Disciplinarum Scientia. Série: Ciências da Saúde, Santa Maria, v. 21, n. 3, p. 1-12, 2020.
Recebido em: 05.03.2020. Aprovado em: 13.11.2020.

ISSN 2177-3335

DOI: doi.org/10.37777/dscs.v21n3-001

IMPACT OF DYSPNEA ON ORAL HEALTH-RELATED QUALITY OF LIFE AMONG OBESE INDIVIDUALS PRIOR TO BARIATRIC SURGERY

IMPACTO DA DISPNEIA NA QUALIDADE DE VIDA RELACIONADA À SAÚDE BUCAL DE INDIVÍDUOS OBESOS ANTES DA CIRURGIA BARIÁTRICA

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ABSTRACT

Objectives: Dyspnea (shortness of breath) is common among obese individuals. However, no studies have evaluated the effect of dyspnea on oral health-related quality of life (OHRQoL). The aim of the present study was to evaluate the impact of dyspnea on the OHRQoL of obese individuals prior to bariatric surgery. **Methods:** A cross-sectional study was conducted with 104 obese individuals. Data were collected on socio-demographic characteristics, body mass index, perceptions of xerostomia (dry mouth), tooth loss and OHRQoL (OHIP-14). Poisson regression analysis was used to determine the association between dyspnea and OHRQoL. **Results:** Individuals with dyspnea had higher total OHIP-14 scores (1.40 ± 3.74) compared to those without dyspnea (0.50 ± 0.39) (P = 0.005). In the multivariate analysis, total OHIP-14 scores were 3.91-fold higher among the individuals with dyspnea. All domains of the questionnaire were associated with dyspnea, except physical disability and psychological disability. **Conclusion:** Dyspnea exerted a negative impact on OHRQoL in obese individuals, independently of socio-demographic and clinical characteristics.

Keywords: Dyspnea; Quality of life; Oral Health; Obesity.

RESUMO

Objetivos: A dispneia (falta de ar) é comum entre indivíduos obesos. No entanto, nenhum estudo avaliou o efeito da dispneia na qualidade vida relacionada à saúde bucal (QVRSB). O objetivo do estudo foi avaliar o impacto da dispneia na QVRSB em indivíduos obesos antes da cirurgia bariátrica. Métodos: foi realizado um estudo transversal com 104 indivíduos obesos. Os dados foram coletados sobre características sociodemográficas, índice de massa corporal, percepção de xerostomia (boca seca), perda dentária e QVRSB (OHIP-14). Regressão de Poisson foi utilizada para determinar a associação entre dispneia e QVRSB. Resultados: Indivíduos com dispneia tiveram um escore total do OHIP-14 alto (1.40 ± 3.74), comparados com aqueles sem dispneia (0.50 ± 0.39) (P = 0.005). Na análise multivariada, o escore total do OHIP-14 foi 3,91 vezes maior entre os indivíduos com dispneia. Todos os domínios do questionário foram associados com dispneia, exceto deficiência física e deficiência psicológica. Conclusion: Dispneia exerce um impacto negativo na QVRSB em indivíduos obesos, independente das características clínicas e sociodemográficas.

Palavras-chave: *Dispneia; Qualidade de vida; Saúde bucal; Obesidade.*

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INTRODUCTION

Obesity is a systemic disease that favors the development of numerous comorbidities, exerting a negative impact on quality of life and increasing the risk of premature death (KAPLAN *et al.*, 2018; KOLOTKIN, ANDERSEN, 2017). Cardiovascular disease, respiratory disease and cancer are among the most common conditions found in obese individuals (CINAR *et al.*, 2016; BHUPATHIRAJU, HU, 2016; MA, REDDY, HIGA, 2016). Obesity has also been associated with oral problems, such as periodontal disease (NASCIMENTO *et al.*, 2015) and tooth loss (NASCIMENTO *et al.*, 2016). Obstructive sleep apnea syndrome (ASHRAFIAN *et al.*, 2015) alveolar hypoventilation syndrome (COLLET *et al.*, 2007) and asthma (JAVANAINEN *et al.*, 2010) are among the most common respiratory illnesses in this population, all of which are associated with dypsnea (shortness of breath).

