Oral health benefits of chewing gum
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General introduction and aim of this thesis
Throughout history, humans have sought various aids to maintain oral health. In ancient
times, by rinsing their mouth with vinegar, later by chewing on the end of a twig of the
Salvadora persica tree, which eventually has led to the modern day toothbrush. Today's
society can choose a vast array of toothbrushes, dentifrices, mouthrinses, toothpicks and
dental floss, which are continuously developing to serve more specific needs (1). Besides
the traditional oral health care products, also chewing gum has developed into an oral care
product.

Undoubtedly, oral health has advanced tremendously over the last decades,
reflected in a decrease in the number of total denture wearers in The Netherlands from
32% in 1981 to 12% in 2009 (2). Nevertheless, prevalence of oral diseases is still one of
the most important diseases present in daily life, as dental caries is one of the most non-
communicable diseases among children worldwide and affecting the vast majority of adults
in industrialized countries (3,4). Only 16% of all young adults in the Netherlands have a
perfect dentition without any restorations (5) and approximately 12% of the Dutch
population receives a dental filling every year (6). Numbers on the epidemiology of
gingivitis vary greatly but estimates are that more than 50% of all adults experience
 gingivitis from which roughly 10% advances to severe periodontitis (7–9). These figures
indicate the difficulty of maintaining oral health and are illustrative for the necessity of
continuous improvement of oral health care products.

Causative to most oral diseases, including caries, gingivitis and periodontitis, is
the formation of oral biofilm. Planktonic bacteria in saliva adhere to the salivary
conditioning film on the tooth surface to form a biofilm; a complex structure of multiple
bacterial species, protected by a matrix of extracellular polymeric substances from
environmental forces and antimicrobials. If the oral biofilm is not mechanically removed,
the composition of the biofilm changes which is the onset of diseases (10–12). In the case
of caries, specific bacteria in the biofilm ferment environmental sugars into acids, causing
softening of the enamel. Normally this is counteracted by minerals in saliva which recover
hardness of the enamel, however when this balance is lost the tooth surface is prone to
cavities (13). As gingivitis is concerned, specific pathogenic bacteria in biofilm in the
gingival margin and in between teeth excrete products that cause a signaling cascade in the
gingival tissue of the host, resulting in an inflammatory response. If left untreated, the
inflammation may advance to periodontitis, affecting the bone around the teeth which can
eventually lead to tooth loss(14).

Since the 1970s, chewing gum developed from a candy into an oral care product.
Replacement of conventional sugars by artificial sweeteners, which cannot be fermented
into acids by oral bacteria, together with the stimulation of saliva during chewing made
chewing gum an established oral care product (15). Currently, dictated by the urge for continuous product development, various active ingredients are incorporated in chewing gum to chemically influence the oral biofilm, for instance by reducing the number of bacteria in saliva or preventing bacterial adhesion to the tooth surface, all aiming to enhance the current oral health benefits (16–18).

**Aims of this thesis**

The general aim of this thesis is to explore new possibilities to further develop the oral health benefits of chewing gum. To this end, we first evaluated the current oral health benefits of chewing gum, emphasizing the effects of active ingredients on biofilm formation. The effects of two active ingredients in chewing gum on oral biofilm after 4 weeks of use and the effects on the mouthfeel perception in relation to tooth surface properties was investigated in an *in vivo* study. Next, we looked into the importance of adhesion forces of bacteria in the oral cavity and its role in the eventual bacterial composition of the biofilm. Subsequently, the possibilities of using a piece of chewing gum to trap oral bacteria and to remove them from the oral cavity was investigated both *in vitro* and *in vivo*. Finally, we explore the first step towards the development of an oral care agent that targets specific bacteria within the oral cavity.
References


