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Association of dietary habits with symptoms of temporomandibular disorders in Bangladeshi adolescents

Running title: TMD and dietary habits

Key words: Dietary habits, Symptoms of TMD, Adolescent

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Abstract The prevalences of signs and symptoms of temporomandibular disorder (TMD) in Bangladeshi adolescents and their associations with intake of various hard food items were investigated. A group of 1,200 randomly selected high school students aged 12-17 years from three communities (rural, semi-urban and urban) completed a questionnaire on dietary habits and presence of TMD symptoms and were examined clinically. In bivariate analysis, no significant relationship was observed between TMD symptoms and eating of hard foods. However, in logistic regression analysis, clicking showed a significant correlation with consumption of hard vegetable and fruits more than 3 times per week ($P<0.05$). A statistically significant correlation was also observed between consumption of all hard food items (at least one item in each of the 4 categories of hard food) more than 12 times per week and pain in the temporomandibular joint (TMJ) ($P<0.05$). A positive association was found between pain in the TMJ and older age (15-17 years) ($P<0.001$). The prevalence of pain in the TMJ was significantly higher in males ($P<0.01$). Prevalences of clicking and pain in the TMJ were significantly higher in subjects living in a rural area than in subjects living in an urban area ($P<0.01$ and $P<0.01$, respectively). Subjects having one or more decayed, missing and filled teeth (DMFT) showed significantly higher prevalences of clicking ($P<0.01$) and restricted mouth opening ($P<0.01$). The results suggest that prevalence of TMD symptoms are related to prolonged consumption of hard food items.

Introduction

Temporomandibular disorders（TMDs）are a common disorder characterized by pain and dysfunction of the temporomandibular joint (TMJ) and masticatory muscles (1, 2). The etiology of temporomandibular dysfunction is generally considered to be multifactorial and is still not clear (3, 4). Even though no clear causal relationship between TMD and a particular risk factor has yet been identified, several factors have been reported to be associated with TMD in adults and adolescents. Morphologic malocclusions, parafunctional habits and trauma have been suggested to be causes of TMD (5, 6). It has also been suggested that psychosocial functioning, life stress, depression, the presence of multiple somatic symptoms and dental factors might be responsible for TMD (5).

Chewing and dietary habits are thought to be factors underlying the onset of TMD (7-16). Patients complaining of TMD have often noted pain around the TMJ after masticating hard foods (16). Other studies have shown that hardness of food has an effect on TMJ movement (7, 8) and also has a strong influence on the level of masticatory muscle activity (9). Prolonged mastication of hard food has been shown to cause masseter muscle pain and displacement of the mandibular condyle and also to affect masticatory laterality (11-13). Most of these studies, however, were conducted by using different kinds of artificial test foods rather than normal hard foods. Moreover, in some studies (10, 11, 13),

TMD patients who visited dental clinics or hospitals were recruited rather than subjects from the general population (17).

Signs and symptoms of TMD were found in all age groups in epidemiological studies, with prevalence being low in small children and increasing with age in adolescence up to young adulthood (1, 18, 19). Past studies have mainly focused on TMD signs or symptoms in subjects over 18 years of age (1, 2, 11-13, 17, 20). Therefore, data for teenagers younger than 17 years of age are limited (5, 6, 19). Moreover, subjects from one particular area or community were used in most previous epidemiological studies (1, 2, 5, 7-9, 21). The results therefore may not be representative of data for adolescents or young adults in the general populations of the countries in which the studies were performed. Although there have been many reports on TMD in developed and some developing countries (4, 5, 7, 8, 14-16, 22-24), there have been very few reports on TMD in Asian developing countries (1, 2, 6, 25). To the best of our knowledge, there has been no report on TMD in Bangladeshi adolescents. This epidemiological study was carried out to determine the association between intake of hard food items and signs and symptoms of TMD in young adolescents in Bangladesh.