Dyspnea is the subjective perception of difficulty breathing, which is perceived as discomfort during movement or at rest (SMITH *et al.*, 2001; PARSHALL *et al.*, 2012). In obese individuals, the loss of respiratory quality may be explained by the occurrence of respiratory comorbidities and the greater accumulation of fat in the abdominal regions, which hampers the movement of the diaphragm and expansion of the thoracic cage. Thus, reducing one's body weight could lead to improvements in both respiratory distress and quality of life in this population (MENDES, VARGAS, 2017).

The use of patient-reported outcomes is necessary to improving the measurement of opinions and responses to treatment (MCGUIRE, SCHEYER, GWALTNEY, 2014). Therefore, the evaluation of oral health-related quality of life (OHRQoL) is a useful complement to normative measures and several assessment tools have been developed for this purpose (LOCKER, ALLEN, 2007). One such assessment tool is the Oral Health Impact Profile-14 (OHIP-14), which has been widely used in different populations (SLADE, 1997), including obese individuals (BASHER *et al.*, 2017), and a translated version has been validated for use on the Brazilian population (OLIVEIRA, NADANOVSKY, 2005).

The literature offers clear evidence that the loss of body weight and reductions in harm to health following bariatric surgery have a positive impact on quality of life (KOLOTKIN, ANDERSEN, 2017). The association between dyspnea and quality of life has also been demonstrated, but only in individuals with respiratory disease and not obese individuals (LEE *et al.*, 2017). OHRQoL has been associated with different oral health conditions (HAAG *et al.*, 2017), socio-behavioral aspects (MAIDA *et al.*, 2013) and the body mass index (BMI) (ZANATTA *et al.*, 2012). However, no studies were found evaluating the effect of dyspnea on the OHRQoL of obese individuals prior to bariatric surgery. Thus, the aim of the present study was to evaluate the impact of dyspnea on OHRQoL in obese individuals after adjusting for confounding factors.

METHODS

SAMPLE AND DATA COLLECTION

An observational cross-sectional study was conducted as part of a longitudinal study involving the evaluation of obese individuals before and after bariatric surgery. Data collection for the present study occurred between December 2016 and February 2017. All patients who sought bariatric surgery at a private medical office in the city of Santa Maria in southern Brazil composed the sample. The city has a population of approximately 270 thousand inhabitants and is a care reference for obesity in the region. This study received approval from the Human Research Ethics Committee of the Franciscan University Center (certificate number: 62100316.2.0000.5306) and all participants signed a statement of informed consent.

The eligibility criteria were age 18 years or older, BMI $\geq$ 35 Kg/m^2 associated with comorbidities or BMI $\geq$ 40 Kg/m^2 without necessarily being associated with comorbidities and candidate for bariatric surgery. The sample size was estimated based on data from a longitudinal study on quality of life prior to and after bariatric surgery. The difference in means of the Medical Outcomes Study Short Form Health Survey (SF-36 - mental component) was used for the calculation (mean ± standard deviation: 39.8 ± 10.2 and 49.0 ± 8.4) (ROBERT *et al*., 2013). Considering a 1% significance level, 90% study power and two-tailed hypothesis test, a minimum of 62 obese individuals would be required. This number was increased to 104 to compensate for a possible 40% dropout rate.

Data were collected on socio-demographic characteristics, behavioral characteristics and health conditions using a structured questionnaire. Perceptions of oral conditions were also determined: xerostomia ("does your mouth feel dry?") (FLINK *et al*., 2008) and tooth loss ("Have you ever lost a permanent tooth?") (CYRINO, MIRANDA COTA, PEREIRA LAGES, 2011).

Body weight was measured using an analog scale (Filizola, São Paulo, Brazil) with a capacity for 1000 kilograms; the participant wore light clothing with no accessories or shoes. Height was determined using a metric column coupled to the scale. The BMI was calculated as weight (Kg) divided by height (m) squared. Obesity was categorized as follows: 30 to 34.9 kg/m^2 = mild (Grade I), 35 to 39.9 kg/m^2 = moderate (Grade II) and $\geq$ 40 kg/m^2 = morbid (Grade III) (WHO, 2000).

