Correlation of Poor Oral Health (POH) with Obesity in Extremes of Age with Role of Excessive Sugars in Childhood Obesity and Oral Salivary Molecule Use for Prognosis of Cardiovascular Events like Acute Myocardial Infarction in Elderly with POH and Obesity-A Review

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Abstract

In our earlier reviews we have focused on the correlation of both oral health and obesity. In this update we further highlight the work done following that on influence of oral health in extremes of age like childhood and old age on development of obesity and further role of this obesity on other associated comorbidities with obesity. Using pubmed database from 2016 till date we found further influence of oral sugar as per international dental association decision in childhood obesity along with how in elderly this influence is exerted. Also role of salivary biomarkers in predicting development of Cardiovascular diseases (CVD) like acute myocardial infarction (AMI) is discussed.

Keywords: *Childhood Obesity; Oral Health; Sugar Sweetened Beverages; Old Age; Periodontitis*

Introduction

In our previews reviews we have tried to cover how poor oral hygiene is a cofactor in development of obesity and its aggravation along with further aggravation of disease like cardiovascular disease (CVD), Type2 diabetes mellitus (T2DM), Metabolic Syndrome, both in the extremes of ages. Here we have further tried to update the correlation of the 2, both in childhood and obesity [1,2].

Childhood obesity and oral health

Refined added sugars in the human diet was minimal for thousands of years. The scene began with a change, when demand for sugar in Europe began to increase with the discovery of the Americans and colonization of distant places was built mainly upon black slavery. Europeans sailed to West Africa kidnapping and buying slaves, who were taken to many Caribbean islands, then later to Brazil and central and north America, where many labour intensive sugar plantations were established. This produce was then shipped back to a sugar hungry Europe. Later the industrial revolution enabled man to move away from muscle power to steam, oil and electric power, resulting in the cheap and plenty of mass production and supply of sugar. The habitual consumption of added sugar in food and drinks in human history is actually very recent, beginning only about 200 years ago and steadily increasing until today, where the industry annually produces upto 25 kg of refined sugar for every man, woman and child. This works out to be 180 million tons of sugar annually, which is equal to 17

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teaspoonfuls of sugar/person/day in the world. Primarily it is worth US $200 billion a year. Such a huge consumption of a condiment that many doctors and nutritionists consider as physiologically unnecessary for human nutrition is disturbing, and there is evidence that it may be the major factor in the rise of many modern acute and chronic ailments.

Historically, dental caries increases in tandem with the increase in sugar consumption [3-5].

At the New Delhi FDI World Dental Congress in 2014, A Policy Statement entitled "Early Childhood Caries (ECC)" was being debated. As the debate progressed, Chow KF, was shocked to realize that they talked about everything except one of the major Causes of ECC-the excessive consumption of sugar? After, Chow KF raised the issue, the author was requested to draft a statement on the spot to be included. Thus at the FDI AWDC (World Dental Federation Annual World Dental Congress) 2014, the statement from Malaysia was adopted in the FDI policy Statement Perinatal and Infant Oral Health: There should be a concerted integrated effort of parents, schools, health ministries and other stake holders to decrease intake the intake of sugar in all its forms [6].

Following this effort, the FDI AWDC 2015 in Bangkok organized a World Oral Health Forum on New World Health Organization (WHO) Guidelines on Sugar intake in Adults and children. The new guidelines for sugar intake for adults and children is that the energy contribution of free sugar in all its forms should be decreased from the current 10% to 16% to 5% or less. This practically translates into a simple rule of thumb meaning just 5 teaspoonfuls of sugar/person/day. The problem has immediately arisen, as how to do it, as the whole world has been addicted to sugar for the past 100 years and is increasing so rapidly, that it is not only causing an increase in caries, but obesity, diabetes mellitus and all the accompanying diseases which follow [7,8]. Hence there is need for tackling this global emergency.

Thus Chow KF summarized that this development of current health crises throughout the world wherever traditional diets are replaced by modern fast food diets, that are usually packed with hidden added refined sugars, is extremely troubling. It becomes all the more urgent and incumbent upon clinicians and somatologists throughout the world to redouble their efforts to reduce or even eliminate drinks. It will not only be to reduce dental caries, but will also reduce many systemic and organ diseases associated with added sugars and which also exacerbate many oral diseases. Thus Chow KF reviewed history, understanding of sugar metabolism and the developing literature and research on the impact of sugar consumption on oral and overall health, as the mouth can't be divorced from the body and vice versa. Hence aim of this author has been to stimulate more research into this area which will result in different positive developments in the food and drink industry and persuade stake holders to comprehensively address this universal health crisis which is closely tied to excessive consumption of added sugars in all its forms [9].