Materials and Methods

Experimental subjects

Data for 1,200 subjects (12-17 years old) were selected for analysis. The mean age of the sample population was 14.5±1.7 years. The number of subjects of 12-14 and 15-17 years old was 611 (307 males and 304 females) and 589 (295 males and 294 females), respectively. No significant difference of gender distribution was observed between the two age groups. The subjects were inhabitants of three different communities: an urban community (Dhaka; n = 552, 46.0% of total subjects), a periurban community (Chandpur; n = 374, 31.2%) and a rural community (Hagigonge; n = 274, 22.8%). After a school had been randomly selected, the attendance resister of a particular class was used for selection of subjects by a systematic random sampling method (20). Every 5th student on the attendance register for a class was selected. For example, from a class of 50 students, 10 students with roll numbers 5, 10, 15…45, and 50 were selected. If a selected student was not present on the day of examination, the student with next roll number was selected for examination. All subjects were given an explanation of the study and gave informed consent for participation in the study. Subjects who had undergone orthodontic treatment and subjects having systemic diseases were excluded from the study. Prior to clinical examination, each subject completed a questionnaire (20, 25). The questionnaire was administered in Bengali. One experienced examiner checked that all of the questions had been correctly understood and answered. Experienced examiners who did not know the answers given to the questionnaires performed the clinical examinations.

TMD Symptoms

The methods used for assessing TMD symptoms were conducted according to the previous study (6). The presence of TMD symptoms in the previous 6 months was assessed by "yes" and "no" answers given to questions in the questionnaire on typical symptoms related to TMD: 1. Have you ever felt pain around an ear while opening your mouth or during chewing hard food? 2. Have you ever noticed restriction during opening mouth? 3. Have you ever noticed any sound around your ear? Subjects were instructed not to report fleeting or minor aches or pains, or conditions that had occurred only on a single day within 6 months (16). Scoring was done as 1 and 0, with a score of 1 for a positive answer and a score of 0 for a negative answer.

Dietary habits

A section in the questionnaire entitled food consumption information provided data necessary to evaluate dietary intake based on weekly consumption patterns. In order to assess the relationships between TMD symptoms and hard food intake, a hard food checklist (26) of 4 categories (proteins: e.g., dried fish and meat/fish bone; carbohydrates: e.g., fried rice, dried mashed rice, hard chips and chanachur; vegetables and fruits: e.g., fried beans, sugarcane and coconut; sweet foods: e.g., hard candy, hard biscuits and cakes) was used to obtain information on foods eaten by the Bangladeshi adolescents. Fried rice,

dried mashed rice and hard chanachur are the especially prepared hard foods in Bangladesh.

Data on the subjects' tooth cleaning habits were obtained from a section in the questionnaire on oral hygiene maintenance (27) and regular use of various oral hygiene aids (toothbrush, toothpicks, toothpaste, powder and charcoal).

Clinical examination

Dysfunction of the TMJ and masticatory muscles (TMD signs) were clinically evaluated. Three calibrated dentists (HN, KN, OH) carried out the clinical examinations. Calibration concerned a weekly training session over a three months period of time. The training consisted of (i) oral presentation followed by discussion and (ii) clinical examination of subjects with use of specified diagnostic criteria and detailed protocols. Reproducibility of the clinical recordings (inter- examiner agreement) was tested by blind re-examination. The inter examiner agreement judged by kappa value ranged from 0.64 to 0.86.

The following signs were assessed: clicking sound, jaw deviation, lockjaw, TMJ and muscle tenderness and pain in the TMJ (19). Clicking of the joint was detected by palpation without using a stethoscope. Subjects complaining at least one side or noted on both sides were considered in the computation of prevalence of clicking. Jaw deviation on opening or closing was determined by inspection of jaw movement and palpation of the ear regions. The tenderness of the muscles and joints were recorded "yes" if pain was noted

during bimanual palpation or if the palpebral reflect was seen**.** The following muscles were palpated: the temporal; the superficial parts of the masseter; and lateral and medial pterygoids and the sternocleidomastoid (21). Temporomandibular joints were palpated bilaterally and following regions were palpated: the lateral and posterior portion of the TMJ, the posterior part of the mandibular ramus. Pain in the TMJ was evaluated during mandibular movement. Number of DMFT in each subject was also recorded by examination with a dental mirror under an artificial light.

