SciForschen
Open HUB for Scientific Research

ISSN 2378-7090

International Journal of Dentistry and Oral Health

Research Article | Volume: 2.2 | Open Access

The Relationship between BMI-for-age (BMI-%) and dmft Index of 6-year-Old Children in Rafsanjan, Iran

Mostafa Sadeghi[1] and Michael W. Roberts[2]*

[1]*Department of Operative Dentistry, School of Dentistry, Rafsanjan University of Medical Sciences, Rafsanjan, Iran*

[2]*Department of Pediatric Dentistry, School of Dentistry, University of North Carolina, Chapel Hill, NC, USA*

***Corresponding author:** Michael W. Roberts, DDS, MScD, UNC School of Dentistry, Department of Pediatric Dentistry, 228 Brauer Hall, CB # 7450, Chapel Hill, NC 27599-7450, USA, Tel: (919)537-3781; Fax: (919)537-3950; **E-mail:** Mike_Roberts@unc.edu

Received date: 11 Dec 2015; **Accepted date:** 18 Jan 2016; **Published date:** 24 Jan 2016.

Citation: Sadeghi M, Roberts MW (2016) The Relationship between BMI-for-age (BMI-%) and dmft Index of 6-year-Old Children in Rafsanjan, Iran. Int J Dent Oral Health 2(2): doi http://dx.doi.org/10.16966/2378-7090.175

Abstract

Objectives: The purpose of this cross-sectional study was to determine whether there is a relationship between *dmft* (decayed, missing and filled primary teeth) index and Body Mass Index for age (BMI-%) in 6-year-old children.

Study design: A census sample of 2197 healthy children(51.1% boys/48.9% girls) aged 72-84 months with a mean age of 77.52 ± 3.49 months was included. The *dmft* index and BMI-%were obtained for each child.The data was analyzed by chi-square, Mann-Whitney, Kruskal-Wallis, Spearman's rho coefficient tests ($p \leq 0.05$).

Results: The mean and SD of BMI-% was 15.21 ± 2.08 with a distribution of underweight (18.0%), healthy weight (69.9%), overweight (5.9%) and obese were (6.2%) per Centers for Disease Control and Prevention guidelines. The mean and SD of *dmft* index was 6.27 ± 3.76; this variable according to BMI-%categories were 7.18 ± 3.81 (underweight), 6.30 ± 3.77 (healthy), 4.89 ± 3.28 (overweight) and 4.51 ± 3.01 (obese). There was a significant inverse relationship between BMI-% scores and *dmft* index and decayed teeth. There was also a positive relationship between BMI% scores and students that were caries free.

Conclusions: An inverse relationship between BMI-% and *dmft* index, and a positive relationship between BMI-% and being caries free was observed.

Keywords: *dmft* index; BMI-for-age; BMI percentile; Dental caries; Preschool children

Introduction

Obesity is a principle factor that increases the risk of some chronic and life threatening disorders [1,2]. Obesity in childhood is an increasing epidemic and represents one of the most serious public health concerns of the 21st century impacting on the physical and psychological health of children [3-12].

In 2013, it was estimated that 42 million children worldwide under the age of five years were overweight. Close to 31 million of these are living in developing countries [6]. Iran has experienced a rapid change in life style characterized by a decrease in physical activity and an increase in calorie intake leading to a rapid increase in overweight individuals since the 1990s [13,14].

Body Mass Index (BMI) is a universally accepted method and practical indicator to assess the body weight in adults [2]. In children and teenagers, with the age range of 2-20 years, BMI is combined with age and gender and expressed as a percentile (BMI-%). The age and gender specific BMI-%values are referred to as "BMI-for-age". According to the Centers for Disease Control and Prevention (CDC), BMI-%are categorized as: 1) underweight (less than 5th percentile), 2) healthy weight 5th percentile to less than 85th percentile), 3) overweight (85th percentile to less than 95th percentile and [4]) obese (95th percentile or greater) [6,9,12].

Dental caries is a multi-factorial and chronic disease [13]. Although its prevalence has been declining in many countries, it is still an important public health issue as developing countries are facing a transition in epidemiological diseases, and nutritional patterns [14]. A study showed that mean dmft index and caries free prevalence among 6-year-old students were 3.4 ± 2.7 and 16% in three Iranian communities [15].