Similarly Sanghavi A and Siddiqui NJ proposed on sugar sweetened children beverages (SSB), effects of oral health of children and association with obesity.

They conducted a scoping peer reviewed literature and a web based review of oral health policy and advocacy initiatives addressing prevention of obesity and decreasing children's consumption of SSB'S were conducted. Of 30 unique references identified 4 peer reviewed and 7 non-peer reviewed references met selection criteria. Qualitative and quantitative data were extracted using a priori determined headings. Their findings suggested a strong role for oral health professionals in preventing childhood obesity and decreasing children's consumption of SSB's; however only a few national, state and local oral health advocacy and policy efforts were identified, such as policy statements by national associations, state and local education campaigns, and clinical guidelines. Evidence was limited on the role of oral health professionals in influencing broader community wide advocacy and policy efforts such as soda taxation and limiting SSB consumption in schools. Thus they concluded that an emerging evidence base to support growing recognition among oral health professionals of their dual role in preventing childhood obesity and dental caries by targeting SSB consumption. It also identified opportunities for oral health professionals to build on initial efforts to more protective influence future policy and advocacy [10].

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The Robert Wood Johnson Foundation (RWJF) has worked to ensure that all children have healthy weights. To promise this goal, the RWGF has supported the Healthy Futures: Engaging the Oral Health Community in childhood obesity Prevention National Conference, Held On November 3 - 4, 2016, and the proceeding of this conference. The goals of this conference were to increase understanding of the science focusing on oral health and childhood obesity, and provide opportunities to network and plan activities to prevent childhood obesity. The papers prepared for the conference identified through systematic review or scoping reviews the state of science related to preventing childhood obesity and decreasing children's consumption of sugar sweetened beverages and strategies that oral health professionals and organizations can employ to prevent childhood obesity. Tinanoff N and Holt K Found that causes of childhood obesity are multifactorial and include genetic components, environmental and lifestyle variables and nutritional factors. Dental caries also is caused by a combination of factors; including cariogenic diet, inadequate fluoride exposure, a susceptible host and the presence of caries causing bacteria in the oral cavity. One key risk factor for both obesity and caries is excessive sugar consumption. Thus concluding that the risk of obesity and dental caries in children, health professionals and parents need to be aware of the sugar content of processed foods and beverages as well as of current daily sugar consumption recommendations. In addition oral health professionals must become more engaged in identifying children who are at risk for obesity and dental caries and provide education, screening and referral to decrease these risks [11].

Since dental caries are very high among children and have negative health consequences, and the occurrence of which might depend partly in school-based environmental or policy related factors, and few workers have explored this subject. Edasseri A., *et al.* conducted a study with the aim of finding oral health promoting school environment types and estimate their relation with 2 year dental caries incidence among Quebec children aged 8 - 10 years. They used data from 2 visits (completed in 2008 and 2011) of the QUALITY (Quebec Adipose Lifestyle Investigation in Youth) cohort, that recruited white children at risk of obesity and their families from Greater Montreal schools. Measures included school and neighbourhood characteristics and Decayed, Missing, Filled-Surfaces index scores. Principal component and cluster analyses and generalized estimating equations were conducted. They got data from 330 children attending 200 schools. Based on a series of statistical analyses conducted in 2016, the authors identified three different school environment types. Type 1 and 2 schools had strong healthy rating programs, while Type 3 had weak programs. Type 1 schools had favourable neighbourhood food environments, whereas Type 2 and 3 had unfavourable ones. Adjusting for potential confounders, children attending Type 1 and 2 schools had 21% (incidence rate ratio = 0.79, 95%CI = 0.68, 0.90) and 6% (incidence rate ratio = 0.94, 95%CI = 0.83, 1.07) lower 2 year incidence of dental caries, respectively, compared with Type 3 schools. Thus concluding that school based oral health promotion programs combined with a favourable neighbourhood can lower dental caries incidence in school children [12].

Oral health and aging population with weight changes

The aging of the population represents a reality throughout the world [13]. It is estimated that Brazil will be the 6th country in total population of older people by 2025 [14], reaching 64 million inhabitants in 2050, about 30% of this population [15]. The economic impacts of this process in health systems has been a reason for concern for health and social policy-makers. The challenge, in addition to providing adequate health assistance, is to implement public policies that will promote general health by controlling risk factors which are common to noncommunicable diseases (NCDs), highly prevalent among the elderly population [16].