Statistical treatment

The SPSS statistical package for Windows, version 11.5 was used for analyses of the data. In bivariate analysis, Pearson's chi-square test was used to establish an association between the prevalence of each TMD symptom and other potential variables related to TMD. When several planned comparisons are made, the probability of obtaining significance by chance is increased. Therefore, yes (%) answers of respondents having TMD symptoms were compared between the groups using the Bonferroni correction to adjust probability. For instance, when clicking was associated with one of the 5 categories of hard food, the number of comparisons was 5 and p-values below 0.05/5 = 0.01 were considered significant.

Logistic regression analysis (25) was used to identify dietary habits and other

independent variables related to symptoms of TMD (dependent variables). Probability levels at $P<0.05$ were considered statistically significant. The odds ratio with 95% confidence intervals was computed from regression results.

Results

The prevalences of TMD symptoms according to age, sex and community are shown in Table 1. Clicking was the most frequent symptom of TMD found in this survey. A significant ($P<0.01$) relationship with pain in the TMJ was found in the older subjects (15-17 years), and the prevalence of pain in the TMJ was higher in the male subjects ($P<0.01$). The prevalences of clicking and pain in the TMJ were significantly higher in the subjects living in a rural area than in subjects living in an urban area ($P<0.001$ and $P<0.01$, respectively).

About 20% of the subjects had at least one clinical sign as evaluated by the examiners. The ratios of subjects with one clinical sign, two signs and three or more signs were 13.4%, 4.7%, and 4.5%, respectively. Prevalences of muscle tenderness, TMJ tenderness and pain in the TMJ were significantly correlated with female gender ($P<0.05$, $P<0.01$ and $P<0.01$, respectively). The prevalences of clicking ($P<0.001$), muscle tenderness ($P<0.001$) and TMJ tenderness ($P<0.001$) were significantly higher in the subjects who lived in a rural area than in the subjects who lived in a periurban area or urban

area.

The associations between reported symptoms in the questionnaire and dietary habits (bivariate analysis) are shown in Table 2. No significant relationship was found between TMD symptoms and dietary habits. There was no significant difference in clinical signs in relation to dietary habits.

Relationships between reported TMD symptoms, DMFT, and oral hygiene behavior are shown in Table 3. A significant association was found between clicking and restricted mouth opening in subjects who had one or more DMFT ($P<0.01$) compared with subjects having no DMFT. Significantly higher prevalences of clicking was found in subjects who cleaned their teeth one time/day or less than in subjects who cleaned their teeth more than 1 time/day. The prevalence of clicking in twig and finger users was higher than that in toothbrush users. Prevalence of clicking was higher in powder and charcoal users than in toothpaste users. No such relationship was found in the case of clinical signs.

Table 4 summarizes the significant relationships between variables tested and the TMD symptoms revealed by logistic regression analysis. Subject's intaking hard vegetable and fruits more than 3 times per week showed a significant correlation with clicking ($P<0.05$). A negative correlation ($OR=0.46$) was found between intake of protein hard food and restricted mouth opening ($P<0.05$). Intake of items in all hard food

categories (at least one item in each of the 4 categories of hard food) more than 12 times per week was associated with increased prevalence of pain in the TMJ ($P<0.05$). Older subjects (15 to 17 years of age) were about 1.6-times more predisposed to feel pain in the TMJ ($P<0.001$) than were younger subjects (12 to 14 years of age). Prevalence of pain in the TMJ was higher in the male subjects than in the female subjects ($P<0.01$). Clicking and pain in the TMJ were more prevalent in subjects living in a rural area than in subjects living in an urban area ($P<0.01$). Subjects who had decayed, missing and filled teeth (DMFT) were about 1.4- times more predisposed to feel clicking ($P<0.01$) and about 2.8-times more apt to experience restricted mouth opening ($P<0.01$) than were subjects who did not have DMFT. The prevalence of clicking was higher in subjects who cleaned their teeth one time per day or less than in subjects who cleaned their teeth more than one time per day ($P<0.05$). The prevalence of pain in the TMJ was about 1.9- times higher in subjects who used oral hygiene aids such as powder or charcoal than in subjects who used toothpaste ($P<0.05$).

Discussion

In order to assess the direct impact of dietary habits on the joints of the stomatognathic system, we evaluated the symptoms reported by the subjects and performed clinical examinations without the use of the craniomandibular index (28) or Helkimo index (29).

These two indices make direct association more complex because they are compound and based on multiple variables, thus making comparison with results of other studies difficult.