Although a relationship between dental caries and excess weight is biologically plausible, the documentation of such a relationship, especially in 6-year-old children, is limited and controversial. A recent study in children 6 years of age reported that 9% of the children were underweight and 6% were obese and there was a significant association (P = 0.04) between BMI-for-age and dental caries [16].

Underweight children often have a disruption of intake and absorption of vital nutrients, and are at risk for infections due to a weak and easily compromised immune system [17,18]. Some studies found that underweight children had higher dmft/DMFT scores than overweight-obese children [19-21]. In contrast, other studies have indicated that obese children are more likely to have dental caries than underweight or health weight [22,23].

Children at the preschool-age (five years) are the index age group for the WHO in assessing dental caries in primary teeth [24]. However, in Iran, the optimum age for school entry is at six years of age; hence this age was used for our study. The aim of the present study was to determine the relationship between BMI-% and dmft index in an unselected sample of 6-years old children in Rafsanjan, Iran. The null hypothesis was that there is no relationship between BMI-% and prevalence of dental caries in the examined children.

Methods

This cross-sectional study was conducted on 2197 children ranging in age from 72 to 84 months with a variety of social backgrounds using a census sampling method. A required pre-school physical examination gathered individual and family demographics, vaccination status, weight and height measurements (BMI-%), growth monitoring, audiometry, optometry, oral and dental evaluation and fluoride exposure. The children suspected to have any illness were excluded from the present study.

All the healthy subjects identified in the screening program that were in the primary dentition were enrolled in this study. Approval was obtained from the ethical committee of Rafsanjan University of Medical Sciences (14 April 2015) and informed written consent was obtained from the parents of the participants. The age of the subjects was obtained from their date of birth records.

Diagnosis of dental caries was established according to the WHO methodology and criteria [24] and performed by two trained/calibrated final year dental students (kappa=0.92) using a non-invasive technique that was supervised by a specialist in operative dentistry. The children were seated in a chair and examined visually with optimal illumination, community periodontal index (CPI) probe, disposable dental mirror (Atlas Teb Co, Tehran, Iran) and tongue blade. Cotton rolls were used to remove any plaque or debris. Dental radiographs were not obtained.

The *deft* index was recorded for the primary dentition. Caries was recorded as being present when there was a lesion in a pit or fissure, or on a smooth tooth surface, had a detectably softened floor, undermined enamel, or softened wall. Restored teeth with recurrent caries and teeth filled with temporary materials were included in this category. White spots were not considered as being decayed. A tooth was recorded as missing if it had been extracted for caries. Teeth extracted or missing due to trauma or absent because of natural tooth exfoliation were not included into consideration in assessing the missing component. Teeth were recorded as filled when one or more permanent restorations were present and there was no remaining caries.

Children's weight and height were measured according to standard protocols. The bodyweight of each child was recorded to the nearest 0.1 kg using a standard digital scale (Seca Co, Hanover, Maryland, USA) with the subject barefoot and wearing light clothing. The scale's balance was calibrated at the beginning of each working day and at frequent intervals throughout the day. Body height was measured to the nearest 0.5 cm using a stadiometer (Seca Co) with subjects wearing no shoes, heels together and head touching the ruler with line of sight aligned horizontally. Body mass index percentile was determined according to Centers for Disease Control and Prevention (CDC) guidelines and assorted into underweight, healthy weight, overweight or obese [12].

Statistical evaluation of data was analyzed with SPSS-20 (SPSS Inc., Chicago, IL, USA) software. Normal distribution of all variables was not confirmed using the Kolmogorov-Smirnov test (p=0.001); therefore, the Kruskal-Wallis H test was used to detect the differences between the median of d, m and f components; dmft index and percentage of caries free with BMI-% scores; the Mann-Whitney U test was used to assess the median age, d, m and f compartments; dmft index and percentage of caries free by sex. The chi-square test was used to determine the difference between BMI-% groups by sex and Spearman's rho correlation coefficient was used to evaluate the relationships between independent variable (BMI-%) and dependent variables (dmft index and percentage of caries free subjects). P value < 0.05 was considered statistically significant.