Obesity has a multifactorial nature which can get influenced by a persons eating habits [17]. It is related to cardiovascular diseases like arterial hypertension, dyslipidemia and type 2 diabetes (T2DM), thus contributing to an increased burden of NTCD'S [18]. The World Health Organization (WHO) regards the metabolic syndrome (of which the main characteristics is the presence of abdominal obesity) as the greatest and most prevalent risk factor for cardiovascular diseases (CVDs) [19]. Mortality because of CVD's rises with age, and remains the main cause of death in Brazil, along with other countries around the world, which accounts for 30%of global deaths [20].

The association between oral health status and factors which increase the risk of developing CVD's has been the aim of various investigations [21-23], that include variable related to eating patterns and nutritional status in their analysis. It's well known that the oral health status might interfere in peoples food choices [24-26]. As an example, tooth loss may lead to chewing and swallowing problems and hence affect the early digestive process, nutrient intake, and appetite itself => adoption of a more softer, more processed diet [24,25]. This diet is usually poor in nourishing terms, affecting the individuals general health, => to increased levels of cholesterol, triglycerides and obesity, and raising the risks of developing cardiovascular diseases [23,27-30].

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The literature which addresses the relationship between the oral health status of independent elderly and the presence of obesity is conflicting. There was a correlation in some studies between edentulous persons and low weight [24,30-32]. Others, still report that dentate elderly with few teeth and those that were edentulous, even if rehabilitated with complete dentures, were more likely to be obese [25,27-29]. Not many workers considered central tendency measurements for assessing the presence of obesity [28,29], that are considered more appropriate for evaluating the risk of developing CVD's [33]. Results of 2 large scale international studies involving different countries showed that measure of waist circumference (WC) [33] and waist hip ratio (WHR) [34] were stronger predictors of CVD's than body mass index (BMI).

Tooth loss and edentulism in Brazil affect about 94%of the individuals between 65 and 74 years of GE [35]. These conditions have a negative impact on quality of life of the elderly from a social standpoint, owing to low self-esteem and self-image [36]. Also they impair the Quality of their dietary intake [25,26,37,38] and might increase the risk of developing various health related problems. Thus Rosada-Peruchi., *et al.* aimed to investigate the association between oral health status and central obesity (CO) in Brazilian independent-living elderly. They carried out a cross sectional study in a sample of 489elderly who were participants of the Study on Aging and Longevity, in Londrina, state of Parana. The number of natural teeth and use of prosthesis were evaluated as per the world health organization criteria. The presence of CO was assessed using measures of WC and WHR. Information concerning sociodemographic profile and some systemic conditions was also collected. Data were analyzed using stepwise logistic regression, $\alpha = 5\%$. According to WC and WHR measures the prevalence of central obesity was 79.3% and 76.1% respectively. CO according to WC was not associated with oral status. Considering the WHR measure, the following oral conditions were associated to CO: having fewer natural teeth (OR = 2.61; 95%CI = 1.17 - 5.80), being edentulous and wearing both upper and lower complete dentures (OR = 2.34; 95%CI = 1.11 - 4.93) and being edentulous wearing only the upper complete denture (OR = 2.64; 95%CI = 1.01 - 6.95). Traditional risk factors for CO such as gender, dyslipidemia, hypertension and diabetes were associated with both measures. A poor health due to extensive tooth loss, whether partial or complete, even if rehabilitated by removal prosthesis, might be considered, a good predictor of CO in Brazilian independent-living elderly [39].

Adiponectin is a circulating plasma protein produced abundantly and specifically by adipocytes and is detected at relatively total levels in the blood stream of humans which regulates the metabolism of lipids and glucose [40-43]. Adiponectin is a major adipocyte derived protein having anti-inflammatory and antiatherogenic properties affecting endothelial cells, hence appears to play a protective role in atherosclerosis development and progression [44,45]. C Reactive Protein (CRP) is released systemically as part of the acute phase response in acute inflammation including infection, injury, neoplasia or chronic local inflammatory conditions, e.g. arthritis. Increased CRP levels have been associated with an increased risk of heart attack and support the contribution of chronic inflammation to atherosclerotic vascular change and coronary risk [46,47]. Recent findings suggest that increased CRP may be just as important as increased LDL cholesterol levels in preventing CVD risk, and that high CRP levels might identify high risk patients [48]. Hence CRP could be considered an independent marker of cardiovascular risk [49,50]. These 2 mediators in serum appear to provide information regarding anti-inflammatory (like adiponectin) and proinflammatory (like CRP) responses that could link metabolic syndrome, obesity, diabetes and CVD.

