

The Correlation between Oral Health Condition in Down Syndrome Children with Physical Fitness: A Literature Review

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Abstract

Down syndrome children often experience oral health problems. Several studies showed the prevalence of caries 89% and periodontitis 59% in down syndrome children. Oral health can impact general health, leading to muscular problems e.g., muscle fatigue. Muscle fatigue will result in decreased physical fitness.

Oral health conditions i.e., periodontitis and caries greatly affect physical fitness. Children with down syndrome are generally vulnerable to periodontitis and caries. These diseases may cause a local systemic inflammation and affect physical fitness. They can change the serum levels of inflammatory biomarkers e.g., TNF- α and interleukins (IL) in muscle injury. Especially, muscle mass, strength, and function may be negatively impacted by the diseases.

Both periodontitis and caries also have anatomical proximity to the vascularization; therefore, these oral health problems can negatively affect physical fitness through the metastatic pathway. Poor oral health has been proved to lower physical fitness in down syndrome children.

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Introduction

Down syndrome or trisomy 21 is a condition due to abnormality of chromosome number 21.¹ It is the most common neurodevelopmental genetic disorder which prevalence is estimated to be per 1000 births². They further mention there are 8 million people with down syndrome globally. Down syndrome can be found with several health problems in the cardiovascular, endocrine, gastrointestinal, and neurological systems. Besides congenital health problems, some health problems are progressive. One of the most common health concerns in down syndrome children is oral health.³

Oral health problems often found in down syndrome children are caries, periodontitis, persistence and malocclusion.² Down syndrome children generally have a high prevalence of caries and periodontitis as some studies have

mentioned that the prevalence of caries is 89% and periodontitis is 59%.^{4,5} The incidence is most likely due to the immune system decreasing the number of T lymphocyte cells, thereby being more susceptible for down syndrome children to get infections including caries and periodontitis.⁶ Caries and periodontitis are diseases experienced by most people in the world. With that said, it is used as an indicator to assess oral health conditions.

Oral health can have an impact on general body health, one of which is muscle problems e.g., muscle fatigue.⁷ Muscle fatigue will result in decreased physical fitness. During the inflammation in the muscles, healthy muscle structures can be damaged, and the process of muscle repair is slower; muscle pain might be more severe, and individuals are more reluctant to contract their skeletal muscles.⁸ Oral health is assumed to correlate with physical health in down syndrome children, and therefore this review addresses this issue.

Review

Down syndrome is briefly described as a disorder arising from an extra copy of

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chromosome 21; it presents with several characteristics such as facial dysmorphology, macroglossia, low muscle tone, short stature, and intellectual disability.¹ Additional copy of chromosome 21, which may be full or partial based on the variants, may cause structural and functional abnormalities and related anomalies of the body systems. Previous research has shown being pregnant at the age of 35 years or more is the main risk factor for mothers to deliver down syndrome children.⁹

Down syndrome children can also have various additional health problems such as congenital heart disease and respiratory disease, while adults with down syndrome can also have various health problems such as recurrent pneumonia, sensory disturbances, musculoskeletal disorders.^{10,11,12} Down syndrome children also have special characteristics of oral health conditions. Oral health condition commonly found in down syndrome children include caries, periodontitis, malocclusion, delayed tooth eruption, macroglossia, crowding, bruxism, microdontia, and poor oral hygiene. Data show that caries and periodontitis occur mostly to down syndrome children compared to normal children^{13,14,1} due to diet cariogenic and decreased manual dexterity,¹⁵ difficulty accessing dental care, side effects from medicines for upper tract infections, poor oral hygiene.¹⁶

Evidence consistently suggests that the spread of inflammatory mediators and immune complexes, including TNF-a, IL-1b, PGE-2, IL-6, IL-8, C-reactive protein, IgA and IgG, are negative impacts of caries and periodontitis. These impacts mostly likely contribute to cardiometabolic disorders, as well as the risk of having insulin resistance and metabolic syndrome.¹⁷ Local inflammation due to oral health problems i.e., both caries and periodontitis could result in a systemic inflammatory response^{18,19} and affect physical fitness. The increase in systemic proinflammatory cytokines present in periodontitis and caries can modify local muscle metabolism and decrease physical health.²⁰ Caries and periodontitis may lead to changes in serum levels of inflammatory biomarkers such as TNF-a and interleukin (IL), that appear in muscle injury. Such changes may can affect physical fitness.⁸