Results

In this study, there was no significant difference in the number of boys and girls (p=0.296). The boys were significantly older (p=0.017) and heavier (p=0.016). The BMI-% distribution can be seen in table 1. The chi-square test showed that the frequency of underweight subjects was significantly higher among boys as compared to girls (P=0.005).

Table 2 shows the mean and standard deviation (SD) of dmft index and its components and percentage of caries free according to sex. The mean and SD of dmft index and its components and percentage of caries free according to BMI-% groups are presented in table 3. The Kruskal-Wallis H test demonstrated that these variables had significant differences within all BMI-%. Figure 1 demonstrates the percentage of caries free children in BMI-% groups. A statistically significant inverse relationship between BMI-% scores and dmft index was noted (p=0.001). There was also a significant positive relationship between BMI-% scores and percentage of caries free (rs=0.063; p=0.003). A significant inverse relationship between BMI-% scores and dmft index and decayed teeth was observed in this study (p=0.001) (Figure 2).

Discussion

The present study evaluated the relationship between BMI-% and dmft index in 6-old-year students entering the first grade. Sampling bias was minimized and the results are more reliable because children in a single age (6-year-old) were selected by a census sampling method.

Childhood dental caries and childhood underweight/obesity are multi-factorial with predisposing genetic and environmental components. Dental caries is an infectious disease and underweight/obesity results from an imbalance between diet calorie intake and the body energy requirements and have significant adverse implications for health [25]. The relationship between weight and dental caries in children is complex and has been investigated with contradicting results [26,27]. Our findings are in agreement with some previous studies that were done on primary (deciduous) teeth [19,28-32]. A literature review did not reveal sufficient evidence regarding the association between obesity and dental caries [33]. However, some previous studies supported a significant relationship between childhood obesity and dental caries. However, some researchers have reported a direct significant relationship between BMI and dmft index [34-38].

Underweight children may be more susceptible to infectious diseases such as dental caries due to a compromised immune system. Dental caries can cause tooth pain and difficulty during mastication [39], thus these children often favor soft foods. This may help explain why children with low body weight may be at a higher risk of developing dental caries [19,40]. Dental treatment of underweight children can improve the growth indicators [41]. Theoretically, there is a putative relationship between excess weight and dental caries. However, many risk factors including diet, genetics, psychological and behavioral factors, and parental weight and dental status, and oral hygiene practices contribute to childhood obesity and dental caries [2,34,39,42]. Further studies are needed to investigate the unique role of these factors. In our study, the prevalence of healthy weight children was highest (69.9%), followed by underweight (18%) and then overweight/obese (12.1%). This is in line with a national survey and

Sex/BMI-%	Underweight n (%)	Healthy weight n (%)	Overweight n (%)	Obese n (%)
Boys 1123 (51.1%)	226 (20.1)	751 (66.9)	74 (6.6)	72 (6.4)
Girls 1074 (48.9%)	170 (15.8)	758 (73.1)	55 (5.1)	64 (6.0)
Total 2197 (100)	396 (18.0)	1536 (69.9)	129 (5.9)	136 (6.2)
chi square test	0.005	0.386	0.094	0.493

Table 1: Distribution of BMI-% groups according to sex among 6-year old children.

Sex/Index	*d*	*m*	*f*	*dmft* Index	Caries Free n (%)
Boys	5.54 ± 3.68	0.36 ± 0.92	0.40 ± 1.10	6.30 ± 3.78	73 (6.5)
Girls	5.56 ± 3.72	0.25 ± 0.70	0.42 ± 1.11	6.24 ± 3.75	60 (5.6)
Total	5.55 ± 3.70	0.31 ± 0.82	0.41 ± 1.10	6.27 ± 3.76	133 (6.1)
Mann-Whitney U test	0.964	0.019	0.463	0.595	0.369†

Table 2: Mean ±SD of d, m and f components, dmft index; and percentage of caries free children among 6-year-old children according to sex.
† chi square test

BMI-%/Index	*d*	*m*	*f*	*dmft* Index	Caries Free n (%)
Underweight	6.66 ± 3.72	0.22 ± 0.82	0.30 ± 0.92	7.18 ± 3.81	17 (4.3)
Healthy weight	5.55 ± 3.72	0.33 ± 0.82	0.42 ± 1.12	6.30 ± 3.77	94 (6.1)
Overweight	3.98 ± 2.76	0.38 ± 1.02	0.53 ± 1.26	4.89 ± 3.28	13 (10.1)
Obese	3.76 ± 2.93	0.26 ± 0.62	0.49 ± 1.19	4.51 ± 3.01	9 (6.6)
Kruskal-Wallis H test	0.001	0.016	0.050	0.001	0.116†