Different studies have started evaluating an array of biomolecules in saliva as a potential diagnostic fluid for both oral and systemic diseases [51-53]. Various reports have explored salivary profiles of analytes related to both oral [53-56] and systemic diseases including metabolic syndrome, diabetes, atherosclerosis and myocardial infarction [51-53,57,58], with some of the studies including assessment of oral disease. Moreover, a fundamental basis of consideration of utilization of saliva as a diagnostic fluid is some consistency/stability in alterations of targeted analytes between health and disease [53,59,60]. In this regard different reports have described this type of differentiation in health and disease, and stability of selected analytes, similar to the ones analyzed in the study by Ebersole JL., *et al* [61,62]. Kosaka., *et al.* [63], recently demonstrated positive correlations of salivary cytokines including IL-6, TNF-α and PGE2 with Odds ratio of 2 - 3 for carotid atherosclerosis. Due to its important cardiometabolic actions, adiponectin represents a biological molecule of interest and is a potential emerging biomarker of disease. Further, CRP levels in serum and saliva have been identified related to CVD [64-67]. Hence Ebersole., *et al.* examined these 2 molecules in serum and unstimulated whole saliva of patients within 48 hrs, of an acute myocardial

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infarction (AMI) compared to control subjects. They hypothesized a differential response in these biomolecules resulting from the heart attack that would be affected by both the BMI and oral health characteristics of the individuals. Significantly lower adiponectin levels were seen in the serum of the AMI patients. Serum adiponectin in both groups were elevated in both groups and salivary adiponectin in AMI patients, and both serum and salivary adiponectin were increased with better oral health in control subjects. Serum CRP levels were increased in the AMI patients regardless of oral health, and both serum and salivary CRP were significantly elevated in S-T wave elevated MI patients (STEMI). Thus they concluded that the initial data provides evidence regarding obesity and oral health to salivary and serum analyte levels that occur in association with cardiac events. Relationships have been described between CVD risk and periodontal disease. Additionally various systemic inflammatory biomarkers appear to reflect both the CVD risk and the extent/severity of periodontitis. Their findings indicated that oral health and obesity contribute to altering level of these salivary and serum analytes in association with cardiac events. The potential that serum and/or salivary biomarkers could aid in evaluating CVD risk require knowledge regarding how the oral health of the individual would impact effectiveness of these biological measures [68].

In older people involuntary weight loss and underweight increase their risk of mortality and morbidity disability [69,70]. In addition to exhaustion, weakness, slow walking speed, and low physical activity, involuntary weight loss and low physical activity, involuntary weight loss is thought to be one component of ''frailty'' and increases the risk of adverse health outcomes [71]. Cross -sectional and cohort studies have found poor oral health to be associated with weight loss [72,73], frailty [74,75], disability [76,77] and mortality [76,78] in older people. Although the mechanisms underlying these relationships are not well established, systemic inflammation caused by peri-odontal disease may function as a mediator [78]. Changes in dietary intake may also mediate the association of poor oral health with weight loss and frailty. Poor oral health due, for example, to fewer remaining teeth or denture use is associated with eating difficulties which restrict food choice [26,79-81], which in turn => poor nutritional status [82-85].

Various studies have found that poor oral health is also associated with underweight [30,86,87] and obesity [27,28,30,87-89]. However only one of the studies investigated the relationship with dietary intake [92] and none had investigated the interaction between poor oral health and dietary intake in relation to BMI. Thus Nakamura., *et al.* analyzed 96794 respondents aged > 65 years who were randomly selected from 31 Japanese municipalities in the Japan Gerontological Evaluation Study. Weight loss was defined as >= 2 – 3 kg of loss over the preceding 6 months. BMI was evaluated in respondents without weight loss. Multiple logistic regression analysis was performed with weight loss, underweight and obesity as dependent variables and having fewer teeth (men: odds ratio [OR] 1.3; 95% Confidence Interval [CI], 1.2 - 1.3; women: OR 1.2; 95%CI 1.1 - 1.3) and infrequent fruit/vegetable intake (men: OR 1.1; 95%CI 1.1 - 1.2; Women; OR 1.4; 95%CI, 1.3 - 1.5) and fish/meat intake (OR 1.2; 95%CI, 1.1 - 1.3 for both sexes). No interaction was observed between having fewer teeth and food intake. Obesity was associated with the same factors: having fewer teeth (OR's 1.2 and 1.3 for men and women respectively) and infrequent intake of fruits/vegetables (OR's 1.1 and 1.2 for men and women, respectively) an fish/meat (OR 1.1 for both sexes). Infrequent intake of fruits/vegetables showed a higher OR for underweight in women with fewer teeth than for others. Thus they concluded having fewer teeth and infrequent food intake were associated with both weight loss and obesity. A significant interaction was observed in the association of having fewer teeth and infrequent food intake with underweight in women [90].

