

Full Length Research Paper

The awareness and educational status on oral health of elite athletes: A cross-sectional study with cluster analysis

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In this cross-sectional survey, this study aimed to determine the factors associated with oral health of elite athletes and to determine the clustering tendency of the variables by dendrogram, and to determine the relationship between predefined clusters and see how these clusters can converge. A total of 97 elite (that is, top-level performing) male handball players aged 18 to 29 years participated in the study. Two questionnaires with high validity scores were computed based on the results of the oral health of elite athletes (Geriatric/General Oral Health Assessment Index (GOHAI) and the Oral Health Impact Profile (OHIP)). The GOHAI mean and standard deviation score was 8.381 ± 3.988 , indicating a low self-perception of oral health by the allocated sample. The OHIP mean and standard deviation score was 11.25 ± 3.553 , indicating a low self-perception of oral health by the allocated sample. OHIP shows low scores based on these results. According to the first sub cluster; dental floss, dental control, brushing, gingival health, age, dieting and education was found significantly related with these two indexes. The ratios of these variables were as follows: dental floss; 56.7%, dental control; 80.4%, brushing; 99%, gingival health; 96.9%, dieting; 94.8%, education; 100% and the mean age was 18.96 ± 3.731 . These results indicate positive correlations among GOHAI and OHIP indexes and positive results for elite athletes included to the current study. As a result, the variables that affect the oral health of the athletes in the study based on multivariate analysis of the clustering results were observed to be healthy at the expected level. The relationships between variables with dendrogram by using hierarchical cluster analysis was discovered.

Key words: Elite athletes, oral health, cluster analysis, dendrogram.

INTRODUCTION

The expression of oral health means much more than it seems because Oral health is considered to have associations with general health and well-being. Oral

health is an important determinant of the quality of life (Needleman et al., 2012). Elite athletes should follow a good diet to obtain the best performance and must have

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good oral health as well. Oral health and general health are two important components. Consequently, oral health is integral to general health (Ashley et al., 2015).

There are multiple factors which causes athletes to have dental problems like the effects of energy drinks, regular tooth brushing and flossing, individual biology, the physical and socio-economic environment, personal behaviors and lifestyle, and the organization of health care (Rajapakse et al., 2007).

Dietary carbohydrate intake is one of the most effective factor for dental caries, and the acidic foodstuffs and beverages are the main factors causing tooth decay. It has been recommended that in order to reduce the occurrence of dental erosion, the amount and frequency of carbohydrate intake, a sugary fruit drinks (including sports drinks), vinegar, citrus fruits and berries should be limited (Baumgartner et al., 2009). Oral health is related to diet in many ways, for example, through nutritional influences on cranio-facial development and oral infectious diseases. Dental diseases include a number of local problems, including inflammation of the pulp (pulpitis), infection and most commonly, decay. Periodontal disease, gum disease, grinding teeth (bruxism), tooth trauma and an abnormal bite are also causes (Sheiham, 2001).

In modern society oral health has an important role in facial appearance. Physical appearance of the athlete provides a very significant impact. Tooth loss can be very hard on athletes, and at times embarrassing thing to cope with especially when it has some effects on speech. This is a situation that cannot be accepted for athletes (Moynihan and Petersen, 2004; Chen et al., 1997).

The health of oral tissues and organs are, inevitably related to the chemical, physical and physiological characteristics of foods and diets. Hence the importance of a healthy diet and nutrition are very high (Wang and Lussi, 2012). Dental caries is caused by the interaction of microbes (plaque), dietary factors and their fermentation on teeth. The acid is produced when sugars (mainly sucrose) in foods or drinks react with bacteria present in the dental biofilm (plaque) on the tooth surface (Loveren et al., 2012; Wang et al., 2002).

The increasing quality of life is associated with dental caries. Consequently, medical care and social programs are focusing increasingly upon enhancement of patients' quality of life (Natio et al., 2006). Individuals and athletes should be recommended to reduce the frequency with which they consume foods containing free sugars, limit the amount of free sugars consumed, facilitating good nutrition and physical well-being to achieve maximum sporting potential. In countries where fluoride toothpaste is accessible, individuals and athletes should be recommended to brush their teeth with a fluoride toothpaste twice a day (Bryant et al., 2011).

The study aims to determine the factors associated with oral health of elite athletes, and to determine the

clustering tendency of the variables by dendrogram. It has been also interested with using hierarchical clustering method to determine the relationship between predefined clusters and see how these clusters can converge.

