SWEDISH DENTAL JOURNAL 2010;34(4):207-215

Self-perceived oral health and obesity among 65 years old in two Swedish counties

GUNNAR EKBÄCK[1], INGMAR NÄSLUND[2], SCOTT M MONTGOMERY[3,4,5], SVEN ORDELL[6,7]

Abstract

The aim of this study was to explore the association between oral health and obesity. The study was conducted in the spring of 2007 as a postal survey of all inhabitants born in 1942 and living in the two Swedish counties of Örebro and Östergötland. This questionnaire survey has been conducted every five years since 1992 but has been updated continually with additional questions and for the sweep used here, height and weight data were collected. A total of 8,313 individuals received the questionnaire and 6,078 of those responded (73,1%). The outcome variable oral health was measured using one global question and four detailed questions representing different aspects of oral health. The independent variable Body Mass Index (BMI) was calculated using self-reported height and weight. A difference in oral health between various BMI groups was found. The difference was both statistically significant and of clinical importance, particularly among the group with severe obesity who reported poorer self-perceived chewing capacity, lower satisfaction with dental appearance, increased mouth dryness and fewer teeth and lower overall satisfaction with oral health. In view of the increased risk of poor oral health demonstrated in this study for those with severe obesity, it may be of value to increase cooperation between dental care and primary health care for these patients.

Key words

Oral health, obesity, questionnaires, population studies, Body Mass Index

[1]Department of Dentistry, Örebro County Council, Örebro, Sweden
[2] Department of Surgery, Örebro University Hospital, Örebro, Sweden
[3] Hälsoakademin, Örebro University Hospital, Sweden
[4] Clinical Epidemiology Unit, Department of Medicine, Karolinska Institutet, Stockholm, Sweden
[5] Department of Primary Care and Social Medicine, Charing Cross Hospital, Imperial College, London, UK
[6] Dental Commissioning Unit, Östergötland County Council, Linköping, Sweden
[7] Department of Oral Public Health, Malmö University, Malmö, Sweden

Fetma och tandhälsa. En studie av 65-åringar i två svenska län

GUNNAR EKBÄCK, INGMAR NÄSLUND, SCOTT M MONTGOMERY, SVEN ORDELL

Sammanfattning

Studiens syfte var att studera sambandet mellan oral hälsa och fetma. Studien genomfördes våren 2007 som en enkätstudie av alla innevånare födda 1942 i två svenska landsting, Örebro läns landsting och Östergötlands läns landsting. Denna enkät har skickats till samma åldersgrupp vart femte år sedan 1992. Frågeställningarna har kontinuerligt kompletterats och 2007 kompletterades frågeställningarna med frågor om längd och vikt. Totalt 8,313 individer fick enkäten och 6,078 besvarade den (73,1%). Studien mätte munhälsa med hjälp av en global munhälsofråga samt fyra ytterligare frågeställningar som representerar olika aspekter av munhälsa. Den oberoende variabeln Body Mass Index (BMI) mättes med självrapporterad längd och vikt. Munhälsan varierade mellan olika BMI-grupper. Skillnaderna var både statistiskt signifikanta och kliniskt betydelsefulla. Speciellt hos gruppen med svår fetma, enligt BMI-gruppering, rapporterades sämre tuggfunktion, lägre nöjdhet med tändernas utseende, ökad muntorrhet och färre tänder samt en minskad tillfredställelse med sin munhälsa generellt. Med den ökade risk för dålig munhälsa som denna studie påvisar för gruppen med svår fetma är det viktigt att öka samarbetet mellan tandvård och övrig hälso- och sjukvård för denna grupp av patienter.

Introduction

Obesity is a rapidly growing medical, social and economic problem in the Western world. Obesity entails an increased risk of premature death, coronary artery disease, diabetes and a number of other diseases as well as lower quality of life [21, 29, 41]. On the other hand, oral health have a different pattern in the Western world there many important determinants of oral health seems to be a decreasing problem [30, 42]. Nevertheless there has been an increased focus on associations between obesity and some components of oral health, including caries and number of teeth [52] for various age groups and among children [11] as well as adults [39]. The terms "oral health" and "dental health" are often used synonymously and with different definitions [14, 51]. Oral health as applied in this study is consistent with a Swedish definition from 2002; *" Oral health is part of the general health and contributes to physical, mental and social well being by experienced and adequate oral functions in relation to individual circumstances and the absence of disease"* [14]. It is also consistent with the health definition by *Dolan* [8] in terms of being a condition of comfortable and functional dentition that allows individuals to continue their desired social roles. Locker [24] summarized his view in the following way "when talking about oral health, our focus is not on the oral cavity itself but on the individual and the way in which oral diseases, disorders and conditions, whether confined to the oral cavity or linked to other medical conditions, threaten or impact on health, wellbeing and quality of life".