Table 3: Mean ± SD of d, m and f components; and dmft index and percentage of caries free children according to BMI-% among 6-year old children.
† chi square test

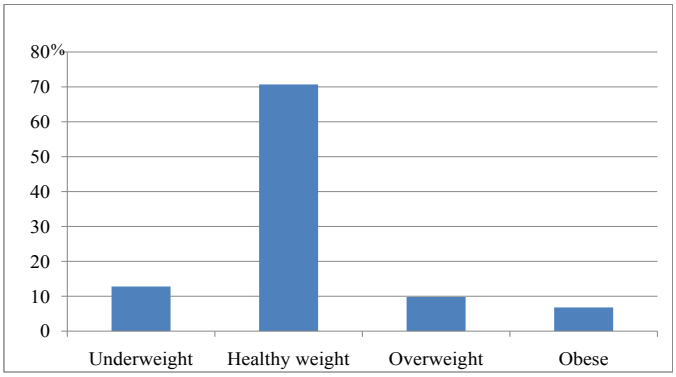

Figure 1: Percentage of caries free individuals according to BMI-% categories among 6-year old children.

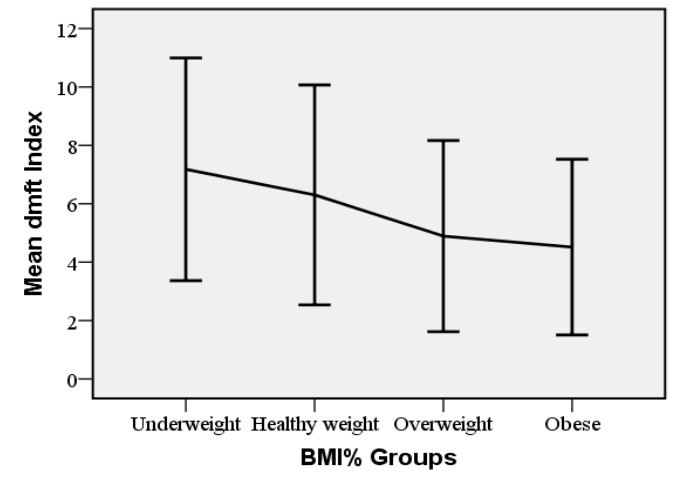

Figure 2: Distribution of dmft index according to BMI-% among 6-year old children.

cross sectional study [22,25].

The mean dmft score of the study population was 6.27 ± 3.76. The biggest portion of the dmft index was decayed (88.6%), while the least was missing teeth (4.9%). These components were only significantly higher in boys (p=0.019). Another nationwide survey on 8725 6-year-olds in Iran showed that the mean dmft index was 5.0 (d, m and f were 4.4, 0.4 and 0.2, respectively and girls had a significantly lower (4.6) mean dmft than boys (5.3) [43]. An explanation for these differences between boys and girls remains speculative.

The data showed that dmft index in healthy weight children were significantly higher compared with overweight and obese children, and lower than underweight individuals (p<0.05). Dental caries prevalence in healthy weight were 1.39 times and 1.47 times significantly greater than overweight and obese children, respectively; and 1.2 times lower than underweight individuals (p<0.05). It seems that children with severe caries may have eating or food access issues and could possibly lose weight due to caries and associated pain [39]. Bafti et al. [29] showed that the caries rate in the primary teeth of 3-6-year-old children decreases with an increase in body weight, and the mean of dmft for normal BMI children was 1.5 fold greater for children who were overweight.

In the present study 6.1% of children were caries free. Among the caries free children, 12.8% were underweight, 70.7% were a healthy weight, 9.8% were overweight and 6.8% were obese. There was a significant positive relationship between BMI-% and caries free (p=0.003). Healthy weight children may have had access to a healthier diet than underweight or obese children. It is a challenge to explain why as a group the healthy weight children had a high dmft score but the group also had the highest number of caries free children. This would suggest that factors beyond diet are important when considering a particular child's risk for caries as the high incidence of dmft is among a select few.

