

# Effect of Obesity on the Oral Cavity of Children

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## Abstract

With the change of people's lifestyle, now children's diet is richer and more sophisticated than in the past, so that the proportion of children with obesity is increasing year by year. Obesity not only has an impact on the whole body health, but also has a certain degree of impact on oral health. This paper introduces the influence of obesity on the structure and function of children's salivary glands, and the relationship between caries and periodontal disease in children. The relationship between saliva and dental caries and periodontal diseases was also studied to explore the internal relationship between obesity and children's oral health. This paper introduces the influence of obesity on the structure and function of salivary glands in children, and the relationship between obesity and dental caries and periodontal disease in children.

## Keywords

obesity; overweight; children; salivary glands; caries; periodontal

## 肥胖对儿童口腔的影响

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## 摘要

随着人们生活方式的改变, 儿童饮食种类与过去相比更丰富也更为精细, 以至于肥胖的儿童比例逐年增高, 肥胖不仅对全身健康有影响对口腔健康也有一定程度的影响, 论文就肥胖对儿童唾液腺结构及功能的影响, 及与儿童龋病和牙周之间的关系做一介绍, 并研究唾液与龋病及牙周疾病之间的关系, 探讨肥胖与儿童口腔健康的内在联系。

## 关键词

肥胖; 超重; 儿童; 唾液腺; 龋病; 牙周

## 1 引言

超重/肥胖是世界范围内的一个社会问题, 其特征是体重增加导致脂肪过度堆积<sup>[1]</sup>。近年来, 我们观察到超重和肥胖的频率稳步增长, 不仅在成人中观察到, 而且在儿童和青少年中也观察到<sup>[2]</sup>。这是由各种遗传、环境和经济因素以及进化条件造成的, 比如快餐和高热量的食物以及久坐不动的生活方式<sup>[1-3]</sup>。根据 WHO 的最新报告, 近 41 万 5 岁以下儿童超重或肥胖<sup>[4]</sup>。研究表明, 约 40% 的超重儿童在青春期会继续增加体重, 而这些肥胖青少年中约有 80% 在成年后仍会保持肥胖<sup>[5]</sup>。虽然发达国家的肥胖率较高, 但发展中国家有更多的超重或肥胖儿童。

## 2 肥胖对唾液腺的影响

唾液腺和唾液在维持口腔健康方面起着重要的作用, 如吞咽、咀嚼、碳水化合物的消化、口腔粘膜愈合和牙釉质

再矿化, 唾液腺还负责一系列酶的分泌, 它们是口腔生物平衡和保护口腔所需的生长因子。受肥胖及其共病影响会改变唾液腺在内的多个器官, 从而带来功能上及结构上的改变。

### 2.1 唾液流速

Lehmann-Kalata<sup>[6]</sup>等人报道, 正常体重儿童的静息唾液流速及刺激唾液流速均高于肥胖儿童, 且差异具有统计学意义。腮腺功能障碍随着 BMI 的增加而加剧, Modeer 等<sup>[7]</sup>表明, 肥胖儿童刺激性唾液的流率与正常体重的儿童相比较低并且有统计学差异 (1.2 比 2.0 mL/min,  $P < 0.001$ ), 肥胖青少年产生的刺激唾液明显少于超重的同龄人, Anna Zalewska<sup>[8]</sup>等人测定 8 个肥胖儿童的唾液流速, 平均唾液流速为 0.7 mL/min, 这被归为唾液不足。巴西一项研究结果显示<sup>[9]</sup>, 7~10 岁肥胖及超重儿童的唾液流速小于 1 mL/min, 其数值较低被认为具有口干风险。当唾液流量减少时, 口腔健康问题就会出现, 如龋齿和口腔感染, 这进一步加剧了肥胖对口腔健康的负面影响。刺激唾液分泌的降低最可能是由肥胖患者的腮腺脂肪变性引起的, 这减少了分泌单位 (腺泡和导管) 的数量<sup>[10,11]</sup>。也可能是因为肥胖相关的炎症环境, 肥胖会导致促炎细胞因子上调<sup>[12]</sup>, 激活金属蛋白酶从而破坏基质组