Although the problems with definitions can be confusing, it can be stated that an association between oral health and general health implies that poor oral health is an indicator of poor general health [2]. Another factor making associations between obesity and oral health interesting is the idea of similar co-variation with lifestyle factors such as nutritional patterns [11]. Obesity and oral health can affect each other [52].

However, there are many studies showing conflicting results in this area [4-5, 10, 19, 28, 31, 33, 36-38]. There are few studies which focus on self-perceived oral health and obesity. This study focused on exploring these areas, to facilitate decisions about cooperation between different parts of medical services. The aim of this study was to explore the association between self-perceived oral health and obesity.

Methods

The study was conducted as a part of a postal survey in 2007. A total of 8,313 individuals received the questionnaire and 6,078 of those responded (73.1%). Subjects who did not answer the question about height and weight were excluded in this study. After excluding subjects with incomplete data for these questions, 5,732 individuals remained (69%). This study belongs to a longitudinal survey and data has earlier been collected in 1992, 1997 and 2002. The data were collected to be used as a tool for the planning of the dental health care services in Örebro and Östergötland counties. The survey started as a collaborative project and the counties was chosen by convenience and not with the purpose of being representative of the total Swedish country. The study design has previously been described by *Unell* [48].

Oral health was assessed from a conceptual model, adapted from *Gilbert et al.* [12] (Fig 1) using one single global item/question as indicator for a com-

Fig 1.Conceptual model of oral health showing associations between oral health constructs, adapted with revision from Gilbert et al [12]

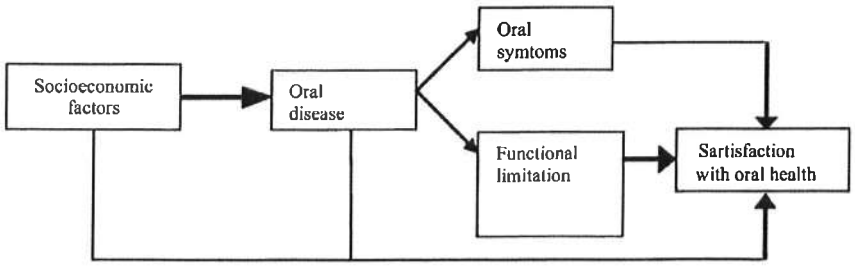

Table 1. Response rates of different aspects of oral health in % (n=5,732)

Oral health perspective	Questions oral health) (indicators for oral health	Answers and cut of points for dichotomizations	Total	Men	Women
Oral symptoms and functional limitations	Can you chew all sorts of food?	Very well	64.3	63.6	65.0
		Fairly well	29.5	29.6	29.4
		Less well	4.6	4.9	4.2
		Poorly	1.7	1.9	1.4
Oral symptoms and functional limitations	Are you satisfied with the appearance of your teeth?	Yes. very satisfied	14.1	15.4	12.7
		Yes. fairly satisfied	63.5	63.6	63.5
		No. not very satisfied	17.9	16.6	19.4
		No. absolutely not satisfied	4.4	4.4	4.4
Oral symptoms and functional limitations?	Do you feel dry in your mouth during the day	No. never	34.8	37.2	32.5
		No. seldom	37.0	39.7	34.2
		Yes. sometimes	22.3	19.2	25.5
		Yes. often	5.9	3.9	7.8
Disease	How many of your teeth do you have left?	All left	13.8	13.1	14.5
		Miss a few	58.2	58.7	57.8
		Miss fairly many	22.5	22.7	23.0
		Almost none left	2.5	3.0	2.2
		Completely toothless	2.5	2.6	2.5
Overall satisfaction with mouth	Are you in general satisfied with your teeth?	Yes. very satisfied	12.6	14.5	10.6
		Yes. fairly satisfied	64.4	63.6	65.3
		No. not very satisfied	17.0	15.8	18.3
		No. absolutely not satisfied	6.0	6.2	5.8

Table 2. Self-rated good oral health measured by one questions (oral disease). Logistic regression model (enter)