A limitation of this cross sectional study is that no cause-effect relationship can be determined between dental status and BMI-%; therefore, further longitudinal designs are needed to clarify possible factors affecting this relationship.

Conclusions

1. This study indicated a significant inverse relationship between BMI-% and dmft index among the 6 year old children.
2. The mean dmft score of the study population was 6.27±3.76. The largest portion of the dmft index was decayed (88.6%), while the least was missing teeth (4.9%).
3. The data showed that the dmft index in healthy weight children was significantly higher when compared with overweight and obese children and lower than underweight individuals (p<0.05).
4. There was a significant positive relationship between BMI-% and number of caries free children (p=0.003).

Acknowledgments

This study was supported by a grant from the Research Vice Chancellor of Rafsanjan University of Medical Sciences. The authors express their gratitude to A. Nouri and Z. Jamali for assisting in the dental examinations.

References

1. Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ, et al. (2002) Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. Lancet 360: 1347-1360.
2. Hasani-Ranjbar S, Jouyandeh Z, Abdollahi M (2013) A systematic review of anti-obesity medicinal plants - an update. J Diabetes Metab Disord 12: 28.
3. National Task Force on the Prevention and Treatment of Obesity (2000) Overweight, obesity, and health risk. Arch Intern Med 160: 898-904.
4. Janghorbani M, Amini M, Willett WC, Mehdi Gouya M, Delavari A, et al. (2007) First nationwide survey of prevalence of overweight, underweight, and abdominal obesity in Iranian adults. Obesity 15: 2797-2808.
5. Lobstein T, Frelut ML (2003) Prevalence of overweight among children in Europe. Obes Rev 4: 195-200.
6. World Health Organization (2015) Obesity and overweight. Fact sheet 311, updated January 2015).
7. Gill T (2006) Epidemiology and health impact of obesity: an Asia Pacific perspective. Asia Pac J Clin Nutr 15: 3-14.
8. Palmer CA (2005) Dental caries and obesity in children: different problems, related causes. Quintessence Int 36: 457-461.
9. Wang Y, Lobstein T (2006) Worldwide trends in childhood overweight and obesity. Int J Pediatr Obes 1: 11-25.
10. Ayatollahi SMT, Mostajabi F (2007) Prevalence of obesity among schoolchildren in Iran. Obes Rev 8: 289-291.
11. Dorosty AR, Siassi F, Reilly JJ (2002) Obesity in Iranian children. Arch Dis Child 87: 388-391.
12. Defining Childhood Obesity. BMI for Children and Teens. Centers for Disease Control and Prevention.
13. Roberts MW (2008) Dental health of children: where we are today and remaining challenges. J Clin Pediatr Dent 32: 231-234.
14. Ghassemi H, Harrison G, Mohammad K (2002) An accelerated nutrition transition in Iran. Public Health Nutr 5: 149-155.
15. Meyer-Lueckel H, Paris S, Shirkhani B, Hopfenmuller W, Kielbassa AM (2006) Caries and fluorosis in 6- and 9-year-old children residing in three communities in Iran. Community Dent Oral Epidemiol 34: 63-70.
16. Malek Mohammadi T, Hossienian Z, Bakhteyar M (2012) The association of body mass index with dental caries in an Iranian sample of children. J Oral Health Oral Epidemiol 1: 29-35.
17. Brown WJ, Mishra G, Kenardy J, Dobson A (2000) Relationships between body mass index and well-being in young Australian women. Int J Obes Relat Metab Disord 24: 1360-1368.
18. Flegal KM, Graubard BI, Williamson DF, Gail MH (2007) Cause-specific excess deaths associated with underweight, overweight, and obesity. JAMA 298: 2028-2037.
19. Koksal E, Tekcicek M, Songul S, Yalcin SS, Tugrul B, et al. (2011) Association between anthropometric measurements and dental caries in Turkish school children. Cent Eur J Public Health 19: 147-151.
20. Vania A, Parisella V, Capasso F, DiTanna GL, Vestina A, et al. (2011) Early childhood caries underweight or overweight, that is the question. Eur J Paediatr Dent 12: 231-235.
