

## Antibacterial Effect of Mastic Gum on Aerobic Oral Bacteria

التأثير البكتيري المضاد لعلكة المستك على بكتريا الفم الهوائية

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## المستخلص:

**الهدف:** تعيين التأثير المضاد لعلكة المستك ضد بكتريا الفم الهوائية والتاكيد على مسبجيات الفم.

**المنهجية:** في هذه الدراسة تم تعيين 10 أشخاص (رجال ونساء تتراوح اعمارهم ما بين 18 – 60 سنة) عشوائياً لكي يمضغو علكة المستك (5, 10) لمدة 45 دقيقة. جمعت غسول الفم قبل وبعد مضغ العلكة. خففت غسولي الفم (10-10-10) وزرعت هوائياً على الوسط الغني الصلب BHI للعد البكتيري الكلي وعلى الوسط المختار الصلب MSF لعد مسبجيات الفم.

**النتائج:** بينت النتائج بأن العد البكتيري الكلي لبكتريا المكورات العنقودية , الناسيريا ومسبجيات الفم على الوسط BHI ولمسبجيات الفم على الوسط MSF قبل وبعد مضغ العلكة قد اختزل بدرجة عالية وصلت الى اكثر من خمس درجات طبقاً للتحليل الاحصائي. تمت ملاحظة وجود فروقات معنوية في العد لبكتيري قبل وبعد مضغ العلكة ا لمسبجيات الفم والناسيريا ( $P < 0.05$ ) , وفروقات غير معنوية للمكورات العنقودية عند ( $P > 0.05$ ).  
**التوصيات:** اوصت الدراسة بمضغ علكة المستك يومياً ولعدة ساعات واستعمال مسحوق العلكة مع بعض انواع الطعام للحفاظ على صحتك العامة وصحة فمك.

## Abstract:

**Objective:** To evaluate the antibacterial effect of mastic gum against the most common aerobic oral bacteria and emphasized on oral streptococci.

**Methodology:** In this study 10 persons (males and females of 18-60 years old) were randomly assigned to chew mastic gum (1.5 gm for 45 minutes). Mouth washes were collected before and after gum chewing. The two mouth washes were diluted (10-1 – 10-6) and cultivated aerobically for 24 hours at 37°C on BHI agar for total bacterial count and on MSF agar for counting the oral streptococci.

**Results:** The results showed that the total bacterial count for staphylococci, Neisseria and oral streptococci on BHI agar and MSF agar for oral streptococci after mastic chewing were highly reduced and arrived to more than 5 grades according to statistical analysis.

**Recommendations:** To keep your mouth healthy we recommended the followings : Chewing of mastic gum daily , using oral mastic products such as toothpaste and mouthwash, and incorporation of mastic as powder with some type of foods.

**Key words:** Antibacterial effect, Mastic gum chewing, Oral streptococci, Staphylococci, Neisseria, Mouthwash.

**Introduction:**

**M**astic gum is gum resin exudates that obtained from the stem and main leaves of the mastic tree *Pistacia lentiscus* cultivated on the Greek island. Mastic has been used as a chewing gum and medicinal food in the Mediterranean and Middle East for many centuries <sup>(1)</sup>. The antibacterial and antifungal activities have been recognized for many years. The Greeks used mastic as medicine and as a food preservative due to its antibacterial properties <sup>(1)</sup>. In the 2<sup>nd</sup> century B.C., Galenus suggested that mastic was useful for bronchitis and improving the condition of the blood, and in the 15th century, Christophor Columbus wrote that mastic gum was antibacterial and even used against cholera, Thomas Fuller's *Pharmacopoeia*, published in 1710, includes mastic <sup>(2)</sup>. In Europe, mastic gum has been used in self-absorbing surgical threads, as bandages in surgery, in toothpaste and mouthwash. Many studies showed that the mastic resin and gum inhibit the growth of different strains of *H.pylori*, the causative agent of peptic ulcers, and it may colonize the mouth and it can re infect a stomach <sup>(3-6)</sup>. Some studies found that mastic had antiviral activity against herpes Simplex <sup>(1)</sup>. Mastic gum (which is sugarless) contains compounds that reduce the growth of oral bacteria and plaque <sup>(1)</sup>. Some researchers in Turkey and Japan showed that chewing mastic gum reduced the total bacterial count in saliva, to a degree comparable to that obtained with the antibacterial drug benzethonium chloride; reduced the incidence of gingival inflammation; reduced the rate of formation of dental plaque; and reduced the acidity of dental plaque <sup>(2-10)</sup>. Another study showed that mastic gum had significant antibacterial effect against *S. mutans* and other oral bacteria it may be useful in the prevention of caries and gingivitis <sup>(11, 12)</sup>. Chewing gum sweetened with sugar can have a negative effect on oral health because it can degrade the enamel of the teeth. Many studies confirm that mastic gum has a low toxicity potential, well tolerated