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织。这种现象可能会干扰残余神经网络和残余分泌单位之间的神经传递,并抑制滤泡细胞的反应<sup>[13,14]</sup>。在唾液保护因素中,唾液清除率是最重要的因素之一,不仅因为它去除了内源性、外源性微生物及其产物,还因为恒定量的唾液保证了口腔中抗菌剂、免疫和非免疫因素的存在<sup>[15]</sup>。唾液清除率与流速直接相关<sup>[16]</sup>,因此唾液流速降低的个体比唾液流速正常的个体口腔中能检测出更多的乳酸杆菌和变形链球菌<sup>[17]</sup>,这会增加患口腔疾病的风险。

## 2.2 结构上的改变

在动物模型上进行的肥胖研究显示,包括唾液腺在内的一些器官会有某些改变。Inoue 等人<sup>[18]</sup>报道了由下丘脑损伤导致的肥胖大鼠的唾液腺重量下降,可能的原因为交感神经活动的减少而造成的改变。此外,有报道称,基因诱导的肥胖大鼠促进了颌下腺的促炎变化,这可能猖獗的龋齿有关<sup>[19]</sup>。Renzi 等<sup>[20]</sup>也报道了肥胖对下颌腺的改变,如腺体的减少,在下丘脑腹内侧核损伤诱导暴饮暴食后,导致腺胚层萎缩以及导管数量增加。在肥胖受试者中,腮腺的体积也有显著增加,可能是由于实质中脂肪细胞的储存,但颌下腺没有受到影响<sup>[21]</sup>。

## 3 龋齿

龋齿是一种慢性进行性疾病,儿童发生龋齿不仅影响儿童的口腔功能,还对营养的摄入和儿童的心理造成影响。龋齿是可以早期预防的,在早期预防后儿童发生龋齿的概率会减少,从而减少患儿承受的治疗痛苦。多项研究显示<sup>[22]</sup>,肥胖儿童更易患龋齿,这可能是由于其饮食习惯造成的,比如喜食甜食、油炸食品及碳酸饮料。Costa 等人<sup>[23]</sup>所做的研究证实了肥胖和龋齿之间的相关性,这些研究人员对一组来自低收入家庭的儿童(平均年龄6岁)进行了研究,发现超过50%的儿童患有龋齿,其中25%的儿童肥胖。然而,家庭的社会经济水平也是决定龋齿是否存在的最重要因素。Lehmann-Kalata 等人<sup>[6]</sup>报道,肥胖患者比正常体重患者的龋齿发病率更高,牙龈和口腔卫生状况更差,且肥胖与唾液中变异链球菌与乳酸菌的数量呈正相关,后者的刺激唾液流速明显高于前者其差异具有统计学意义,在之前的一项研究中发现变形链球菌计数与刺激性唾液流速之间存在显著的反向关系<sup>[24]</sup>。在ECC的微生物发病机制中变形链球菌和乳酸杆菌起主要作用<sup>[25-32]</sup>。这些酸性和酸尿性细菌可以发酵膳食底物并产生有机酸,从而导致牙齿组织脱矿<sup>[33,34]</sup>。

另外,唾液的变化,如磷酸盐、唾液酸、蛋白质、免疫球蛋白和过氧化物酶活性,也可以解释肥胖儿童患龋齿风险增加的可能性更大。对不同唾液成分的总浓度进行分析发现,正常体重、超重和肥胖儿童受刺激和未受刺激唾液中总蛋白、淀粉酶、尿素、磷酸盐、甘油三酯和钙的浓度相似。然而,在正常体重和肥胖组中,受刺激和未受刺激唾液的尿素、磷酸盐和钙浓度差异显著,受刺激唾液值最低<sup>[35]</sup>。据