The prevalence of pain in the TMJ in subjects consuming all hard food items more than 12 times per week was about 1.5- times higher than that in subjects consuming hard food less frequently (Table 4). The results of the present study showed that dietary habits are associated with symptoms of TMD, especially pain in the TMJ, and may therefore be potential risk factors for TMD. This speculation is supported by results of previous studies showing a correlation of severity of pain of masseter and sternocleidomastoid muscles with biting of hard food (13-15). Other studies have shown that activity of the masticatory muscle and TMJ increases in relation to food hardness and texture (14, 15). The texture of food, especially hardness, has been shown to have an influence on masticatory laterality (12). Apparently, masticating hard foods induce displacement of TMJs and causes pain by increasing the activity of masticatory muscles (11).

Logistic regression analysis showed that subjects who eat hard vegetable and fruits more than 3 times per week were about 1.4- times more predisposed to feel clicking than were subjects who ate such food 3 times or less per week. The reason why vegetable and sweet hard food but not protein, carbohydrate or sweet showed a significant association with this symptom is not clear. The very low prevalence of restricted mouth opening may be a reason why we found a negative association with the subjects who ate protein hard

food more than 3 times per week. Another reason might be that our study is cross-sectional and did not reveal the causal relationship. It is possible that subjects with restricted mouth opening cannot eat hard protein food.

Prevalence of pain in the TMJ in the older age group (28%) was higher than that in the younger age group and is similar to the prevalence reported by Pow et al. (33%) (30). According to logistic analysis, older subjects (15-17 years of age) had a 1.6- times higher risk of developing pain in the TMJ than did younger subjects (12-14 years of age). Nilner (31) reported a higher prevalence of TMD symptoms in young adults than in children. It has been reported that pain in the TMJs of old adolescents is related to daily stress at home or in school (5).

Gender was not a strong precipitating factor for self-reported TMD symptoms. However, males had a significantly higher prevalence of TMJ pain (28%) than did females (20.3%). The high prevalence of TMJ pain in males differs from results of earlier studies showing a significantly higher prevalence of TMJ pain in females than in males (17, 32). This difference might be due to the variability of the population. The higher prevalence of pain in the TMJ in females was consistent in the literature of samples drawn from clinical subjects, but not from samples drawn from populations at large (33). Several past studies support our results. Men have approximately 50% to 60% more injuries than women and this difference might lead to different pain experiences between the genders (5).

The past study also shows that male tended to have more often a restricted mouth opening than girls due to the role of maturity of fine motor control of the orofacial muscles (21).

There have been few reports on differences in the prevalences of TMD in different communities since most of previous studies were carried out in only one community (1, 6, 21, 25). A notable in the present study is that the prevalences of TMD symptoms, especially clicking and pain in the TMJ, were higher in adolescents in rural areas than in adolescents in urban/periurban areas in Bangladesh. The higher prevalences of TMD symptoms in adolescents in rural areas might be due to the higher degrees of stresses encountered routinely within that particular community (30). Further multifactorial studies are needed to explain this difference.

Significant relationships were found between DMFT and clicking ($P<0.01$) and between DMFT and restricted mouth opening ($P<0.01$). Kampe (34) compared TMD symptoms in subjects with and those without dental restorations and also found a significantly higher prevalence of more severe TMD symptoms in subjects with restored dentition. He therefore suggested that dental restoration should be considered as an etiological factor of TMD.

It has been stated frequently that poor oral hygiene habit is a major risk factor leading to TMD and other dental problems (27, 35). This was also indicated by the results of our study. Subjects who cleaned their teeth only one time/day or less showed a higher

risk of developing clicking ($P<0.05$) than did subjects who cleaned their teeth more than one time/day. Moreover, prevalences of TMD symptoms were higher in twig or finger users than in toothbrush users and higher in powder or charcoal users than in toothbrush users. However, insufficient knowledge of oral health care, including proper use of a toothbrush and toothpaste, cannot be explained as a risk indicator for TMD.

We could not find any significant correlation between clinical TMD signs and dietary habits, and further investigation is therefore needed. One possible reason for this discrepancy between the associations of dietary factors with TMD signs and symptoms is that the result obtained from clinically determined TMD signs was based on point prevalence and is different from those obtained from the questionnaire (period prevalence).

