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Original articles

Mastication and deglutition in obese children and adolescents

Mastigação e deglutição de crianças e adolescentes obesos

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ABSTRACT

Purpose: to characterize the orofacial myofunctional profile of children and adolescents with obesity compared to a group of eutrophic and check which aspects influence the functions of chewing and swallowing.

Methods: they checked the organs of the Stomatognathic system, chewing and swallowing by applying the Myofunctional Assessment Protocol Orofacial with Expanded Scores (AMIOFE-E) in 50 female and male individuals, aged between 9 and 18 years, met in an outpatient of Nutrology. They were divided into two groups, the research group, obese group, and the control group, of eutrophic people. The statistical tests used were: analysis of variance (ANOVA), Fisher's exact Test, confidence interval for mean and coefficient of Variation.

Results: the obese people, when compared to eutrophic people, showed worse performance in tonicity and mobility aspects of cheeks and swallowing ($p < 0.05$), and 71% of individuals with tonicity reduction presented multiple swallows against 25% of eutrophic individuals. In addition, 68% of obese children and adolescents from that research showed alternating bilateral chewing.

Conclusion: the obese children and adolescents studied in this research presented a higher occurrence of orofacial myofunctional changes when compared to eutrophic people in relation to tonicity and mobility of cheeks and swallowing. In this research, there was also a statistical association between the reduction of obese children and adolescents´s cheeks tonicity and the presence of multiple swallows during swallowing.

Keywords: Chewing; Obesity; Child; Adolescent

RESUMO

Objetivo: caracterizar o perfil miofuncional orofacial de crianças e adolescentes com obesidade comparados a um grupo de eutróficos e verificar quais aspectos influenciam as funções de mastigação e deglutição.

Métodos: foram avaliados os órgãos do sistema estomatognático, a mastigação e a deglutição aplicando o protocolo de Avaliação Miofuncional Orofacial com Escores Expandidos (AMIOFE-E) em 50 indivíduos do sexo feminino e masculino, com idades entre 9 e 18 anos, atendidos em um ambulatório de Nutrologia. Eles foram divididos em dois grupos, o grupo pesquisa, de obesos, e o grupo controle, de eutróficos. Os testes estatísticos utilizados foram: análise de variância (ANOVA), Teste Exato de Fisher, Intervalo de Confiança para Média e Coeficiente da Variação.

Resultados: os obesos, quando comparados aos eutróficos, apresentaram pior desempenho nos aspectos de tonicidade e mobilidade de bochechas e na deglutição ($p<0,05$), sendo que 71% dos indivíduos com redução da tonicidade apresentaram deglutições múltiplas contra 25% dos indivíduos eutróficos. Além disso, 68% das crianças e adolescentes obesos dessa pesquisa apresentaram mastigação bilateral alternada.

Conclusão: as crianças e adolescentes obesos estudados nessa pesquisa apresentaram maior ocorrência de alterações miofuncionais orofaciais quando comparados aos eutróficos em relação à tonicidade e mobilidade de bochechas e na deglutição. Nesta pesquisa também houve associação estatística entre a redução da tonicidade de bochechas das crianças e adolescentes obesos e a presença de deglutições múltiplas durante a deglutição.

Descritores: Mastigação; Obesidade; Criança; Adolescente

INTRODUCTION

According to the World Health Organization (WHO) obesity is defined as a chronic disease that is characterized as abnormal or excessive fat accumulation that presents a risk to health, causing problems to the health of the individual, causing problems to the health of the individual. In several studies in recent years, there was the demonstration of the significant increase of overweight due to epidemiological, demographic and socioeconomic changes[1]. According to the data of the World Health Organization (WHO) 1.6 billion people over 15 years old were classified as overweight and 400 million people were obese in 2005[2]. The projections for 2015 are approximately 2.3 billion overweight people and more than 700,000,000[3] are obese.

A study in 2007 showed that genetic factors are less relevant in the incidence of obesity than the external socio-environmental factors, among them are: changes in eating habits (preference for processed foods, rich in fats and simple sugars) and in lifestyle, in which we can check the sedentary lifestyle of the population in recent decades[4].