21. Cameron FL, Weaver LT, Wright CM, Welbury RR (2006) Dietary and social characteristics of children with severe tooth decay. Scott Med J 51: 26-29.
22. Willershausen B, Moschos D, Azrak B, Blettner M (2007) Correlation between oral health and body mass index (BMI) in 2071 primary school pupils. Eur J Med Res 12: 295-299.
23. Yao Y, Ren X, Song X, He L, Jin Y, et al. (2014) The relationship between dental caries and obesity among primary school children aged 5 to 14 years. Nutr Hosp 30: 60-65.
24. World Health Organization (1997) Oral health surveys: basic methods. 3rd ed. Geneva: WHO.
25. Selwitz RH, Ismail AI, Pitts NB (2007) Dental caries. Lancet 369: 51-59.
26. Artz E, Haqq A, Freemark M (2005) Hormonal and metabolic consequences of childhood obesity. Endocrinol Metab Clin North Am 34: 643-58.
27. Wyatt SB, Winters KP, Dubbert PM (2006) Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. Am J Med Sci 331: 166-174.
28. Edalat A, Abbaszadeh M, Eesvandi M, Heidari A (2014) The Relationship of Severe Early Childhood Caries and Body Mass Index in a Group of 3- to 6-year-old Children in Shiraz. J Dent (Shiraz) 15: 68-73.
29. Bafti LS, Hashemipour MA, Poureslami H, Hoseinian Z (2015) Relationship between body mass index and tooth decay in a population of 3-6-year-old children in Iran. Int J Dent 126530 [Open Access].
30. Hong L, Ahmed A, McCunniff M, Overman P, Mathew M (2008) Obesity and dental caries in children aged 2-6 years in the United States: National Health and Nutrition Examination Survey 1999-2002. J Public Health Dent 68: 227-233.
31. Macek MD, Mitola DJ (2006) Exploring the association between overweight and dental caries among US children. Pediatr Dent 28: 375-80.
32. Pinto A, Kim S, Wadenya R, Rosenberg H (2007) Is there an association between weight and dental caries among pediatric patients in an urban dental school? A correlation study. J Dent Educ 71: 1435-1440.
33. Silva AE, Menezes AM, Demarco FF, Vargas-Ferreira F, Peres MA (2013) Obesity and dental caries: systematic review. Rev Saude Publica 47: 799-812.
34. Hayden C, Bowler JO, Chambers S, Freeman R, Humphris G, et al. (2013) Obesity and dental caries in children: a systematic review and meta-analysis. Community Dent Oral Epidemiol 41: 289-308.
35. Bagherian A, Sadeghi M (2013) Association between dental caries and age-specific body mass index in preschool children of an Iranian population. Indian J Dent Res 24: 66-70.
36. Bhoomika W, Ramakrishna Y, Munshi AK (2013) Relationship between severe early childhood caries and body mass index. J Clin Pediatr Dent 37: 235-242.
37. Powell JC, Koroluk LD, Phillips CL, Roberts MW (2013) Relationship between adjusted body mass index percentile and decayed, missing, and filled primary teeth. J Dent Child 80: 115-120.
38. Vazquez-Nava F, Vazquez-Rodriguez EM, Saldivar-Gonzalez AH, Lin-Ochoa D, Martinez-Perales GM, et al. (2010) Association between obesity and dental caries in a group of preschool children in Mexico. J Public Health Dent 70: 124-130.
39. Marshall TA, Eichenberger-Gilmore JM, Broffitt BA, Warren JJ, Levy SM (2007) Dental caries and childhood obesity: roles of diet and socioeconomic status. Community Dent Oral Epidemiol 35: 449-458.
40. Pourhashemi SJ, Golestan B (2008) Effect of sugars and carbonated drinks' consumption on anthropometric indices and dental health. J Dent Sch 26: 263-267.

41. Malek Mohammadi T, Wright C, Kay E (2009) Childhood growth and dental caries. Community Dent Health 26: 38-42.

42. Cinar AB, Murtomaa H (2011) Interrelation between obesity, oral health and life-style factors among Turkish school children. Clinical Oral Investigations 15: 177-184.

43. Bayat-Moahed S, Samadzadeh H, Ziyarati L, Memary N, Khosravi R, et al. (2011) Oral health of Iranian children in 2004: a national pathfinder survey of dental caries and treatment needs. East Mediterr Health J 17:243-249.