MATERIALS AND METHODS

A total of 97 elite (that is, top-level performing) male handball players aged 18 to 29 years participated in the study. Written informed consent was received from each participant after the aims and methods of the study were explained. Participants were free of drugs. Their physical examinations and routine laboratory analyses were in normal ranges. Smokers, individuals on medication and had muscle injuries or who have developed muscle lesions were not included to the study. Self-report questionnaire data were collected from a sample of 97 athletes. The periodontal condition was assessed by a dentist.

Study design and sampling method

The design of the study was a cross-sectional survey. 97 elite handball players selected as subjects using "Random Sampling Method" who played in Turkish handball league.

Study questionnaires

Two questionnaires with high validity scores were computed based on the results of the oral health of elite athletes. One of them was GOHAI the well-established Geriatric/General Oral Health Assessment Index. The other was frequently used questionnaires which include the Oral Health Impact Profile (OHIP) (Slade and Spencer, 1994, Atchinson and Dolan, 1990). The GOHAI has been adapted for general use, translated and tested on the samples of adults in many countries, independently or compared to other indices (Kristjansson et al., 2003).

Aiming to evaluate elderly oral health self-perception, GOHAI utilizes the original questionnaire composed of 12 items divided in 3 dimensions that address physical function, pain and discomfort, and psychosocial aspects (Atieh, 2008). Patients were questioned about the frequency at which they experience any of 12 listed problems, using a three-value scale (Table 1). The final score was classified as high (34 to 36 points), moderate (31 to 33 points) and low (≤ 30 points) self-perception. OHIP questionnaire contains 49 questions. It contains seven dimensions, with seven questions in each dimension (Davit et al., 2009).

Statistical analysis

Mean and standard deviation (SD) were calculated for continuous variables. The normality of the variables was analyzed by Kolmogorov-Smirnov test. Hierarchical Cluster Analysis (CA) of modern multivariate statistical methods was employed to find the clustering tendency of the variables. The dendrogram of the variables was found by means of the Average Linkage (between-groups) Cluster Method. Classifications are generally pictured in the form of hierarchical trees, also known as dendrograms. CA is one of the primary methods of modern multivariate analysis. Because of its utility, clustering has emerged as one of the leading methods of multivariate analysis. CA is a multivariate statistical method which

Table 1.The 12 items utilized in the GOHAI index using a Likert scale.

GOHAI index	Always	Sometimes	Never
Limit the kinds of food consumed	1	2	2
Trouble biting or chewing	1	2	2
Able to swallow comfortably	1	2	2
Unable to speak clearly	1	2	2
Able to eat without discomfort	1	2	2
Limit contact with people	1	2	2
Pleased with appearance of teeth	1	2	2
Use medication to relieve pain	1	2	2
Worried about teeth, gum or dentures	1	2	2
Self-conscious about teeth, gums or dentures	1	2	2
Uncomfortable eating in front of others	1	2	2
Sensitive to hot, cold or sweet food	1	2	2