Conclusions

Thus importance of increased intake of sugars right from childhood to adulthood has been emphasized in initiation of poor oral health which not only initiates dental caries but is also associated with marked development of obesity and its associated morbidities. As far as the elderly group was concerned a strong association was found between oral health status and central obesity as assessed using waist circumference (WC) and waist-hip ratio (WHR). Also once poor oral health was rehabilitated due to extensive tooth loss even by removable prosthesis, is a good predictor whether central obesity will be prevented or not. Further a study that examined 2 molecules in serum and unstimulated whole saliva in patients having acute myocardial infarction (AMI), namely adiponectin and C Reactive Protein (CRP),

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found markedly lower adiponectin in serum of AMI patients. Serum adiponectin was markedly lower in both controls as well as obese ones although salivary adiponectin in AMI patients decreased with increasing BMI. Oral health was significantly worse in AMI patients and both serum and salivary adiponectin were elevated with better oral health in controls. Serum CRP levels were increased in AMI patients irrespective of their oral health. Thus initial data supports evidence which relates obesity and oral health to salivary and serum analytes levels with cardiovascular disease (CVD) markers and systemic inflammatory markers reflect both the CVD risk and severity of periodontitis and hence how salivary biomarkers might predict or evaluate CVD events needs further evaluation. Further both low weight and obesity are correlated with old age with tooth loss, and thus poor oral health impacting on diet and importance of poor intake of essential food items is emphasized.

Bibliography

1. Kochar Kaur K., *et al.* "Correlation of Poor Oral Hygiene with Obesity-A Mini Review". *EC Dental Science* 17.6 (2018): 1304-1308.

2. Kochar Kaur K., *et al.* "A Comprehensive Review with Emphasis on Geographical Area Childhood Obesity and Prevention along with Role of Breast Feeding". *EC Dental Science* 17.10 (2018): 1699-1709.

3. Natella S., *et al.* "Sugar Consumption at a Cross roads". Publisher CREDIT Suisse AG, Research Institute, Zurich, Switzerland (2013).

4. "Sugar Papers Reveal Industry Role in Shifting National Heart Disease Focus to Saturated Fat". Dental Progress by Sugar Science. Editor (2016).

5. John Yudkin. "Pure, White and Deadly: How sugar is Killing us and what we can do to stop It". Penguin Group (USA) New York, USA (2013).

6. Biggs S., *et al.* "Beyond the sugar chemicals-in sodas -and their link -to systemic-diseases-and oral health" (2017).

7. FDI World Dental Federal, FDI Policy statements on dietary free sugars and dental caries. Adopted by the FDI General Assembly (2015).

8. Sugar and dental caries (2017).

9. Chow KF. "A Review of excessive Sugar Metabolism on Oral and General Health". *Chinese Journal of Dental Research* 20.4 (2017): 193-198.

10. Sanghavi A and Siddiqui N. "Advancing oral health policy and advocacy to prevent child hood obesity and reduce children's consumption of sugar sweetened beverages". *Journal of Public Health Dentistry* 77.1 (2017): S88-S95.

11. Tinanoff N and Holt K. "Introduction tp proceedings of healthy futures: engaging the oral health community in childhood obesity prevention national conference". *Journal of Public Health Dentistry* 77.1 (2017): S5-S7.

12. Edasseri A., *et al.* "Oral Health-Promoting School Environments and Dental Caries in Quebec Children". *American Journal of Preventive Medicine* 53.5 (2017): 697-704.

13. Veras R. "Population aging today: demands, challenges and innovations". *Revista de Saúde Pública* 43.3 (2009): 548-554.

14. Carvalho JAM and Rodriques-Wong LL. "The changing age distribution of the Brazilian population in the first half of the 21st Century". *Cadernos de Saúde Pública* 24.3 (2008): 597-605.

15. Carvalho La F., *et al.* "Envelhecimento populacional e os desafos para Io sistema de saude brasiliero". Sao Paulo Instituto de Saude (2013).

16. Peterson PE and Yamamoto T. "Improving the oral health of older people: the approach of the WHO Global Oral Health Programme". *Community Dentistry and Oral Epidemiology* 33.2 (2005): 81-92.