		Many remaining teeth	
		(OR)	95%CI
Gender	male	1	
	female	1.01	0.89-1.15
Education	primary education	1	
	secondary education	1.57***	1.32-1.86
	high school	2.15***	1.67-2.77
	university education	2.45***	2.04-2.94
	other education	1.44**	1.17-1.78
Place of residence	big town	1	
	small town	1.01	0.87-1.16
	rural	1.00	0.84-1.18
Experience of pedodontic dental care	scared several times	1	
	scared one time	1.76***	1.50-2.05
	never scared	2.33***	1.99-2.73
	don't remember	1.70***	1.26-2.29
Caregiver	public dentist	1	
	private dentist	1.84***	1.60-2.10
	other	0.86	0.43-1.71
	don't remember	0.08**	0.02-0.37
Country of birth	Sweden	1	
	other Scand. country	0.36***	0.25-0.51
	other country	0.44***	0.32-0.62
BMI group	normal weight	1	
	underweight	0.47	0.26-1.85
	overweight	0.94	0.81-1.09
	moderate obesity	0.67***	0.55-0.81
	severe obesity	0.47***	0.32-0.69
	extreme obesity	0.89	0.48-1.65

OR= Odds ratio, CI= Confidence interval. *P<0.05, **P<0.01, ***P<0.001

Table 3. Self-rated good oral health measured by three questions (oral, symtoms and functional limitations)). Logistic regression model (enter)

		Have good chewing capacity		Are satisfied with dental appearance		Are not dry in mouth during day	
		(OR)	95%CI				
Gender	male	1					
	female	1.35*	1.06-1.73	0.86*	0.75-0.99	0.60***	0.53-0.68
Education	primary education	1					
	secondary education	1.57**	1.13-2.19	0.98	0.82-1.18	1.10	0.93-1.30
	high school	2.53***	1.51-4.24	0.90	0.70-1.15	1.88***	1.45-2.43
	university education	2.45***	1.69-3.54	1.09	0.91-1.32	1.86***	1.56-2.22
	other education	1.44	0.97-2.14	0.96	0.77.1.20	1.15	0.94-1.42
Place of residence	big town	1					
	small town	1.19	0.92-1.55	1.20*	1.03-1.39	1.06	0.93-1.22
	rural	1.88***	1.32-2.68	1.39***	1.16-1.68	1.33**	1.12-1.58
Experience of pedodontic dental care	scared several times	1					
	scared one time	1.94***	1.43-2.62	2.00***	1.69-2.35	1.30**	1.12-1.58
	never scared	1.91***	1.43-2.56	2.30***	1.95-2.72	1.20*	1.03-1.39
	don't remember	2.53**	1.35-4.72	2.31***	1.64-3.24	1.27	0.94-1.71
Caregiver	public dentist	1					
	private dentist	1.75***	1.37-2.24	1.70***	1.47-1.96	1.25**	1.09-1.43
	other	0.70	0.27-1.83	1.36	0.64-2.86	0.71	0.36-1.40
	don't remember	0.24*	0.08-0.74	0.43	0.16-1.20	0.52	0.19-1.41
Country of birth	Sweden	1					
	other Scand. country	0.37***	0.23-0.62	0.96	0.64-1.43	0.72	0.50-1.02
	other country	0.26***	0.16-0.41	0.56**	0.40-0.79	0.65*	0.46-0.91
BMI group	normal weight	1					
	underweight	0.25**	0.11-0.56	0.56	0.31-1.01	0.59	0.33-1.04
	overweight	1.10	0.83-1.45	1.08	0.93-1.26	0.91	0.79-1.05
	moderate obesity	0.94	0.65-1.37	0.84	0.68-1.03	0.68***	0.56-0.83
	severe obesity	0.27***	0.16-0.45	0.61*	0.41-0.90	0.34***	0.23-0.50
	extreme obesity	0.41*	0.18-0.95	1.42	0.68-3.00	0.51*	0.29-0.92

OR= Odds ratio, CI= Confidence interval. *P<0.05, **P<0.01, ***P<0.001

pound oral health perspective and four more specific questions (Table 1). This model was proposed by adapting the work of *Locker* [25] & *Johnson and Wolinsky* [18] and has been evaluated in the Florida Dental Care study [13]. In accordance with this model, studies of oral health address the following main concepts: biological and physiological variables in terms of oral diseases, symptoms/functional limitations and oral disadvantage. Within this terminology, oral disease and tissue damage refers to disorders at the organic level or tissue loss. In this study one question ("How many teeth do you have left?") was used as an indicator of oral disease. This variable has been shown to be closely associated with clinical findings in an earlier study on this population [45]. Oral symptoms and functional limitations denote the consequences of disease and tissue damage for dysfunctions such as pain and inability to chew food adequately and were assessed with three questions. All five questions and their response categories are presented in Table 1.