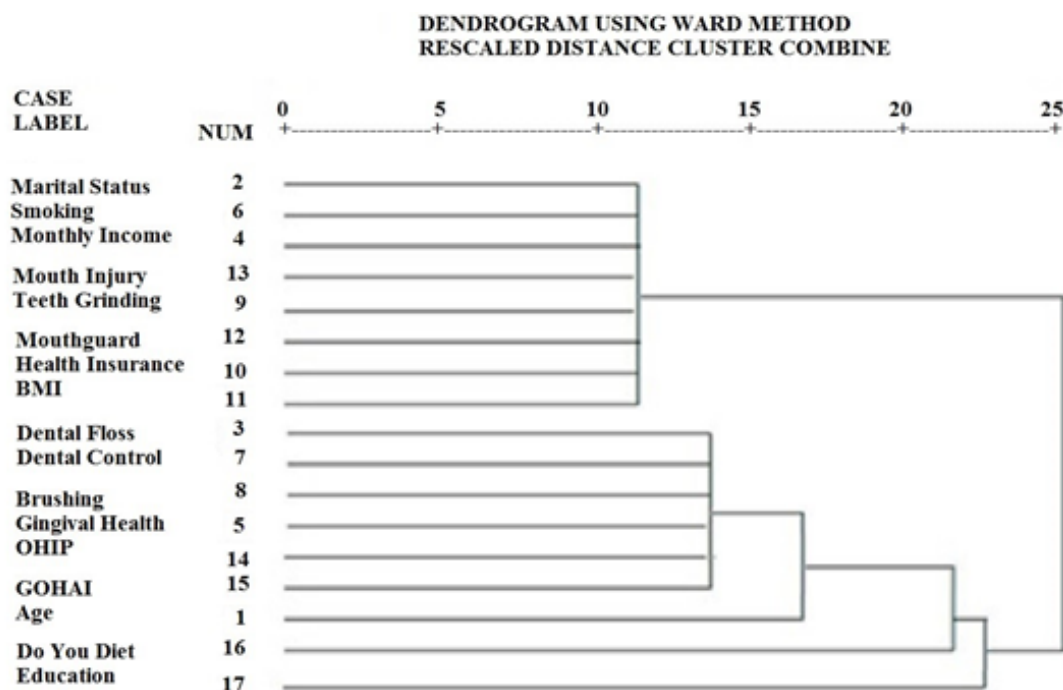


Figure 1. Dendrogram shows the sub clusters of variables.

was originally developed for biological classification (Kettenring, 2006). Two-sided p values were considered statistically significant at $P \leq 0.05$. Statistical analyses were carried out by using the statistical packages for social sciences (SPSS) 15.0 for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

To indicate the connections between variables, cluster

method was used which identified two main distinct groups, with each cluster having several related features (Figure 1). These two clusters were named on the basis of their key characteristics. The first cluster included the following: Dental floss, Dental control, Brushing, Gingival health, OHIP, GOHAI, Age, Dieting and Education. The second cluster included; marital status, smoking, monthly income, mouth injury, teeth grinding, mouth guard, health insurance, and body mass index (BMI). It should be

Table 2. Descriptive statistics of OHIP, GOHAI index, age and BMI.

Variable	Mean	±SD	Min-Max
Oral health impact profile	11.25	3.553	3.00-21.00
General oral health assessment index	8.381	3.988	1.00-19.00
Age	18.96	3.731	15.00-39.00
BMI	23.95	20.21	17.28-220.2

Table 3. The frequencies of marital status.

Variable	Frequency	Percentage
Single	93	95.9
Married	4	4.1
Total	97	100.0

Table 4. The distribution of educational status.

Variable	Frequency	Percentage
High School	64	66.0
Undergraduate	32	33.0
Master of science	1	1.0
Total	97	100.0

Table 5. The distribution of monthly income.

Variable	Frequency	Percentage
≤1000 TL	50	51.5
1001-2000 TL	21	21.6
2001-3000 TL	10	10.3
3001-4000 TL	8	8.2
4001-5000 TL	3	3.1
≥5001	5	5.2
Total	97	100.0

Table 6. The distribution of the smokers and non-smokers.

Variable	Frequency	Percentage
Non-smokers	91	93.8
Smokers	6	6.2
Total	97	100.0

noted that dental control, brushing, gingival health, age and education variables was clustered with OHIP and GOHAI sub cluster. The horizontal axis of the dendrogram represents the distance or dissimilarity

Table 7. The answer of "Overall, how would you rate the health of your teeth and gum?"

Variable	Frequency	Percentage
Excellent	9	9.3
Very good	23	23.7
Good	46	47.4
Fair	16	16.5
Bad	3	3.1
Total	97	100.0

Table 8. The answer of "Do you diet?"

Variable	Frequency	Percentage
Never	5	5.2
Sometimes	35	36.1
I usually do	45	46.3
I often	10	10.3
I'm constantly	2	2.1
Total	97	100.0

between clusters. It has been found that this sub cluster was found to be closer in distance. While rescaled distance cluster combine of the second sub cluster was close to 25, the distance of second cluster was over 10 at the horizontal scale of Dendrogram as shown in Figure 1. Descriptive statistics, mean, standard deviation, min and max values were calculated and presented in Table 2. The frequencies of the variables are presented in Tables 3 to 13.

DISCUSSION

As a results of hierarchical cluster method; dental floss, dental control, brushing, gingival health, age, dieting and education variables were more related with OHIP and GOHAI indexes that all together built a same sub set (cluster). Oral health impact profile is also known as the OHIP-14 questionnaire includes 14 functional and psychosocial impacts that individuals have experienced in the previous year as a result of problems with their

Table 9. The answer of "Do you grind your teeth".