17. Santos RD., *et al*. "I Diretriz sobre o consume de gorduras e saudo cardiovascular". *Arquivos Brasileiros de Cardiologia* 100.1 (2013): 1-40.

18. Simalo AF., *et al*. "I Diretriz Brasuluera de Preven cado Cardiovascular". *Arquivos Brasileiros de Cardiologia* 101.6 (2013): 1-63.

19. World Health Organization-WHO, Cardiovascular Diseases (CVD). Geneva: World Health Organization (2011).

20. Andrade JP., *et al*. "National physician quantification program in Cardiovascular Disease prevention and integral care". *Arquivos Brasileiros de Cardiologia* 100.3 (2013): 203-211.

21. Johansson I., *et al*. "Dental status, diet and Cardiovascular risk factors in middle aged people in Northern Sweden". *Community Dentistry and Oral Epidemiology* 22.6 (1994): 431-436.

22. Castro LCV., *et al*. "[Nutrition and Cardiovascular Disease: the risk markers in adult]". *Revista de Nutrição* 17.3 (2004): 369-377.

23. Syrjala AMH., *et al*. "Number of teeth and selected Cardiovascular risk factors among elderly people". *Gerodontology* 27.3 (2010): 189-192.

24. Sheiham A., *et al*. "The relationship between oral health status and body mass index among older people: a national survey of older people in Great Britain". *British Dental Journal* 192.12 (2002): 703-706.

25. Marcenes W., *et al*. "The relationship between dental status, food selection, nutrient intake, nutritional status and body mass index in older people". *Cadernos de Saúde Pública* 19.3 (2003): 809-816.

26. Savoca MR., *et al*. "Severe tooth loss in older adults as a key indicator of compromised dietary quality". *Public Health Nutrition* 13.4 (2010): 466-474.

27. Hilgert JB., *et al*. "Oral status and its association with obesity in southern Brazilian older people". *Gerodontology* 26.1 (2009): 46-52.

28. De Marchi RJ., *et al*. "Number of teeth and its association with central obesity in older in southern Brazilians". *Community Dental Health* 29.1 (2012): 85-89.

29. Ostberg AL., *et al*. "Oral health and obesity indicators". *BMC Oral Health* 12.1 (2012): 50.

30. Torres LH., *et al*. "Association between underweight and overweight/obesity with oral health among independently living Brazilian elderly". *Nutrition* 29.1 (2013): 152-157.

31. De Marchi RJ., *et al*. "Association between oral health status and nutritional status in south Brazilian independent living older people". *Nutrition* 24.6 (2008): 546-553.

32. De Marchi RJ., *et al*. "Association between number of teeth, edentulism and use of dentures with percentage body fat in southern Brazilian community dwelling people". *Gerodontology* 29.2 (2012): e69-e76.

33. Belkau B., *et al*. "International day for the evaluation of abdominal obesity (IDEA): a study of waist circumference, Cardiovascular Disease, and diabetes mellitus in 168, 000 primary care patients in 63 countries". *Circulation* 116.17 (2007): 1942-1951.

34. Roseagren A., *et al*. "Association of psychosocial risk factors with risk of acute myocardial infarction in 111119 cases and 13648 controls from 52 countries (the INTERHEART study): case controlled study". *Lancet* 364.9438 (2004): 953-962.

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35. Peres MA., *et al*. "Perdas dentarias no Brasil: analise da Pesquisa Nacional de Saude Bucal 2010". *Revista de Saúde Pública* 47.3 (2013): 78-89.

36. Ulinski KGB., *et al*. "Factors related to oral health quality of life of independent Brazilian elderly". *International Journal of Dentistry* (2013): 705047.

37. Hung HC., *et al*. "The association between tooth loss and the self-reported intake of selected CVD-related nutrients and foods among US women". *Community Dentistry and Oral Epidemiology* 33.3 (2005): 167-173.

38. Rodriques HL Jr., *et al*. "Relation between oral health and nutritional conditions of the elderly". *Journal of Applied Oral Science* 20.1 (2012): 38-44.

39. Peruchi RCT., *et al*. "Association between oral health status and central obesity among Brazilian independent living elderly". *Brazilian Oral Research* 30.1 (2016): e116.

40. Shehzad A., *et al*. "Adiponectin: Regulation of its production and its role in human diseases". *Hormones (Athens)* 11.1 (2012): 8-20.

41. Gu W and Li Y. "The therapeutic potential of the. Adiponectin pathway". *BioDrugs* 26.1 (2012): 1-8.

42. Kawamoto R., *et al*. "Relationships between lipid profiles and metabolic syndrome, insulin resistance and serum high molecular weight. Adiponectin in Japanese community dwelling adults". *Lipids in Health and Disease* 10 (2011): 79.