Parafunctional habit and psychological distress are considered as one of the factors responsible for TMD. However, in our study we did not focus on these two aspects. Due to limitations in the design of the present study, it was not possible to draw any relationships between parafunctional and psychological factors among the adolescents surveyed. To examine such relationships, a well-designed longitudinal study needs to be carried out.

In summary, the present study showed that dietary habits are related, though not strongly, to TMD symptoms. TMD seems to be multifactorial disorder. However, the possible roles of dietary factors in the etiology of TMD should be investigated in detail in

future studies utilizing multifactorial and interaction statistics that include not only subjects' symptoms but also clinical findings in order to obtain more insights into the precipitating and perpetuating factors for TMD.

REFERENCES

1. Shiau YY, Chang C. An epidemiological study of temporomandibular disorders in

university students of Taiwan. Community Dent Oral Epidemiol 1992 Feb; 20(1): 43-7.

2. Zulqarnain BJ, Khan N, Khattab S. Self reported symptoms of temporomandibular dysfunction in a female university student population in Saudi Arabia. J Oral Rehabil 1998 Dec; 25(12): 946-53.

3. American Academy of Orofacial Pain Etiology. In: Temporomandibular disorders: guidelines for classification, assessment, and management. 2nd edn. (Ed. C. McNeill). Chicago: Quintessence Publishing Co; 1993.

4. Verdonck A, Takada K, Kitai N, Kuriama R, Yasuda Y, Carels C et al. The prevalence of cardinal TMJ dysfunction symptoms and its relationship to occlusal factors in Japanese female adolescents. J Oral Rehabil 1994 Nov; 21(6): 687-97.

5. List T, Wahlund K, Larsson B. Psychosocial functioning and dental factors in adolescents with temporomandibular disorders: A case control study. J Orofac Pain 2001 Summer; 15(3): 218-27.

6. Winocur E, Gavish A, Finkelshtein T, Halachmi. M, Gazit. E. Oral habits among adolescent girls and their association with symptoms of temporomandibular disorders. J Oral Rehabil 2001 Jul; 28(7): 624-9.

7. Peyron MA, Maskawi K, Woda A, Tanguay R, Lund JP. Effects of food texture and sample thickness on mandibular movement & hardness assessment during biting in man. J Dent Res 1997 Mar; 76 (3): 789-95.

8. Peyron A, Lassauzay C, Woda A. Effects of increased hardness on jaw movement and muscle activity during chewing of visco-elastic model foods. Exp Brain Res 2002 Jan; 142 (1): 41-51.

9. Horio T, Kawamura Y. Effects of texture of food on chewing patterns in the human subject. J Oral Rehabil 1989 Mar; 16 (2): 177-83.

10. Kurita H, Ohtsuka A, Kurashina K, Kopp S. Chewing ability as a parameter for evaluating the disability of patients with temporomandibular disorders. J Oral Rehabil 2001 May; 28(5): 463-5.

11. Komiyama O, Asano T, Suzuki H, Kawara M, Wada M, Kobayashi K et al. Mandibular condyle movement during mastication of foods. J Oral Rehabil 2003 Jun; 30(6): 592-600.

12. Mizumori T, Tsubakimoto T, Iwasaki M, Nakamura T. Masticatory laterality-evaluation and influence of food texture. J Oral Rehabil 2003 Oct; 30(10): 995-9.

13. Shiau YY, Peng CC, Wen SC, Lin LD, Wang JS, Lou KL. The effects of masseter muscle pain on biting performance. J Oral Rehabil 2003 Oct; 30(10): 978-84.

14. Plesh O, Bishop B, McCall W. Mandibular movements and jaw muscles' activity while voluntarily chewing at different rates. Exp Neurol 1987 Nov; 98(2): 285-300.

15. Steiner JE, Michiman J, Litman A. Time sequence of the activity of the temporal and masseter muscles in healthy young human adults during habitual chewing of different

test foods. Arch Oral Biol 1974 Jan; 19(1): 29-34.