DYSPNEA

Dyspnea was determined using the modified Medical Research Council (mMRC) and modified BORG (BORGmod) scales. The mMRC scale measures the participant's perception of shortness of breath in five categories: 0) when shortness of breath emerges only after performing intense physical activity; 1) shortness of breath is felt when walking fast on a flat surface or walking up an incline;

2) the perception of walking slower than others of the same age due to shortness of breath or feeling shortness of breath when walking on a flat surface; 3) shortness of breath when walking less than 100 meters or a few minutes on a flat surface; and 4) shortness of breath impedes leaving the house or dressing (complete disability). The BORGmod scale quantifies shortness of breath on a ten-point scale ranging from "no shortness of breath" to "maximum shortness of breath" based on perception at rest, with higher score denoting greater intensity of dyspnea (BORG, 1982).

ORAL HEALTH-RELATED QUALITY OF LIFE

The outcome was OHRQoL measured using the Oral Health Impact Profile (OHIP-14), which has been translated and validated for use in Brazil (OLIVEIRA, NADANOVSKY, 2005). The OHIP-14 has fourteen items distributed among seven domains (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and social handicap). Each domain has two items scored from 0 to 4 points: never, rarely, sometimes, often and very often. Severity (total score) was determined by the sum of all scores and ranged from 0 to 56 points, with higher scores denoting greater negative impact perceived by the participant.

DATA ANALYSIS

The analysis of the OHIP-14 was performed with the sum of the item scores and different domain scores. The variables were categorized: dyspnea determined by the mMRC scale dichotomized as "without dyspnea" (categories 0 and 1) and "with dyspnea" (categories 2, 3 and 4), gender (female and male), age in years (75th percentile: ≤ 44 or > 44 years), employment (works or does not work), tobacco use (non-smoker or former/current smoker), alcohol use (non-user or former/current user), physical activity (yes or no), BMI (< 40 or ≥ 40 kg/m²), xerostomia (yes or no) and tooth loss (yes or no).

The Shapiro-Wilk test was used to determine the normality of the data. The Mann-Whitney test was used to compare OHIP-14 scores between participants with and without dyspnea. Poisson regression models with robust variance were run to determine covariables associated with OHRQoL. The stepwise backward method was used, with the elimination of variables one-by-one with higher P-values until only those with $p < 0.20$ remained. In the final model, rate ratios (RR) and 95% confidence intervals (CI) were estimated to determine the strength of the associations between dyspnea and both the total OHIP-14 score and domain scores. The data were analyzed using the Predictive Analytics SoftWare (PASW, version 22.0, Chicago, IL, USA).

RESULTS

One hundred four obese individuals were included in the study (62 without dyspnea and 42 with dyspnea). The response rate was 100%. Table 1 displays the socio-demographic, behavioral and clinical characteristics of the sample. Most of the participants with and without dyspnea were women (85.7% and 79.0%, respectively), employed (80.5% and 81.4%), non-smokers (76.2% and 80.6%) and non-practitioners of physical exercise (83.3% and 85.5%). Most had Grade III obesity (85.7% and 67.7%), reported not having xerostomia (63.3% and 61.0%) and reported having no missing teeth (56.8% and 61.7%). Approximately 50% of both groups consumed alcoholic beverages.

Table 1 - Distribution of socio-demographic, behavioral and clinical characteristics of obese individuals with and without dyspnea.

Variables	With dyspnea	Without dyspnea
	n (%)	
Age (years): mean ± SD	40.1 ± 10.6	37.5 ± 9.4
Sex		
Female	36 (85.7)	49 (79.0)
Male	6 (14.3)	13 (21.0)
Employment		
Works	33 (80.5)	48 (81.4)
Does not work	8 (19.5)	11 (18.6)
Tobacco use		
Non-smoker	32 (76.2)	50 (80.6)
Former/current smoker	10 (23.8)	12 (19.4)
Alcohol use		
Non-user	22 (52.4)	30 (48.4)
Former/current user	20 (47.6)	32 (51.6)
Physical activity		
Yes	7 (16.7)	9 (14.5)
No	35 (83.3)	53 (85.5)
Obesity		
Grade II	6 (14.3)	20 (32.3)
Grade III	36 (85.7)	42 (67.7)
Xerostomia		
No	28 (63.6)	36 (61.0)
Yes	16 (36.4)	23 (39.0)
Tooth loss		
No	25 (56.8)	37 (61.7)
Yes	19 (43.2)	23 (38.3)
Total	**42**	**62**

The impact on OHRQoL was low, as the mean (± standard deviation) score was 2.52 ± 0.63. In the comparison of the OHIP-14 scores between the groups with and without dyspnea (Table 2),

a statistically significant difference in mean total score was found (1.40 ± 3.74 versus 0.50 ± 0.39) (P < 0.001). The functional limitation, physical pain, psychological discomfort, social disability and social handicap scores were significantly higher in the group with dyspnea compared to the group without dyspnea.