and has no serious side effects <sup>(13)</sup>. The aim of this study was to evaluate the antibacterial effect of mastic gum against aerobic oral bacteria and emphasize on the oral streptococci.

**Methodology:**

**Subjects:** - This study was conducted on 10 subjects randomly selected, the age range was (18 -62) years old.

**Mastic gum:** - Crude mastic gum was brought from Saudi Arabia.

**Normal saline:** - 0.8% NaCl for dilutions <sup>(14)</sup>

**Culture media:** - Brain Heart Infusion Agar (BHI - A) (enriched medium) and Mannitol Sorbitol Fuchsin Agar (MSF-A) (selective medium for oral streptococci) <sup>(15)</sup>.

**Processing:** - Washing of the oral cavity for each person (10 persons) was done before mastic chewing with sterile saline (20 ml). The washing sample was diluted with sterile saline ( $10^{-1}$  - $10^{-6}$ ), the three last dilutions ( $10^{-4}$  -  $10^{-6}$ ) were cultured on BHI-A for total bacterial count and on MSF-A for counting of oral streptococci. 1.5 gm of mastic gum was given for each person to chew for 45 minutes. After chewing, mouth washing was done with sterile saline (20 ml), and the washing samples were diluted with sterile saline ( $10^{-1}$  - $10^{-4}$ ). The dilutions ( $10^{-2}$  -  $10^{-4}$ ) were cultured on BHI-A and MSF-A and incubated at 37°C for 24 hours. The choice of dilutions for bacterial counting depended on dilution should had between 25-250 colonies (CFUs), that are statistically acceptable <sup>(14)</sup>. Triplicate plates were cultured for each dilution before and after chewing.

**Statistical analysis:-** The following statistical data analysis approaches were used (Mean value, Standard Deviation, Standard Error, (95%) Confidence interval for population Mean value, Two Extreme values (min. and max.) respondents. Then inferential data analysis used to accept or reject the statistical hypotheses, which included the paired matched (t- test), and Least significant difference (LSD) <sup>(16)</sup>.

**Results:****Table 1.** Descriptive statistics for the studied types of bacterial a count in ( $\text{Log}_{10}$  of the cells / ml) on (BHI and MSF) Agar before and after mastic chewing

Bacterial groups	Mean	N	S.D.	S.E.
Staphylococci - BHI Agar : (Before)	6.81	10	3.90	1.23
Staphylococci - BHI Agar : ( After )	2.9	10	2.44	0.77
Streptococci - BHI Agar : (Before)	9.8	10	2.47	0.78
Streptococci - BHI Agar : ( After )	5.8	10	2.43	0.77
Neisseria - BHI Agar : (Before)	6.3	10	2.88	0.91
Neisseria - BHI Agar : ( After )	4.32	10	1.68	0.53
Streptococci - MSF Agar : (Before)	8.74	10	1.39	0.44
Streptococci - MSF Agar : ( After )	5.07	10	1.93	0.61

N=Number; SD=Standard Deviation; SE=Standard Error

Table (1) showed the summary statistics for the two periods, before and after outcome's account of the studied types of bacteria in ( $\text{Log}_{10}$  of the cells / ml) at mastic chewing process on (BHI and MSF) Agar media

**Table 2.** Descriptive statistics of differences for outcome's accounts at the studied types of bacterial a count in along the two periods on (BHI and MSF) Agar

Bacterial group	N	Mean of diff.	S.D.	S.E.	95% C.I. for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Neisseria - BHI Agar	10	1.74	2.45	0.77	(0.02)	3.48	0	7.00
Staphylococcus- BHI Agar	10	3.94	2.21	0.70	2.32	5.48	0.64	7.4
Streptococcus- BHI Agar	10	3.54	2.32	0.73	1.88	5.20	0	6.7
Streptococci - MSF Agar	10	3.67	2.57	0.81	1.84	5.51	0.43	7.92

N=Number; SD =Standard Deviation; SE=Standard Error C.I. = Confidence Interval; Min =Minimum; Max =Maximum; diff=differences

Table (2) showed the differences for outcome's accounts at the studied types of bacterial a count along the two periods.