All statistical analysis was performed using SPSS (version 14). Logistic regression analysis was performed with BMI group, gender, education, place of residence, frightening experience of pedodontic dental care, caregiver and country of birth as independent variables (Tables 2, 3 and 4) and the five questions in table 1 as dependent variables. For logistic regression the method "Enter" was used. All measures were modelled as series of dummy variables in the analysis. Body Mass Index (BMI) and cut off points, BMI group, frequency and range are shown in Table 5.

Statements of ethics

The original studies in 1992 and 1997 were approved by the Ethics Committee in the Örebro and Östergötland region, Sweden, but due to new regulations, approval by an ethics committee for the follow-up studies in 2002 and 2007 was not required.

Results

Analysis of non-response examined variation by

county and gender. The difference in non-response rates between counties was small, 26.4% and 27.7%, respectively (p=0.227). The non-response rate for men was somewhat higher (23.0%) than for women (21.3%) (p< 0.001).

All independent variables were tested for mutual correlation and no strong correlations exist. The strongest correlation found was between "frightening visit" and "country of birth" (Spearman's correlation 0.103). Adjusted values for odds ratios did not differ noticeably from unadjusted values.

The proportion of women and men with BMI>30 were 16% and 17%, respectively (Table 5). The group with severe obesity (BMI =35-39.9) showed a statistically significant odds ratio for deteriorated oral health, regardless of which oral health perspective was used in the analysis compared with the normal weight group (Tables 2, 3 and 4). They had fewer remaining teeth, worse perceived chewing capacity, lower satisfaction with dental appearance, increased mouth dryness and lower overall satisfaction with oral health. The overweight group showed no statistically significant differences in odds ratios while the group with moderate obesity had fewer remaining teeth and increased mouth dryness compared with the normal weight group. The group with extreme obesity had worse perceived chewing capacity and increased mouth dryness and finally, the group with underweight had worse perceived chewing capacity compared with the normal weight group. There were small gender differences in associations but women had in general higher OR compared with men in "experience of pedodontic dental care" (seldom or never scared in pedodontic dental care) (p<0.001) while men had higher OR in "caregiver" (private dentist) (p<0.001).

Table 4. Self-rated good oral health, measured by a single global question. Logistic regression model (enter)

		Generally satisfied with oral health	
		(OR)	95%CI
Gender	male	1	
	female	0.88	0.77-1.01
Education	primary education	1	
	secondary education	1.09	0.90-1.30
	high school	1.17	0.91-1.50
	university education	1.45***	1.20-1.75
	other education	1.05	0.84-1.31
Place of residence	big town	1	
	small town	1.21*	1.04-1.41
	rural	1.40***	1.16-1.68
Experience of pedodontic dental care	scared several times	1	
	scared one time	1.91***	1.62-2.25
	never scared	2.32***	1.96-2.74
	don't remember	1.82***	1.33-2.51
Caregiver	public dentist	1	
	private dentist	1.77***	1.54-2.04
	other	0.73	0.37-1.45
	don't remember	0.40	0.15-1.10
Country of birth	Sweden	1	
	other Scand. country	0.63*	0.44-0.91
	other country	0.51***	0.36-0.72
BMI group	normal weight	1	
	underweight	0.82	0.43-1.57
	overweight	1.05	0.90-1.22
	moderate obesity	0.91	0.74-1.13
	severe obesity	0.43***	0.29-0.63
	extreme obesity	1.25	0.62-2.51

OR= Odds ratio, CI= Confidence interval. *P<0.05, **P<0.01, ***P<0.001

Discussion

Although Statistics Sweden (SCB) provides detailed and updated information about residents in the country, it is important to consider potential problems with self-reported data. A census study minimizes some problems with selection bias and can be practical if the population is limited [27]. Despite that, non-response is often a problem. Other common limitations in validity for self-reported data can lead to recall and other forms of reporting bias. In addition, there is a possibility that behaviours that have a positive or negative attribution have been over or under reported. In this study it may lead to

Table 5. BMI groups by gender (n=5,732)

		Men		Women	
	BMI	Frequency	Percent	Frequency	Percent
Underweight	<18.5	8	0.3	46	1.6
Normal weight	18.5-24.9	911	31.8	1 264	44.1
Overweight	25-29.9	1 453	50.7	1 093	38.1
Moderate obesity	30-34.9	405	14.1	358	12.5
Severe obesity	35-39.9	68	2.4	72	2.5
Extreme obesity	>39.9	20	0.7	34	1.2

underestimation of weight and overestimation of height, resulting in lower BMI. This survey targeted all 65-year-old residents in two Swedish counties comprised both urban and rural areas. The response rate was high and differences in response rates by gender and between counties were small, indicating that the results are representative of people in these counties who were born in 1942. In broad terms, this sample is representative of the Swedish population for this birth cohort, excluding areas with a very high exclusively urban or rural composition [15]. The confidence intervals and internal consistency indicate that statistical significance is not an artefact of large sample size. Most of the results in this study were also of notable magnitude suggesting clinical relevance.