报道,唾液磷酸盐浓度降低与龋齿增加之间存在关联<sup>[36]</sup>。Pannunzio 等人<sup>[37]</sup>研究了超重和肥胖的儿童,发现磷酸盐、游离唾液酸和蛋白质的浓度以及过氧化物酶活性的改变。Kittner 等<sup>[38]</sup>发现低龋人群的唾液中钙、磷含量明显高于高龋人群。唾液中磷酸盐和钙的浓度与龋齿的患龋率和釉质再矿化有直接的关系。牙齿萌出后,唾液中中钙磷对其影响较大,可使其继续矿化成熟,如含量过饱和、比例适当还可保护牙齿不受龋的侵蚀。在健康的牙齿中,矿物质的流失与唾液修复机制是平衡的,所以如果唾液的数量和质量较少,就会导致龋易感性增加。巴西<sup>[9]</sup>对90名7至10岁学生的一项研究表明,与正常体重儿童相比肥胖和超重儿童的过氧化物酶活性明显降低,超重组约为40%,肥胖组约为65%。过氧化物酶是一种具有抗菌特性的酶,在口腔中由唾液腺分泌,催化硫氰酸被过氧化氢氧化,产生氧化形式的硫氰酸盐<sup>[39]</sup>。过氧化物酶催化的反应产物抑制细菌生长,此外,通过消耗过氧化氢可以防止这种有毒物质的积累<sup>[40]</sup>。此项研究还得出肥胖组唾液蛋白浓度比对照组高26.2%,游离唾液酸平均值高于正常体重儿童。根据鲁德尼等人的说法<sup>[41]</sup>唾液中的高蛋白质浓度有助于 *S. mutans* 的依附。唾液酸是唾液糖蛋白的重要组成部分,可增强细菌聚集并参与获得性菌斑和牙菌斑的形成<sup>[42]</sup>。

## 4 对口腔菌群及牙周的影响

健康的人类微生物群主要由微生物组成<sup>[43]</sup>,有不同的因素影响其组成,如年龄、饮食、抗生素和多元素的生活方式,以及某些疾病。到目前为止,肥胖和口腔微生物群之间的关系还不清楚。然而,在对动物模型的研究中,肥胖会干扰免疫系统。从而降低人体对牙周病原体牙龈卟啉单胞菌感染的适当反应能力<sup>[44]</sup>。

脂肪因子可以影响口腔和肠道黏膜水平的免疫反应,从而影响微生物的定植。Ley 等人<sup>[45]</sup>,报道肥胖个体的胃肠道菌群与正常体重的个体存在差异,并推断当体重减轻时,菌群会发生变化。奥特<sup>[46-48]</sup>指出,肥胖个体的口腔中几种细菌的水平更高,似乎这些细菌物种可以作为超重状况发展的生物学指标。肥胖个体微生物群的变化可能与循环脂肪因子的浓度有关,它可以影响口腔和肠道黏膜水平的免疫反应,从而影响微生物定植<sup>[48]</sup>。

Modeer 等人<sup>[7]</sup>报道,与正常体重的儿童相比,儿童肥胖与牙龈炎症增加相关( $P < 0.001$ )。斯科泽蒂<sup>[49]</sup>等人发现了肥胖与儿童牙周风险指标之间存在联系,如牙菌斑沉积和出血。关于牙周炎和超重之间的关系卡瓦尔坎蒂<sup>[50]</sup>等人在分析了559人后,发现18.6%超重,98.4%有某种形式的牙周变化,如出血(34.3%)、结石(38.8%)、浅袋(22.9%)和深袋(2.3%),牙周变化与肥胖存在关系( $P < 0.05$ )。此外,与正常体重的受试者相比,肥胖青少年的龈沟液中促炎细胞因子水平升高<sup>[51,52]</sup>,且存在超炎症反应。肥胖如何影响

牙周组织的可能原因可能是由于脂肪组织分泌的促炎细胞因子<sup>[53]</sup>。此外,在体重增加时,脂肪组织的扩张会限制血管,导致巨噬细胞向牙周组织迁移。

综上所述,肥胖会导致唾液流速降低,增加龋病的发病率,并对牙周有一定程度的影响,因此应着重关注肥胖儿童的口腔问题,及时对龋病及牙周病进行早期干预,并调整饮食结构和生活习惯来促进全身健康。

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