable, and could partially explain the low consumption of fruits and vegetables. Our data include a relatively small group of the age cohort, but orthodontists represent a category of clinicians ideally suited to contribute to the obesity problem. The orthodontic sample was less ethnically/racially diverse and more affluent than the Californian population, so results may not be generalizable to the community population, but presumably are generalizable to the orthodontic population. Still, 22% of the sample was overweight or obese, and few consumed the recommended diet, suggesting, as the literature does, that the problems of obesity and poor nutrient intake span income and racial/ethnic categories.

Our adoption of the CHIS definition of a serving as “whatever it means to you” may have inconsistently classified participants into categories; however, children are often unable to accurately quantify portion size when asked [30]. The assessment omitted caloric and macro/micro-nutrient intake, precluding evaluation of other nutritional issues such as overconsumption of nutrients. Nonetheless, cruder measures are better than unreliable ones.

Future studies describing the orthodontic, dental and other populations should include a larger study sample to reveal statistical differences where for this study only trends were apparent. Twenty-four hour dietary recalls would provide a better description of diet, including caloric intake, macro- and micro-nutrients.

Conclusions

Contrary to the assumption that the orthodontic population is not a group in need of assistance, the majority of orthodontic patients could benefit from intervention. Similar to trends seen within the general population, the male, Hispanic, and lower income groups could benefit the most. Orthodontic and other dental providers, who already discuss nutrition in the context of oral health, have the opportunity to improve patient risk profile and contribute to chronic disease prevention.

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