16. Dworkin SF, Huggins KH, LeResche L, Von Korff M, Howard J, Truelove E et al. Epidemiology of signs and symptoms in temporomandibular disorders: Clinical signs in cases and controls. J Am Dent Assoc 1990 Mar; 120(3): 273-81.
17. Kamisaka M, Yatani H, Kuboki T, Matsuka Y, Minakuchi H. Four-year longitudinal course of TMD symptoms in an adult population and the estimation of risk factors in relation to symptoms. J Orofac Pain 2000 Summer; 14(3): 224-32.
18. Behrents RG, White RA. TMJ research: responsibility and risk. Am J Orthod Dentofacial Orthop 1992 Jan; 101(1): 1-3.
19. Kitai N, Takada K, Yasuda Y, Verdonck A, Carels C. Pain and other cardinal TMJ dysfunction symptoms: a longitudinal survey of Japanese female adolescents. J Oral Rehabil 1997 Oct; 24(10): 741-8.
20. Matsuka Y, Yatani H, Kuboki T, Yamashita A. Temporomandibular disorders in the adult population of Okayama City, Japan. J Cranio Mandib Pract 1996 Apr; 14(2): 158-62.
21. Pahkala R, Laine T. Variation in function of the masticatory system in 1008 rural children. J Clin Pediatr Dent 1991 Fall; 16(1): 25-30.
22. De Kanter RJ, Truin GJ, Burgerdijk RC, Van‘t Hof MA, Battistuzzi PG, Kalsbeek H et al. Prevelence in the Dutch adult population and meta analysis of signs and symptoms

of temporomandibular disorder. J Dent Res 1993 Nov; 72(11): 1509-18.

23. Glass EG, McGlynn FD, Glaros AG, Melton K, Romans K. Prevalence of temporomandibular disorder symptoms in a major metropolitan area. Cranio 1993 Jul; 11(3): 217-20.

24. Probert TC, Wiesenfeld D, Reade PC. Temporomanibular pain dysfunction disorder resulting from road traffic accidents-- an Australian study. Int J Oral Maxillofac Surg 1994 Dec; 23(6 Pt 1): 338-41.

25. Gavish A, Halachmi M, Winocur E, Gazit E. Oral habits and their association with sign and symptoms of temporomandibular disorders in adolescent girls. J Oral Rehabil 2000 Jan; 27(1): 22-32.

26. Daly RM, Elsner RJF, Allen PF, Burke FM. Associations between self reported dental status and diet. J Oral Rehabil 2003 Oct; 30(10): 964.

27. Ullah MS, Aleksejuniene J, Eriksen HM. Oral health of 12-year-old Bangladeshi children. Acta Odontol Scand 2002 Mar; 60(2): 117-22.

28. Fricton JR, Schiffman EL. Reliability of a craniomandibular index. J Dent Res 1986 Nov; 65(11): 1359-64.

29. Helkimo M. Studies on function and dysfunction of the masticatory system. II. Index for anamnestic and clinical dysfunction and occlusal state. Sven Tandlak Tidskr 1974 Mar; 67(2): 101-21.

30. Pow EH, Leung KC, McMillan AS. Prevalence of symptoms associated with temporomandibular disorders in Hong Kong Chinese. J Orofac Pain 2001 Summer; 15(3): 228-34.

31. Nilner M. Prevalence of functional disturbances and diseases of the stomatognathic system in 15 to 18 year olds. Swed Dent J 1981; 5(5-6): 189-97.

32. Solberg WK, Woo MW, Houston JB. Prevalence of mandibular dysfunction in young adults. J Am Dent Assoc1979 Jan; 98(1): 25-34.

33. Duckro PN, Tait RC, Margolis RB, Deshields TL. Prevalence of temporomandibular symptoms in a large United States metropolitan area. Cranio 1990 Apr; 8(2): 131-8.

34. Kampe T. Function and dysfunction of the masticatory system in individuals with intact and restored dentitions. Swed Dent J Suppl 1987; 42:1-68.

35. Humphrey SP, Lindroth JE, Carlson CR. Routine dental care in patients with temporomandibular disorders. J Orofac Pain 2002 Spring; 16(2): 129-34.