Table 2 - Comparison of OHIP-14 scores in obese individuals with and without dyspnea.

	With dyspnea		Without dyspnea		P*
$OHIP_{14}$ (range in score)	**Mean (SD)**	**Observed range**	**Mean (SD)**	**Observed range**	
Total score (0-56)	1.40 (3.74)	0-15	0.50 (0.39)	0-3	<0.001
Domain scores (0-8)					
Functional limitation	0.28 (0.63)	0-2	0.17 (0.13)	0-1	**0.003**
Physical pain	0.18 (0.54)	0-2	0.00 (0.00)	0-0	**0.008**
Psychological discomfort	0.23 (0.77)	0-4	0.00 (0.00)	0-0	0.018
Physical disability	0.14 (0.51)	0-2	0.17 (0.13)	0-1	0.170
Psychological disability	0.21 (0.74)	0-4	0.18 (0.13)	0-1	0.077
Social disability	0.23 (0.74)	0-4	0.00 (0.00)	0-0	**0.008**
Social handicap	0.16 (0.53)	0-2	0.00 (0.00)	0-0	**0.018**

* Mann-Whitney test

In the univariate analysis (Table 3), dyspnea was significantly associated with the mean total OHIP-14 score (P = 0.005) as well as the functional limitation (P = 0.002), physical pain (P = 0.008), psychological discomfort (P = 0.021), psychological disability (P = 0.049), social disability (P = 0.017) and social handicap (P = 0.018) domains. When the model was adjusted for age, employment, BMI, xerostomia and tooth loss, the total OHIP-14 scores were 3.91-fold (95% CI: 1.44 to 10.61) higher among the individuals with dyspnea and only the psychological disability domain lost its association with dyspnea (P = 0.071).

Table 3 - Association between dyspnea and both total OHIP-14 score and domain scores.

Variables	RR (95%CI)[b]	P	RR (95%CI)[a]	P
Total OHIP-14 scale	3.89 (1.50-10.09)	**0.005**	3.91 (1.44-10.61)	**0.007**
Functional limitation	1.29 (1.10-1.52)	**0.002**	1.28 (1.08-1.51)	**0.004**
Physical pain	1.20 (1.05-1.38)	**0.008**	1.20 (1.04-1.38)	**0.011**
Psychological discomfort	1.26 (1.03-1.53)	**0.021**	1.26 (1.03-1.56)	**0.025**
Physical disability	1.13 (0.99-1.29)	0.078	1.12 (0.98-1.30)	0.104
Psychological disability	1.21 (1.00-1.45)	**0.049**	1.20 (0.98-1.47)	0.071
Social disability	1.26 (1.04-1.51)	**0.017**	1.25 (1.03-1.54)	**0.021**
Social handicap	1.17 (1.03-1.34)	**0.018**	1.18 (1.03-1.35)	**0.016**

RR: rate ratio; Crude analysis[b] and analysis adjusted[a] for age, employment, BMI, xerostomia and tooth loss

DISCUSSION

The present study evaluated the effect of shortness of breath in obese individuals on OHRQoL. The findings show low OHIP-14 scores, but a significant association between dyspnea and OHRQoL,

even after adjusting for demographic, behavioral and clinical variables. Studies have evaluated quality of life in patients with different diseases and report worse results for those with symptoms of dyspnea. In a cross-sectional study involving patients with chronic obstructive pulmonary disease with and without dyspnea, those who reported shortness of breath has worse quality of life scores (SULLIVAN *et al*., 2013). Arnold *et al.* (2009) found a negative impact of dyspnea on the quality of life of patients with coronary artery disease. In patients with idiopathic pulmonary fibrosis, higher mMRC scores were associated with poorer quality of life (RAJALA *et al*., 2007) and the same association has been identified in patients with lung cancer (SMITH *et al*., 2001). In the present study, dyspnea was associated with a negative impact on OHRQoL. No previous study was found evaluating this possible association. The plausibility of the finding may reside in physical limitations with regard to performing activities of daily living in these individuals. Moreover, the craniofacial complex enables humans to perform diverse functions, such as smiling, breathing, chewing, detecting aromas and speaking (PETERSEN, YAMAMOTO, 2005), all of which can be compromised by dyspnea. In the present, nearly half of the obese individuals had moderate to severe dyspnea, determining negative impacts on both physical and mental domains of the OHIP-14.

