



Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.jfma-online.com



ORIGINAL ARTICLE

Bite-force difference among obese adolescents in central Taiwan



Kuo-Ting Sun ^{a,b,c,h}, Shih-Chueh Chen ^d, Yu-Fen Li ^{e,h},
Hsien-Hsiung Chiang ^b, Hung-Huey Tsai ^f, Chi-Yuan Li ^{a,g,*},
Ming-Gen Tu ^{c,*}

^a Graduate Institute of Clinical Medical Science, China Medical University, Taichung, Taiwan

^b Department of Pediatric Dentistry, China Medical University Hospital, Taichung, Taiwan

^c School of Dentistry, China Medical University, Taichung, Taiwan

^d Department of Endocrinology, Cheng Ching Hospital, Taichung, Taiwan

^e Institute of Biostatistics, China Medical University, Taichung, Taiwan

^f Department of Oral Hygiene, Taipei Medical University, Taipei, Taiwan

^g Department of Anesthesiology, China Medical University Hospital, Taichung, Taiwan

Received 23 April 2015; received in revised form 9 May 2015; accepted 12 May 2015

KEYWORDS

adolescence;
bite force;
body mass index;
obesity;
testosterone

Background/Purpose: Maximal bite force of the jaw can cause thorough food chewing and result in good digestion. Bite force is related to the health of the masticatory muscles. Muscle force is frequently affected by obesity in adolescence, however, little is known about how obesity influences the maximum bite force and the difference between genders.

Methods: Five hundred and seventy-seven adolescent students (292 girls and 285 boys), aged 13–16 years, from central Taiwan were recruited for a cross-sectional study in 2009. The maximum bite force, hand strength, triceps skin-fold fat thickness, serum level of testosterone, and body mass index (BMI) were measured. Dental health was evaluated based on malocclusion and dental caries.

Results: Bite force in girls was highest in the obese group (32.49 ± 19.13 kg, mean $\pm$ standard deviation), whereas in boys it was higher in the overweight group (41.89 ± 19.3 kg) than in the obese group (33.21 ± 17.12 kg). The prevalence of obesity was twofold higher in boys (14.39%) than in girls (7.88%). The mean serum level of testosterone increased with BMI in girls ($p = 0.0172$), whereas it decreased with BMI in boys ($p = 0.0014$). The relationships of serum testosterone level and bite force with BMI were similar in the two gender groups.

Conflicts of interest: The authors have no conflicts of interest relevant to this article.

* Corresponding authors. School of Dentistry and Graduate Institute of Clinical Medical Science, China Medical University, Number 91, Hsueh Shih Road, Taichung, Taiwan.

E-mail addresses: cyl168@gmail.com (C.-Y. Li), mgtu@mail.cmu.edu.tw (M.-G. Tu).

^h Kuo-Ting Sun and Yu-Fen Li's contributed equally to this work.

<http://dx.doi.org/10.1016/j.jfma.2015.05.007>

0929-6646/Copyright © 2015, Formosan Medical Association. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Conclusion: The maximum bite force decreased in obese boys but increased in obese girls, which may be due to the sensitivity to testosterone being modulated by the fat level.

Copyright © 2015, Formosan Medical Association. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Bite force is an indicator of the functional state of the masticatory system,¹ because it strongly influences masticatory performance and dietary selection.^{2,3} Determinants of the maximum bite force include age, gender,² body size, craniofacial morphology,^{4,5} the number of functional tooth units,² occlusion,⁶ and masseter muscle thickness.⁷ An impaired masticatory performance due to decreased bite force may result in unbalanced nutrition intake.

Childhood obesity has rapidly become a major public health problem in the United States,⁸ and the prevalence of being overweight in children across all ages, gender, racial groups, and geographic boundaries has increased significantly over the last 3 decades.⁹ The prevalence of obesity was 4.3% among adolescents aged 12–19 years from 1976 to 1980, which increased to 18.4% from 2009 to 2010 in the United States.¹⁰ Obese adolescents are more likely to become obese adults, and hence they have an increased risk of morbidity and mortality in adulthood.¹¹ Moreover, overweight and obese adolescents exhibit poorer performance in health-related physical fitness than normal-weight adolescents.¹²

Although many known factors can affect bite force, as summarized above, there are also unknown biological, behavioral, and social contributing factors.² A study which focused on older Japanese people revealed that being overweight was significantly associated with lower bite force,¹³ which indicated that bite force does not necessarily increase with body weight. Overweight and obese adolescents exhibit poorer performance in health-related physical fitness than normal-weight adolescents.¹² Previous studies have found that physical fitness is significantly and positively correlated with bite force.^{14,15} Because obese adolescents might have lower bite force, it is very important to understand how obesity influences the maximum bite force in this population. Moreover, the role gender difference plays in the association between obesity and bite force is less studied.

Our hypotheses include that obesity is associated with bite force, and this association is different in the two gender groups in adolescents. The purposes of this study were to: (1) confirm whether obesity influences bite force; (2) identify the mechanisms that might mediate this effect, and (3) most importantly, determine whether the mechanism differed between genders in adolescents.

Methods

Participants

The study was performed in the city of Taichung. Taichung is located in the middle part of Taiwan and is the largest

city in central Taiwan. According to the Ministry of the Interior, the demographic characteristics of Taichung were similar to those of Taiwan. We selected a public junior high school in North District of Taichung by purposive sampling, and students from different socioeconomic levels were chosen as a representative sample of general junior high school students. The subject numbers of this study were calculated according to Kamegai's and Tsai's studies.^{16,17} One half of the classes were randomly selected from the school for this cross-sectional study. As a result, 577 adolescents (292 girls and 285 boys, aged 13–16 years) were recruited from January 2009 to October 2009. The inclusion criteria were as follows: (1) understanding the study procedure; (2) providing consent to participate; (3) absence of systemic diseases; and (4) undergo various physical examinations/performance. The exclusion criteria included: (1) active orthodontic treatment; and (2) a high probability of dental damage when measuring the maximum bite force. The examination was performed in the auditorium of the school.

The Institutional Review Board of the China Medical University Hospital approved this study (approval no. DMR96-IRB-183), and written informed consent was obtained from each participant prior to his or her participation.

Anthropometric measurements

The collected anthropometric data included height, weight, and triceps skin-fold fat thickness. All measurements were made by well-trained examiners following standardized techniques using accurate equipment.

Height was measured using a stadiometer to the nearest 0.1 cm, and weight was measured using an electronic scale in kilograms. The triceps skin-fold fat thickness was used to estimate the total body fat, and was measured using Lange skin-fold calipers (Beta Technology Incorporated, Cambridge, MD, USA). Body mass index (BMI) is the most frequently used measure of obesity in children, and based on its values the children were categorized into underweight, normal weight, overweight, and obese groups, according to the cutoff values defined by the Department of Health, Taiwan. Body mass index categorization differed according to age and gender (Table 2).

Maximum bite force

Bite force was measured by a well-trained pediatric dentist using a portable GM10 occlusal force meter (Nagano Keiki, Tokyo, Japan). The sensor of the occlusal force meter was inserted into the first-molar area and the participant was requested to bite as hard as possible, with the measurement made on both sides. The sensor was protected with a

Download English Version:

<https://daneshyari.com/en/article/3478223>

Download Persian Version:

<https://daneshyari.com/article/3478223>

[Daneshyari.com](https://daneshyari.com)