In the investigation of the nutritional aspects, the orofacial myofunctional assessment performed by the speech-language pathologist is important, especially in children. Direct analysis of the functions as chewing may show of eutrophic difficulties in feeding that impact directly the nutritional state[5].

Commitment in the development of the Stomatognathic system or in the maintenance of its integrity will cause an inappropriate chewing function, interfering in food choice and diet quality[6].

Studies show that obese individuals could present problems in the Stomatognathic system due to the accumulation of adipose tissue in the oral and pharyngeal[7,8] cavity.

Some authors report that the obese individuals, due to facial feature reduced the tonus of lips and tongue, changing the chewing and swallowing (Berlese, 2012) [9].

Thus, the need to evaluate orofacial myofunctional conditions in obese children and adolescents is justified, considering the increase of cases seen in clinical practice, in order to offer a speech-language therapy and the treatment that answers these issues. Such knowledge will help in the planning of specific interventions against obesity, since there are few deeper studies on this topic.

In this context, the objective of this research was to characterize the orofacial myofunctional profile in children and adolescents with obesity, compared to a group of people and check if there were associations in orofacial myofunctional aspects and functions of chewing and swallowing between obese and eutrophic individuals.

METHODS

This research has received approval from the Research Ethics Committee at the Universidade Federal de São Paulo/UNIFESP with the number 17914813.6.0000.5505.

Fifty individuals of both genders, aged between 9 and 18 years old, attended the outpatient clinic of the Nutrition Department of the Department of Pediatrics of UNIFESP. These individuals were monitored on a regular basis by specialties (Nutritionist, nutritional doctor, Pediatrician, speech therapist, pediatric dentist and Psychologist). The parents signed the Termo de Consentimento Livre e Esclarecido and the participants signed the Termo de Assentimento. The sample was divided into two groups: obese individuals 25, who formed the research group, and 25 eutrophic individuals, who formed the control group. There was no distribution by gender and by age.

Inclusion criteria: were selected children and adolescents who after the assessment of nutritional status were classified as obese to form the research group. The control group was formed by children and adolescents who were classified as eutrophic people.

Individuals who after being evaluated by the team of Pediatric Dentistry were diagnosed with dental malocclusion and/or use of braces, in orofacial myofunctional therapy, with craniofacial abnormalities and mouth breathing, were excluded from the sample.

The participants were submitted to assessment of nutritional status by obtaining anthropometric data such as weight and height and waist circumference measurement. For the anthropometric data, the nutritionist performed height measurement using Alturexata ® portable stadiometer, with scale in millimeters, in flat smooth surface, guiding participants to remain in upright posture, with feet parallel, heels, calves, buttocks, shoulders and head, positioning it according to the Frankfurt Plane, which creates an imaginary horizontal line between the lower eyelid and the highest part of the ear lobe. For measurement of body weight, individuals wore light clothes, were barefoot and positioned on a digital anthropometric scale (Plenna ® brand), with scale 0, 1 kg, and the maximum load of 150 kg. The data of weight and height of each individual

were classified on growth curves expressed in percentiles and z-score of IMC and height for Age (5-19 years old for boys and girls), according to parameters of nutritional status indicators established by the WHO, 2007. The rating is performed by means of percentiles and z-score obtained, as described below:

Table 1. Rating of nutritional status of children and teenagers from 5 to 19 years old. Points of IMC for age, WHO 2007.

Critical values		Nutritional Diagnosis
< Percentile 0.1	< Z-Score -3	Severe thinness
≥ 0.1 Percentile and Percentile < 3	Z-Score ≥ -3 and < z-Score -2	Thinness
≥ 3 and ≤ 85 Percentile Percentile	-2 z-Score ≥ and ≤ z-Score +1	Eutrophy
> 85 Percentile and ≤ 97 Percentile	+1 z-Score ≥ and ≤ z-Score +2	Overweight
> 97 Percentile and ≤ 99.9 Percentile	+2 z-Score ≥ and ≤ z-Score +3	Obesity
> 99.9 Percentile	> Z-Score +3	Severe obesity

Table 2. Rating of nutritional status of children and teenagers from 5 to 19 years old. Points of height for age, WHO 2007

Critical values		Nutritional Diagnosis
< Percentile 0.1	< Z-Score -3	Very low height
≥ 0.1 Percentile and Percentile < 3	Z-Score ≥ -3 and < z-Score -2	Low height
≥ 3 Percentile	Z-Score ≥ -2	Adequate height

The measurement of waist circumference (CC) was measured using a flexible measuring tape made of inextensible fiber glass (*Fiber-Glass*) positioned on the midpoint between the last rib and iliac crest and properly measured the midpoint.