43. Kishida K., *et al*. "Molecular mechanisms of diabetes and atherosclerosis. Role of adiponectin". *Endocrine, Metabolic and Immune Disorders - Drug Targets* 12.2 (2012): 118-131.

44. Patel JV., *et al*. "Circulating serum adiponectin levels in patients with coronary artery disease: relationship to atherosclerotic burden and cardiac function". *Journal of Internal Medicine* 264.6 (2008): 593-598.

45. Siasos G., *et al*. "Adiponectin and cardiovascular disease: mechanisms and new therapeutic approaches". *Current Medicinal Chemistry* 19.8 (2012): 1193-1209.

46. Mugabo Y., *et al*. "The connection between C Reactive protein (CRP) and diabetes vasculopathy. Focus on preclinical findings". *Current Diabetes Reviews* 6.1 (2010): 27-34.

47. Hamirani YS., *et al*. "Markers of inflammation and coronary artery calcification: a systematic review". *Atherosclerosis* 201.1 (2008): 1-7.

48. Abd TT., *et al*. "The role of C Reactive protein as a risk predictor of coronary atherosclerosis: implications from the JUPITER trial". *Current Atherosclerosis Reports* 13.2 (2011): 154-161.

49. Quist-Paulsen P. "Statins and inflammation: an update". *Current Opinion in Cardiology* 25.4 (2010): 399-405.

50. He LP., *et al*. "Early C Reactive protein in the prediction of ling term outcomes after acute coronary syndromes: a meta-analysis of longitudinal studies". *Heart* 96.5 (2010): 339-446.

51. Schafer CA., *et al*. "Saliva diagnostics: utilizing oral fluids to determine health status". *Monographs in Oral Science* 24 (2014): 88-98.

52. Miller CS., *et al*. "Current developments in salivary diagnostics". *Biomarkers in Medicine* 4.1 (2010): 171-189.

53. Giannobile WV and Wong DT. "Salivary diagnostics: oral health and beyond". *Journal of Dental Research* 90.10 (2011): 1153-1154.

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54. Ebersole JL., *et al*. "Patterns of salivary analytes provide diagnostic capacity for distinguishing chronic adult periodontitis from health". *Journal of Clinical Immunology* 33.1 (2013): 271-279.

55. Brinkmann O., *et al*. "Salivary biomarkers for periodontal disease diagnostics". *Expert Opinion on Medical Diagnostics* 5.1 (2011): 25-35.

56. Yakob M., *et al*. "Salivary biomarkers for detection of oral squamous cell carcinoma-current state and recent advances". *Current Oral Health Reports* 1.2 (2014): 133-141.

57. Miller CS., *et al*. "Utility of salivary biomarkers for demonstrating acute myocardial infarction". *Journal of Dental Research* 93.7 (2014): 72S-79S.

58. Yeh CK., *et al*. "Current development of saliva/oral fluids -based diagnostics". *Texas Dental Journal* 127.7 (2010): 651-661.

59. Giannobile WV. "Salivary diagnostics for periodontal disease". *Journal of the American Dental Association* 143.10 (2012): 6S-11S.

60. Ebersole JL., *et al*. "Targeted salivary biomarkers for discrimination of periodontal health and disease(s)". *Frontiers in Cellular and Infection Microbiology* 5 (2015): 62.

61. Syndergaard B., *et al*. "Salivary biomarkers associated with gingivitis and responses to therapy". *Journal of Periodontology* 85.8 (2014): e295-e303.

62. Thomas MV., *et al*. "Within -subject variability in repeated measures of salivary analytes in healthy adults". *Journal of Periodontology* 80.7 (2009): 1146-1153.

63. Kosaka T., *et al*. "Salivary inflammatory cytokines may be novel markers of carotid atherosclerosis in a Japanese general population: the Suita study". *Atherosclerosis* 237.1 (2014): 123-128.

64. Out D., *et al*. "Assessing salivary C Reactive protein: Longitudinal association with systemic inflammation and cardiovascular disease risk in women exposed to intimate partner violence". *Brain, Behavior, and Immunity* 26.4 (2012): 543-551.

65. Mattila KJ., *et al*. "Dental infections and cardiovascular diseases: a review". *Journal of Periodontology* 76.11 (2005): 2085-2088.

66. Ballantyne CM and Nambi V. "Markers of inflammation and their clinical significance". *Atherosclerosis Supplements* 6.2 (2005): 21-29.