Variable	Frequency	Percentage
Sometimes	62	63.9
Often	12	12.4
Very often	1	1.0
Always	22	22.7
Total	97	100.0

Table 10. The answer of "How often do you go to the dentist?"

Variable	Frequency	Percentage
I don't	19	19.6
Only when necessary	57	58.8
Every six months	15	15.5
Once a year	6	6.2
Total	97	100.0

Table 11. The answer of "How often do you brush your teeth?"

Variable	Frequency	Percentage
I don't	1	1.0
Once a day	34	35.1
Two times a day	51	52.6
Not regularly	11	11.3
Total	97	100.0

Table 12. The answer of "Do you use dental floss or any other device to clean between your teeth?"

Variable	Frequency	Percentage
I Don't	42	43.3
Dental floss	12	12.4
Toothpick	43	44.3
Total	97	100.0

Table 13. The answer of "Do you have any oral or maxillofacial area injuries?"

Variable	Frequency	Percentage
No	81	83.5
Yes	16	16.5
Total	97	100.0

teeth, mouth or dentures. It is concluded that the higher the total score, the more severe the problem and the lower the quality of life (Basol et al., 2014).

GOHAI, developed by Atchison and Dolan in 1990 was based on the following expression; oral-dental health can be measured through self-examination, oral-dental health changes from one to another, and this changing can be evidenced through the use of measurements based on the individual's self-perception, and self-perception has been determined as an oral dental health. GOHAI is based on a 12 item questionnaire with Likert-type responses (Montoya et al., 2008).

The GOHAI mean and standard deviation score was 8.381 ± 3.988 , indicating a low self-perception of oral health by the allocated sample. The maximum value was 19 points, and the minimum value was 1 point. The OHIP mean and standard deviation score was 11.25 ± 3.553 , indicating a low self-perception of oral health by the allocated sample. The maximum value was 21 points, and the minimum value was 3 points. OHIP shows low scores based on these results. It should be remembered that the higher the total score, the more severe the problem and the lower the quality of life.

According to the first sub cluster; dental floss, dental control, brushing, gingival health, age, dieting and education was found significantly related with these two indexes. The ratios of these variables were as follows: dental floss; 56.7%, dental control; 80.4%, brushing; 99%, gingival health; 96.9%, dieting; 94.8%, education 100% and the mean age was 18.96 ± 3.731 . These results indicate positive correlations among GOHAI and OHIP indexes and positive results for elite athletes included to the current study.

Oral hygiene means to keep the mouth and teeth clean to prevent dental problems. Not provide oral hygiene and not brushing teeth significantly increases oral bacteria in the saliva. In this case, saliva increases the concentration of bacteria (Langmore et al., 1998). Inflammation of the gums is induced by bacterial plaque (Shay, 2002). Infection process impairs oral hygiene. It does cause gingivitis and tooth decay (Kornman et al., 2000). As a result, evidence of this can be seen clinically with changes in tissue color from pink to red, swelling, and bleeding starts (Armitage, 2003).

Elite athletes were included in the current study were dieting with 94.8% ratio. According to the outcomes of Carole and Palmer (2009), nutritional status and dietary habits can affect and be affected by oral conditions. Addition to that, diet and nutritional factors can play important roles in oral health and disease. Especially, elite athletes also need to be aware of their nutritional goals and their meals should be checked by a dietician (Maughan et al., 2011). Epidemiological studies have shown that individuals with little or no education have much worse dental health than those with well education (Chen et al., 1997). To maintain oral and dental health routine professional care, patient education, environmental hygiene and nutrition education is required (Baker et al., 2010; Yu et al., 2001).

During athletic training and competition, the risk of injury to the teeth, arches, lips and gums increases when they are not wearing a mouth guard. Dentists should educate athletes and trainers about the importance of using mouth guard during athletic training and competition to reduce the risk of injury (Özdemir and Ersoy, 2010).

As a result, the variables that affect the oral health of the athletes in the study based on multivariate analysis of the clustering results were observed to be healthy at the expected level. It has also been discovered the relationships between variables with dendrogram by using hierarchical cluster analysis.

Oral health is directly linked with general life quality and sports performance. Therefore to generate awareness using and educations on oral health is essential. In this study, the subjects answered GOHAI and OHIP questionnaires for the first time in their life. It can be considered that via current questionnaires generating awareness on oral health and oral health education should be fulfilled to some degree.

Conflict of Interests

The authors have not declared any conflict of interests.

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