The CC is an important tool to identify excess weight (overweight and obesity) in children and adolescents from risks to the development of metabolic and cardiovascular complications (Hirschler et al. 2005)[10]. The values of the CC were classified according to the cut-off points proposed by McCarthy et al. (2001) [11].

The evaluations of the Stomatognathic system structures, as well as the functions of chewing and swallowing have been evaluated through the Orofacial Myofunctional Assessment Protocol Orofacial with Expanded Scores-AMIOFE-E (Felício, Folha, Ferreira, Medeiros; 2010) [12] a sensitive instrument to evaluate orofacial myofunctional disorders, such as malfunctions/changes of the appearance, posture and/or mobility and functions.

The myofunctional evaluation was applied by a speech therapist. In the evaluation the patients were sitting in a chair, with their feet on the ground. They filmed with a digital camera placed one meter away from the individual.-

The structures of the phono-articulatory organs were analyzed according to the AMIOFE-E Protocol, which appears in the following reviews: appearance and posture: lips, tongue, jaw and cheeks.

The position of the lips was analyzed according to the following criteria: normal posture; occlusion of the lips with tension; if there has been increased activity of lips and mentalis; If there was absence of labial occlusion with mild dysfunction or excessive and opening of the mouth with severe dysfunction.

For the position of the jaw were considered: normal posture when there was functional space free; occlusion of the teeth without functional space free; open mouth with mild dysfunction; excessive mouth opening with severe dysfunction.

As for the posture of cheeks were adopted the following criteria: normal; increased volume or flaccid/mild or severe arch.

For the position of the tongue were considered: If is contained in the oral cavity; If is interposed between the dental arches with adaptation or dysfunction; brought to the dental arches with excessive protrusion.

Concerning to the mobility of the structures of the phono-articulatory organs were requested movements to demonstrate: the lips movements of elevating, bringing down, and lateralizing. For the tongue,

movements of protrusion, right lateralization, left lateralization, lifting, lowering and ability to maintain the tongue stable in protrusion for five seconds. For cheeks, inflate, suck, retract and keep the air; jaw protrusion moves, lowering, lifting, right and left lateralization. Considered as normal: isolated movements of each component, with precision and no tremor. Considered with changes: lack of precision in movement, shaking, movements associated with other components and the inability to perform the movement.

The analysis was performed by 4 speech language pathologists experienced in orofacial motor function, assigning a score 3 points scale: 3 = normal, precise movements and no tremors; 2 = insufficient capacity when lack precision in movements, there are tremors and associated movements of other components; 1 = lack of ability or inability to perform the task.

As for breathing, patients were observed at home, in a normal position, and the breathing mode was assessed. Breathing was analyzed and considered nasal when the lip closed effortlessly, during rest[9].

Aiming at evaluating the chewing and swallowing, patients chewed and swallowed a piece of bread, as usual. As for chewing, the grinding, whether alternated, bilateral, simultaneous bilateral, chronic unilateral (95% of the time at the same side of the oral cavity), unilateral masticatory preference (66% of the same side), or anteriorly, and total time of food consumption[9], were analyzed. As for swallowing, the analysis was considered normal when the tongue was kept within the oral cavity, if there was contraction of the elevator muscles and lip closed effortlessly[9] .

After data collection and analysis, children and adolescents who had presented alteration to the masticatory and standard nutritional status were referred for evaluation and treatment in clinics of UNIFESP.

For the analysis of the results of this study, parametric tests were used, because the data were quantitative and continuous. In addition, there was a sampling of more than 30 subjects, which by the Central Limit Theorem ensures that the distribution tends to a Normal distribution.