67. Joshipura KJ., *et al*. "Periodontal disease and biomarkers related to cardiovascular diseases". *Journal of Dental Research* 83.2 (2004): 151-155.

68. Ebersole JL., *et al*. "Salivary and serum Adiponectin and CRP Levels in Acute Myocardial Infarction related to BMI and Oral Health". *Journal of Periodontal Research* 52.3 (2017): 419-427.

69. Launer LJ., *et al*. "Body mass index, weight change, and risk of morbidity disability in middle aged and older women. The epidemiologic follow up studies of NHANES I". *Journal of the American Medical Association* 271.14 (1994): 1093-1098.

70. Murphy RA., *et al*. "Health, Aging and body composition study. Weight change, body composition and risk of mobility disability and mortality in older adults: a population based cohort study". *Journal of the American Geriatrics Society* 62.8 (2014): 1476-1483.

71. Fried LP., *et al*. "Frailty in older adults: evidence for a phenotype". *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences* 56.3 (2001): M146-M156.

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72. Sullivan DH., *et al*. "Oral health problems and involuntary weight loss in a population of frail elderly". *Journal of the American Geriatrics Society* 41.7 (1993): 725-731.

73. Weyant RJ., *et al*. "Periodontal disease and weight loss in older adults". *Journal of the American Geriatrics Society* 52.4 (2004): 547-553.

74. Castrejon-Perez RC., *et al*. "Oral health conditions and frailty in Mexican community -dwelling elderly: a cross-sectional analysis". *BMJ Public Health* 12 (2012): 773.

75. deAndrabe FB., *et al*. "Relationship between oral health and frailty in community -dwelling elderly individuals in Brazil". *Journal of the American Geriatrics Society* 61.5 (2013): 809-813.

76. Holm-Pederson P., *et al*. "Tooth loss and subsequent disability and mortality in old age". *Journal of the American Geriatrics Society* 56.3 (2008): 429-435.

77. Aida J., *et al*. "Association between dental status and incident disability in an older Japanese population". *Journal of the American Geriatrics Society* 60.2 (2012): 338-343.

78. Avlund K., *et al*. "Effect of inflammation in the periodontium in early age on mortality at 21 year follow up". *Journal of the American Geriatrics Society* 57.7 (2009): 1206-1212.

79. Sheiham A and Steele J. "Does the condition of the mouth and teeth affect the ability to eat certain foods, nutrient and dietary intake". *Public Health Service* 4.3 (2001): 797-803.

80. Koshihara A., *et al*. "The relationship between dietary intake and the number of teeth in elderly Japanese subjects". *Gerodontology* 22.4 (2005): 211-218.

81. Kagawa R., *et al*. "Effect of dental status ability on decreased frequency of fruits and vegetable intake in elderly Japanese subjects". *International Journal of Prosthodontics* 25.4 (2012): 368-375.

82. Lee JS., *et al*. "Edentulism and nutritional status in a biracial sample of well functioning, community -dwelling elderly: the health, aging and body composition study". *American Journal of Clinical Nutrition* 79.2 (2004): 295-302.

83. Semba RD., *et al*. "Denture use, malnutrition, frailty and mortality among older women living in the community". *Journal of Nutrition Health and Aging* 10.2 (2006): 161-167.

84. Newjack-Remer RE and Sheiham A. "Number of natural teeth, diet and nutritional status in US adults". *Journal of Dental Research* 86.12 (2007): 1121-1125.

85. Wakai K., *et al*. "Tooth loss and intake of nutrients and foods: a nationwide survey of Japanese dentists". *Community Dentistry and Oral Epidemiology* 38.1 (2010): 43-49.

86. Ikebe K., *et al*. "The relationship between oral function and body mass index among independently living older Japanese people". *International Journal of Prosthodontics* 19.6 (2006): 539-546.

87. Ekback G., *et al*. "Self perceived oral health and obesity among 65years old in 2 swedish countries". *Swedish Dental Journal* 34.2 (2010): 207-215.

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280

88. Ostberg AL., *et al*. "Tooth loss and obesity in a defined Swedish population". *Scandinavian Journal of Public Health* 37 (2009): 427-433.

89. Benguigui C., *et al*. "Evaluation of oral health related to body mass index". *Oral Diseases* 18.8 (2012): 748-755.

90. Nakamura M., *et al*. "Poor oral Health and diet in relation to weight loss, stable underweight, and obesity in Community-Dwelling older adults: A cross-sectional study from the JAGES 2010 Project". *Journal of Epidemiology* 26.6 (2016): 322-329.

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