The main determinants of OHRQoL in different populations have been social and behavioral factors (COHEN-CARNEIRO, SOUZA-SANTOS, REBELO, 2011) as well as oral conditions, such as xerostomia (NIKLANDER *et al*., 2017) and tooth loss (HAAG *et al*., 2017). Moreover, individuals with a higher BMI experience a negative impact on OHRQoL compared to those with a lower body weight (ZANATTA *et al*., 2012). However, one study found no association between obesity and OHRQoL, which was measured using the Oral Impacts on Daily Performance questionnaire (YAMASHITA *et al*., 2015). While all these factors could contribute to a negative impact on OHRQoL among obese individuals, the results in the present study were adjusted for age, employment, BMI, xerostomia and tooth loss, thereby strengthening the association between dyspnea and OHRQoL.

Therefore, OHRQoL has a multidimensional nature. The individuals with dyspnea reported a negative impact on items related to function and oral pain as well as those related to the psychosocial component. In general, obese individuals, especially those with dyspnea, may have low self-esteem, may exhibit carelessness with regard to both personal and oral hygiene and may seek dental care little (NASCIMENTO *et al*., 2016, ÖSTBERG *et al*., 2012, WU, BERRY, 2017). Concerns with the oral cavity may be associated with the perception that obesity and dyspnea have a harmful effect on oral health. Moreover, this population is more associated with psychiatric and cognitive disorders (BOER, KOLBE, WILSHER, 2014), which could contribute to and explain the negative impact on the psychological and social dimensions of OHRQoL.

The OHIP-14 scores were very low among the obese individuals in both groups and the physical disability and psychological disability domains were not associated with dyspnea after the adjustment of the model. These results may be explained by the fact that a convenience sample was used, with the

inclusion of all obese individuals who sought bariatric surgery at a private clinic and therefore had a higher socioeconomic status. Socioeconomic level is associated with better oral health status in comparison to less privileged population and exerts an impact on perceptions with regard to OHRQoL. Populations with a higher socioeconomic status may have greater access to oral health services as well as better perceptions regarding their oral health and, consequently, OHRQoL on disability domains (GUPTA *et al*., 2015, REBELO *et al*., 2016). Therefore, one may hypothesize that OHRQoL may be impacted more in obese individuals who visit public services and are awaiting bariatric surgery. Moreover, the general health status of the sample was poor, as more than 75% were morbidly obese and many had comorbidities, which exerts a strong impact on general quality of life (KAPLAN *et al*., 2018; KOLOTKIN, ANDERSEN, 2017) and helps explain the low impact on OHRQoL as well as the lack of differences in some domains.

One of the limitations of the present study is the fact that respiratory aspects were determined only using subjective measures (mMRC and BORGmod scales). However, these measures have been defined as the most adequate for evaluating dyspnea (GERLACH, WILLIAMS, COATES, 2005) and the mMRC scale is considered a standard assessment tool for determining dyspnea in daily practice (PEREZ *et al*., 2015). Another limitation is the fact that the clinical dental data were collected based only on the perceptions of the participants, which likely led to underestimations of the occurrence of the outcomes. Moreover, the convenience sample constitutes selection bias. Recruiting locations and volunteerism may not represent the population, since reference health centers, such as a private clinic, may concentrate patients with greater exposure to confounding factors. However, multivariate analysis was performed in an attempt to control exposure to potential confounding factors.

The present data underscore the importance of dyspnea prevention and treatment strategies, especially in obese individuals, to improve OHRQoL. Thus, public and private policies directed at improving the health status of this population should be implemented. The association between dyspnea and a negative impact on OHRQoL can be generalized to obese individuals with similar socio-demographic and clinical characteristics to those who participated in the present study. Longitudinal studies involving different populations are needed to confirm these results.

CONCLUSION

Dyspnea in obese individuals prior to bariatric surgery exerted a negative impact on OHRQoL, independently of confounding variables.

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