The measures and results have clear face validity and interpretation is facilitated by by the fact that other studies have adopted this questionnaire in several countries [16-17, 32, 44-47]. The purpose of the survey was firstly to fulfil the county councils' obligations in planning and measuring health status for the inhabitants but secondly also for scientific research. A weakness of the study is that when the study began in 1992 there were no well-tested relevant questionnaire-based instruments available in Swedish. This has resulted in longitudinally consistent use of some original questions that are less than ideal. Despite this, the study has been demonstrated to be a useful research tool which has been used to influence policy [9].

Self-perceived oral health is a multidimensional construct and several authors have used different models to describe various determinants of oral health [13, 23, 26, 50]. In this study it is measured in several ways using a conceptual theory. Number of teeth is a relevant indicator of oral disease because more severe manifestations of both caries and periodontitis, the most frequent oral diseases, result in loss of teeth [40]. Chewing capacity, dental appearance and dry mouth reflect functional limitation, pain and discomfort. In this study, satisfaction with oral health is measured with a single global question. The use of a single item measure is widespread in medical disciplines other than odontology. They are deemed to be of value since they, can assess components of what a multi-item instrument measures [6, 34]. Earlier research has shown that single-item measures can be more than adequate for measuring oral health and general health [3, 7, 20, 34].

Despite the use of multiple measures of oral health in this study, there are limited numbers of independent variables included in the logistic regression models, thus unobserved heterogeneity and the potential for misinterpretation of data.

The results show clinical important differences in oral health between those with obesity and normal weight. In this study the overweight group shows a small difference in oral health compared with the normal weight group while the group with severe obesity shows the clearest deterioration. The underweight group has also poorer oral health and in this respect is similar to the obese group. However, this group is small (n=54) and heavily skewed as concerns gender (Table 5). The BMI distribution by sex found by this study is consistent with other general population studies in similar areas [22]. The results demonstrate significant associations between people's satisfaction with their oral health and severe obesity. It also show significant associations between different oral health determinants (number of teeth, chewing capacity, dental appearance, dry mouth) and severe obesity. This is consistent with other studies showing association between tooth loss and obesity [39, 52]. Partly because of the limited number of high qualitative studies, SBU (The Swedish Council on Technology Assessment in Health Care) have not previously reported any associations between obesity and caries in their caries report [43].

In contrast to the results from *Östberg et al* (but consistent with *Sheiham et al*), this study supports strong associations between obesity and number of teeth over the age of 60 years [39, 52]. In this study of 65-years olds, obesity (in particular severe obesity) was strongly associated with poor oral health, also when measured by number of teeth. Even so, comparing results can be problematic due to variation in study design and measures. This study is dependant on self-reported data to estimate BMI in contrast to the study of *Östberg et al.* In this study, self-reported number of teeth was dichotomized between all present or missing a few; and many missing, almost none left or completely toothless. In contrast, *Östberg et al.* used another dichotomized scale: more or fewer than twenty teeth. There were also differences between the studies in terms of age distribution. This study is a cross-sectional study of a single age group; so cohort and period effects can limit comparability with other groups [1].

In conclusion, our study provides strong support for the statement that obese patients, particularly those with severe obesity, are at risk of poorer oral

health. This is consistent with reports from WHO with recommendations on diet and physical activities to tackle the rapidly growing burden of diseases, including obesity [49] and caries [35], which are closely linked to unhealthy environments and lifestyles. These findings highlight the importance for health care providers to prioritize regular dental visits and advice for obese patients, in view of their increased risk of poor oral health. The poor oral health demonstrated in severely obese men and women, suggests that it may be of value to increase cooperation between dental care and primary health care for these patients.

Acknowledgments

This study was supported by the Department of Dentistry, Örebro County Council, Örebro, and by the Dental Commissioning Unit, Östergötland County Council, Linköping.

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Address
Dr Gunnar Ekbäck
Dental Department, Örebro County Council
PO Box 1613
SE-70116 Örebro, Sweden
E-mail: gunnar.ekback@orebroll.se