Person who can carry out physical activities is considered having physical fitness. Physical activity itself is often defined as behavior

that involves body movements produced by skeletal muscles that require energy.⁸ Physical fitness can provide physical and psychological benefits for people with disabilities including down syndrome and for those at risk of suffering from vascular disease, type II diabetes, and obesity²¹. With physical fitness, self-confidence may get better, and anxiety and stress may get lower.²² Physical fitness has the potential to improve the general health of adolescents with down syndrome, which can improve their cardiovascular, metabolic, Musculo-skeletal, and psychosocial health functions.^{10,23}

Discussion

This review questions whether oral health is correlated with physical fitness. It showed oral health conditions i.e., periodontitis and caries greatly affect physical fitness. Periodontitis and caries are dental and oral health problems that often occur in down syndrome children.¹⁵ Deeper caries and periodontitis can induce inflammatory process. The accumulation of bacteria can make them circulate to the body through the blood vessels; given this circumstance, it could give response to fight back by releasing the immune system components. The immune system itself trigger the release of pro-inflammatory cytokine products (IL-6, IL-1 β and TNF- α) to protect the body from bacterial attack. These products are markers of infection in the body. Furthermore, the infected body often become more susceptible to diseases and make the metabolism decrease, thereby disrupting the flow of oxygen in the body and muscles. The lack of oxygen in the muscles is likely to produce inadequate oxygen supply. This results in a buildup of lactic acid in the muscles. Lactic acid itself is a product of the body's metabolism. The buildup of lactic acid in the muscles is what triggers muscle fatigue. When muscle fatigue occurs, it will have an impact on decreased physical fitness.^{24,25,26}

The problem above is also proven in previous studies reporting that dental and oral health problems e.g., caries can cause decreased physical fitness in children.^{27,28} Other studies also have mentioned that periodontitis affect physical fitness.^{29,8} Along with dental and oral health problems in male athletes, both caries and periodontitis have an adverse effect on their physical performance.⁷ Lower physical illness in relation to inflammation can lower concentrations

of pro-inflammatory biomarkers as a person engages less in frequent and intense physical activity.^{30,20}

Physical fitness indicates that someone can do physical activities, and theoretically, body composition and muscle performance are the indicators of physical fitness. Body fat and muscle metabolism can affect physical fitness.^{31,8} For example, muscle damage may decrease physical fitness and prompt the increase in leukocytes and proinflammatory cytokines serum levels such as interleukin (IL)-1 β , IL-6, and tumor necrosis factor (TNF)- α . This muscle inflammation can harm muscle structures and prolong the process of muscle recovery. Moreover, it can make muscle pain worse and individuals more reluctant to move and force skeletal muscles.²⁰ As a result, physical fitness gets weaker.

As similar pro-inflammatory biomarkers are found in muscle metabolism and periodontitis,^{8,32} oral health problems can affect physical fitness related to muscle mass, strength, and function.^{25,33} Besides, both periodontitis and caries also have anatomical proximity to the vascularization; therefore, these oral health problems can negatively affect physical fitness through the metastatic pathway that deals with chronic oral and dental diseases that correspond with atherosclerotic cardiovascular diseases according to the biological mechanisms.^{17,20} Both caries and periodontitis are likely to decrease physical fitness of down syndrome children.

Down syndrome children are at higher risk of several diseases compared to normal children. For example, they have poor oral health which may weakens physical fitness. Therefore, physical fitness needs to be of priorities for daily activities as it can improve health in general.^{23,34} Well-maintained physical fitness vigorously results in various biological functions,³⁵ considering oral health that affects physical fitness of down syndrome children. In conclusion, deficient oral health has something to do with decreased physical fitness of down syndrome children.

Conclusions

Poor oral health has been proved to lower physical fitness in down syndrome children.

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Declaration of Interest

The authors report no conflict of interest.

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