Aiming at comparisons between the groups, a model of analysis of variance (ANOVA) was used. The ANOVA is a fairly usual parametric test that does a comparison of averages using the variance. The Fisher´s Exact Test, which is a non-parametric test that allows one to calculate the likelihood of Association of the features that are under consideration, was used as well.

The confidence for interval range is a technique used to analyze how the average may vary within a given probability of confidence. The coefficient of variation is a statistical test that evaluates how much variability represents the average. The result of each comparison is expressed in p-value**.**

RESULTS

The data in table 3 show that there was no statistically significant difference between the groups for scores of cheek appearance, its mobility and swallowing. Note that the scores of the Obese were always lower than those of Eutrophic people, as for Swallowing in those who scored respectively 12.00 and 13.16 (p-value = 0.037).

Table 4 shows the link between facial symmetry and chewing for each group.

A statistical relation between facial symmetry with chewing was found in both groups. Thus, individuals with symmetric face had bilateral chewing and the individuals with asymmetric face tended to show unilateral chewing.

In Table 5 the degree of relation between tonicity and swallowing was analyzed separately for each group using the Fisher´s Exact Test. The data of Chart 3 show that there was no statistical relation between multiple swallows and tone reduction. 71% of obese individuals who presented cheek tone reduction performed multiple swallows, while only 25% of eutrophic individuals demonstrated the same relation.

Table 3. Comparison between the obese and normal weight groups for the results of Myofunctional Assessment Protocol Orofacial with scores Expanded

Groups		Mean	Median	Standard Deviation	CV	Min	Max	N	IC	P-value
Face	Eutrophic	11,60	12	0,50	4%	11	12	25	0,20	0,515
	Obese	11,50	12	0,58	5%	10	12	26	0,22	
Appearance of Cheeks	Eutrophic	7,44	8	0,77	10%	6	8	25	0,30	<0,001*
	Obese	5,92	6	1,22	21%	4	8	25	0,48	
Relation Mandible/Maxilla	Eutrophic	12,00	12	0,00	0%	12	12	25	- x -	1,000
	Obese	12,00	12	0,00	0%	12	12	25	- x -	
Lips	Eutrophic	11,36	12	0,81	7%	10	12	25	0,32	0,953
	Obese	11,35	12	0,85	7%	10	12	26	0,33	
Mentalis	Eutrophic	3,72	4	0,46	12%	3	4	25	0,18	0,438
	Obese	3,62	4	0,50	14%	3	4	26	0,19	
Tongue	Eutrophic	7,84	8	0,55	7%	6	8	25	0,22	0,201
	Obese	7,54	8	1,03	14%	5	8	26	0,40	
Hard palate	Eutrophic	7,88	8	0,44	6%	6	8	25	0,17	0,583
	Obese	7,81	8	0,49	6%	6	8	26	0,19	
Tongue Mobility	Eutrophic	35,88	36	0,44	1%	34	36	25	0,17	0,317
	Obese	35,62	36	1,24	3%	30	36	26	0,47	
Lips Mobility	Eutrophic	24,00	24	0,00	0%	24	24	25	- x -	0,236
	Obese	23,81	24	0,80	3%	20	24	26	0,31	
Mandible Mobility	Eutrophic	30,00	30	0,00	0%	30	30	25	- x -	1,000
	Obese	30,00	30	0,00	0%	30	30	26	- x -	
Cheeks Mobility	Eutrophic	23,92	24	0,28	1%	23	24	25	0,11	0,049
	Obese	23,54	24	0,90	4%	21	24	26	0,35	
Breathing	Eutrophic	4,00	4	0,00	0%	4	4	25	- x -	0,083
	Obese	3,88	4	0,33	8%	3	4	26	0,13	
Swallowing	Eutrophic	13,16	14	1,93	15%	9	15	25	0,76	0,037
	Obese	12,00	12	1,94	16%	7	15	26	0,75	
Chewing	Eutrophic	13,88	14	2,13	15%	9	16	25	0,83	0,350
	Obese	13,36	13	1,75	13%	11	16	25	0,69	