Table 1. Prevalence of TMD symptoms by age, sex and community

		TMD Symptoms		
Factors		Clicking around the TMJ	Pain in the TMJ	Restricted mouth opening
Age	12-14 years	41.2	20.7	3.5
	15-17 years	39.7	27.7*	3.0
Sex	male	42.3	28.0$	3.5
	female	38.5	20.3	3.0
Community	rural	48.2‡	30.0†	1.8
	periurban	47.9‡	25.1	3.5
	urban	31.5	20.7	3.8

*: Significantly higher than that in the 12-14-year-old group (P<0.01)

$: Significantly higher than that in females (P<0.01)

†, ‡: Significantly higher than that in subjects in an urban community (†: P<0.01, ‡: P<0.001)

Table 2. Prevalence of TMD symptoms according to dietary habits

	TMD Symptoms		
Factors	Clicking around the TMJ	Pain in the TMJ	Restricted mouth opening
Protein hard food			
≤ 3 times/week	42.5	22.2	4.2
> 3 times/week	38.5	26.0	2.4
Carbohydrate hard food			
≤ 3 times/week	38.7	23.7	3.6
> 3 times/week	41.7	24.5	3.0
Vegetable and fruits hard food			
≤ 3 times/week	37.3	25.2	3.5
> 3 times/week	42.8	23.4	3.0
Sweet hard food items			
≤ 3 times/week	41.6	24.9	3.0
> 3 times/week	45.1	23.5	3.5
Combination of all hard food items			
≤ 12 times/week	40.1	22.7	3.6
> 12 times/week	39.8	25.4	3.0

Table 3. Associations between symptoms reported in the questionnaire and other oral indexes

	TMD Symptoms, Prevalence (%)		
Factors	Clicking around the TMJ	Pain in the TMJ	Restricted mouth opening
DMFT			
No DMFT	37.5	22.6	2.1
≥1 DMFT	44.5**	26.3	4.8**
Frequency of teeth cleaning			
≤1 time/day	44.0*	26.1	3.4
>1 time/day	33.3	20.3	3.0
Adjuvant			
Toothbrush	37.7	23.3	3.5
Twig/Finger	50.4*	26.7	2.5
Materials			
Toothpaste	37.5	22.7	3.1
Powder/Charcoal	49.3*	28.3	3.5

*: Significantly different between the two groups by chi-squared test and Bonferroni correction.

: Significantly higher than that in the other group by chi-square test (: $P<0.01$)

Table 4. Results of multiple regression analysis

	TMD Symptoms		
	Clicking around the TMJ	Pain in the TMJ	Restricted mouth opening
Factors	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (15-17 years)	0.98 (0.77-1.26)	1.62 (1.22-2.16)***	0.72 (0.36-1.43)
Sex (Female)	0.97 (0.76-1.24)	0.67 (0.51-0.89)**	0.91 (0.46-1.76)
Community			
Periurban	1.10 (0.79-1.53)	0.82 (0.57-1.20)	2.03 (0.69-5.93)
Urban	0.59 (0.42-0.84)**	0.60 (0.41-0.88)**	2.73(0.93-8.04)
Protein hard food			
>3 times/week	1.01 (0.78-1.32)	1.31 (0.97-1.78)	0.46 (0.22-0.96)*
Carbohydrate hard food			
>3 times/week	1.19 (0.91-1.56)	1.01 (0.74-1.37)	0.91(0.44-1.90)
Vegetable& fruit hard food			
>3 times/week	1.42 (1.07-1.88)*	0.76 (0.55-1.05)	0.75 (0.35-1.59)
Sweet hard food			
>3 times/week	0.97 (0.74-1.28)	0.79 (0.58-1.07)	1.32 (0.62-2.78)
All hard food items			
>12 times/week	0.93 (0.66-1.32)	1.54 (1.04-2.30)*	1.10 (0.43-2.82)
DMFT ≥1	1.40 (1.09-1.79)**	1.18 (0.89-1.57)	2.80 (1.41-5.56)**
Frequency of teeth cleaning			
>1 time/day	0.75 (0.57-0.98)*	0.84 (0.61-1.14)	0.85 (0.40-1.80)
Adjuvant			
Twig and finger	1.16 (0.65-2.05)	0.55 (0.29-1.02)	0.51 (0.14-1.91)
Materials			
Powder and charcoal	1.18(0.69-2.02)	1.94 (1.09-3.44)*	2.17 (0.71-6.66)

*: P<0.05, **: P<0.01, ***: P<0.001