**Table 3.** Testing of period's effectiveness for the studied types of bacterial a count in ( $\text{Log}_{10}$  of the cells / ml ) on (BHI and MSF) agar before and after mastic chewing

Paired Samples t-test	Paired t-test	d.f.	S. (2-tailed)	C.S.
Staphylococci - BHI Agar : ( Before – After )	2.24	9	0.052	NS
Streptococci - BHI Agar : ( Before – After )	5.59	9	0.000	HS
Neisseria - BHI Agar : ( Before – After )	4.82	9	0.001	HS
Streptococci - MSF Agar : ( Before – After )	4.52	9	0.001	HS

DF=degree of freedom; S=Significant; CS=Comparative Significance, HS: Highly Significant at  $P < 0.01$ ; NS: Non Significant at  $P > 0.05$

Table (3) showed the comparison significant for the two repeated periods, the statistic test proved within a none suspicion that a highly changeability occurred as a result or due to the studied process since.

**Table 4.** Multiple Comparisons (LSD) among all pairs of different responding in the studied domains

Pair wise Comparisons		
Dependent Variable: Difference		
Bacterial groups	Bacterial groups	S.
Staphylococci - BHI Agar	Streptococci - BHI Agar	0.049
	Neisseria - BHI Agar	0.100
	Streptococci - MSF Agar	0.078
Streptococci - BHI Agar	Neisseria - BHI Agar	0.735
	Streptococci - MSF Agar	0.833

S: Significant at  $P < 0.05$ ; NS: Non-Significant at  $P > 0.05$ , Level of significance  $\leq 0.05$

Table (4) showed the results of this study by the Multiple Comparisons by LSD for testing of equality of mean's differences.

#### Discussion:

Our experiment was preliminary study evaluating the effect of mastic gum against the most common aerobic oral bacteria by chewing the crude mastic gum (1.5 gm. for 45 minutes). The results reported a highly of differentiated in the total account which had been occurred regarding to the statistics recorded in the two periods.

From Stem –Leaf chart we can conclude that all readings of the studied samples had been showed a highly grade of convergent properties, and that indicating good attribute of reliability for studying of registered data. According to the mean value statistics, the reduction in the studied criteria arrived to more than 5 grades. A highly significant different at ( $p < 0.01$ ) were recorded in testing the mean value of differences overall the total individuals of the studied sample except with the type Staphylococci in BHI Agar media reported a minor differentiation in the total account regarding to the statistics recorded with left over, which was reported a non significant difference at ( $P > 0.05$ ). Nevertheless of the preceding result and since the probability level of real significant level which has asymptotically closes with the cutoff point (0.05), the significant level of the statistical decision, which was reported (0.052), and that should be

formed more informative to be reported. By LSD test a significant difference at ( $P < 0.05$ ) was reported between staphylococci –BHI agar, while non-significant (at  $P > 0.05$ ) was recorded with the left over. In addition to that, for the preceding comparisons between staphylococci - BHI Agar and the two types (Neisseria - BHI Agar and Streptococci - MSF Agar) which were reported real significant levels (0.10 and 0.078), and that should be formed more informative to be reported.

Our results are in agreement with other findings of Will block<sup>(1)</sup>, Stephen and his coworker<sup>(2)</sup>, Hyla<sup>(3)</sup> and Richard P.Huemer .M.D.<sup>(4)</sup> that showed mastic gum suppress the growth of the oral bacteria and significantly reduction in their count . We concluded that chewing of mastic gum daily and for many hours may be useful in controlling dental caries, and dental plaque. It is good for general and oral hygiene; it protects teeth, and other organs from systemic inflammation caused by oral bacteria<sup>(1-4)</sup>.

**Recommendation:** To protect your health we recommend incorporation of mastic gum as powder with some type of foods such as roast meat, chicken, during grill of veal steak, and in preparation of pizza and bread<sup>(1)</sup>.

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