Test ANOVA

Table 4. Relationship between the results of Symmetry and Masticatory function per Group

N		Asymmetric		Symmetric		Total		P-value
		%	N	%	N	%		
Eutrophic	Bilateral	1	10%	15	100%	16	64%	<0,001 (Y)
	Unilateral	9	90%	0	0%	9	36%	
Obese	Bilateral	3	27%	14	100%	17	68%	0,001 (Y)
	Unilateral	8	73%	0	0%	8	32%	

Fisher's Exact Test

Table 5. Relationship between the results of tonicity with swallowing function per Group

N		Flaccid		Normal		Total		P-value
		%	N	%	N	%		
Eutrophic	Multiple Swallows	1	25%	3	14%	4	16%	0,886
	No repeats of the swallowing of the same food bolus	1	25%	6	29%	7	28%	
	A repeat	2	50%	12	57%	14	56%	
Obese	Multiple Swallows	12	71%	3	38%	15	60%	0,123 (Y)
	No repeats of the swallowing of the same food bolus	3	18%	0	0%	3	12%	
	A repeat	2	12%	5	63%	7	28%	

Fisher's Exact Test

DISCUSSION

The obese children showed worse performance compared to eutrophic children regarding the appearance and movement of cheeks. The results showed that there was a statistically significant difference in average between the groups concerning reduction of the cheeks, a finding that differs from a study with obese adults, which found that the integrity and shape of the tongue, cheeks and jaw was preserved[13]. In this research, it was found that 68% of the obese children showed reduced tonicity and mobility of cheeks against only 16% of the eutrophic children. It must be considered that the reduction of the muscular tonus of phono-articulatory organs can impair chewing[14]. Studies show that obese individuals could present problems in the stomatognathic system due to the accumulation of adipose tissue in the oral cavity and pharynx[15.16]. Though the ages in the researches are different, there is a study with children of 17 and 25 months, which found that 57.1% of children examined presented hypotonia of the cheek and 42.8%, hypotonia of lips which interfered in the eating pattern[17].

The results showed that 68% of the obese individuals presented a bilateral alternating chewing, a finding consistent with the study by Berlese, et al., (2012)[18] in which 82.1% of the population of obese children studied showed alternating bilateral chewing. It is important to highlight that in this research, individuals with change in dental occlusion and/or use of braces, in orofacial myofunctional therapy, with craniofacial abnormalities and mouth breathing, were excluded.

The obese individuals showed lower effectiveness of swallowing as compared to eutrophic individuals. There was a statistically significant difference between obese people, who presented lower scores when compared to eutrophic people, regarding swallowing 12.00 and 13.16, respectively (p-value = 0.037). It should be noted that 71% of obese individuals who had reduced tonicity of cheeks presented multiple swallows, while only 25% of eutrophic individuals presented this feature. A statistical relation between tonicity reduction and multiple swallows was seen. The authors stated that multiple swallows indicate the presence of residues in the oral cavity and pharyngeal recesses, suggesting oral propulsion difficulties[17.19].

This study found no significant differences between obese people and eutrophic ones as for posture and mobility of lips, tongue and jaw and breathing function. Similar data were found in a research carried out in 2013[20], with 28 obese people from 8 to 16 years old, when the majority presented the occlusion of the lips and vertical posture of normal jaw. In this study[20], the tongue was kept in the oral cavity in 60% of the individuals.

The present study has not made comparisons between the variables of age, gender and nutritional status, in order to obtain a more detailed characterization of the myofunctional profile of obese children and adolescents.

The results of this work show the need of developing more detailed researches in the field of speech therapy for individuals of the age studied and also younger ones. In addition, they show the importance of efforts of the joint medical team, nutrition, psychology, speech therapy, among others, for a better diagnosis and treatment of these individuals, since obesity is influenced by biological, psychological and socio-economic[21] factors.

CONCLUSION

The obese children and adolescents studied in this research presented a higher occurrence of orofacial myofunctional changes when compared to eutrophic people, in relation to tonicity and mobility of cheeks and swallowing.

In this research, it was also possible to observe a statistical association between the reduction of tonicity of the cheeks in children and adolescents and the presence of multiple swallows.

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