

## Efficacy of German chamomile mouthrinse on plaque, gingivitis, periodontal pockets and calculus in man

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### Abstract

The aims of this study were to evaluate the effectiveness of German chamomile extract as a mouthrinse on the development of plaque, gingivitis, pathological pockets and calculus in man to determine whether it can provide any benefit without the addition of other additives. Fifty adult volunteers participated in this controlled single blind cross-over study. The subjects used either German Chamomile or a chlorhexidine mouthrinse for 1 minute twice daily during eight weeks period, 2 weeks interval between each visit for motivation and reinforcement of application of the material. Four applied indices (plaque and gingival indices by Loe and Silness), CPITN index by Ainamo and calculus index by Ramfjord were recorded at baseline, after each experimental period and at the last visit. The mean reduction in plaque, gingival and periodontal pocket depths were determined by using paired Z-test between each visit at  $P \leq 0.01$  significantly lower for GC than for CHX mouthrinse. While for calculus index there was significant increase between each visit at  $P \leq 0.05$  using paired Z-test and for all visits using repeated measures F-test at  $P \leq 0.01$ . Using GC mouthrinse in a percentage of 1:4 appears to offer benefit in plaque, gingival, pocket depth reductions but with significant adverse increase in calculus index.

تأثير فعالية مستخلص نبات البابونج المستخدم كغرغرة فم على الصفائح الجرثومية والتهاب اللثة والجيوب اللثوية (التكلس) لمجموعة من البالغين

فراند داوود سلمان شيماء خزعل يونس

### المستخلص

إن الهدف من هذه الدراسة هو تقييم تأثير فعالية مستخلص نبات البابونج المستخدم كغرغرة فم على الصفائح الجرثومية، التهاب اللثة، عمق الجيوب اللثوية والقلح (التكلس) لمجموعة من البالغين باستخدام المؤشرات الخاصة بكل حالة باستخدام مستخلص مخفف بارد بنسبة 1:4، فتبين أن تأثير المحلول فعال في منع تكوين الصفائح الجرثومية، التهاب اللثة، الجيوب اللثوية بدرجة معنوية أقل من غرغرة الكلوروكسدين المستعمل للمقارنة لكن هناك زيادة معنوية في تكوين القلح على سطوح الأسنان أيضا بدرجة أقل من غرغرة الكلوروكسدين الشائع استعمالها.

## Introduction

Vast majority of patients will not completely remove plaque by mechanical measures(1) particularly handicapped or elderly individuals because of their compromised dexterity or motivation (2-5). To overcome these problems, chemical plaque control has been the subject of scientific interest(6,7). Chlorhexidine (CHX) is the gold standard against which other antiplaque agents are evaluated(8,9). But its local side effect such as tooth staining, taste impairment and desquamation of oral mucosa have limited its use on the long-term (10). So alternative agents based on herbal extracts are therefore of particular interest. There is some evidence indicating the beneficial effect of plant extract on gingival inflammation and plaque accumulation(11-13) or subgingival periodontopathic microorganisms(14). German Chamomile (GC) has been known as an anti-inflammatory, antibacterial and bacteriostatic promoter and has been used in combination with other herbal ingredients as mouth wash or dentifrice to reduce plaque growth and to improve gingival health(15). The therapeutic properties of GC are analgesic, antibiotic, anti-inflammatory, bactericidal effects.(15) There has not been any direct, controlled long-term study on the effects of GC extracts alone on plaque accumulative on or gingival status or pocket depth & calculus.

### Aims of the Study:

1. To evaluate the effectiveness of pure GC extract as a mouthrinse on the development of plaque, gingivitis, pathological pockets and calculus in adults.
2. To evaluate any adverse reaction of this extract.

## Material and methods

### Preparation of chamomile mouthrinse:

Chamomile oil is extracted from 250mg of the flower heads of *matricaria chamomilla* by steam distillation of 250ml water for 24 hours, then filtering the extract by using 3 layers of gauze, the GC yields about 0.2-0.4%

of the fresh flowers (16). After separation of active ingredients then apignine I+ Azulene III solutions are diluted by a ratio of 1:4 as a mouth rinse to be used in dentistry.

### Study population:

Fifty adult volunteers including dental students, dentists, general practitioners were recruited for this study (Faculty of Dentistry, University of Mosul, Iraq). All the subjects had moderate plaque, gingivitis, periodontal pockets (3.5-5mm) and very low calculus. The eligible subjects were informed regarding the purpose of this study and the products being evaluated. Half of the sample (25 subjects) were grouped as a test group using GC, the other half used the control rinse. Healthy individuals were excluded from the examination (13 females, and 12 males for each group); the controlled and the experimental groups with age range from 25-40 years old. Any subject who has any medical problem was excluded from the examination.

### Study design:

The present study had a controlled single blind cross-over experimental design. It consisted of 4 experimental periods  $\times$  2 weeks interval between each visit plaque(17), gingival(18), periodontal pockets (19) and calculus indices(20) were recorded for all subjects at baseline, followed by random assignment to receive the test or control mouthrinses. The indices were measured by the same clinician at the baseline, between each visit and at the final visit. The test GC extract mouthrinse and the control CHX mouthrinse had a similar appearance and bottle. The participants were asked to use their assigned rinse measures and not to use any mouthrinse during the duration of this study. The test subject group were instructed to rinse with 10ml of 0.25% GC extract mouthrinse twice daily for 1 minute, while for control subjects were instructed to rinse with 0.2% CHX for 1 minute twice daily with instruction not to use the rinse with brushing but independently or proceeded by a water if it is used after brushing. The participants' compliance was evaluated by measuring the remaining volume of the mouthrinse that they



brought back during their recalls. They were also asked to report any adverse reactions experienced during the use of mouthrinses. The material had been examined for its biological activity in the laboratory to clarify its effectiveness to suppress pathogens as a mouthrinse. Statistical analysis included mean, standard deviation between visits using paired Z-test at  $P < 0.05$  level, while percentage difference at  $P < 0.01$  level. For comparison between the two materials it included mean, standard deviation using Z-test for each visit and repeated measures F-test for all visits at  $P < 0.01$  level but for percentage difference unpaired Z-test at  $P < 0.01$  was used:

All had been calculated as follow: i.e.:

$$\left. \begin{array}{l} \text{All} = 2\text{nd} - 1\text{st visit} \\ + 3\text{rd} - 1\text{st visit} \\ 4\text{th} - 1\text{st visit} \end{array} \right\} \div 3$$

### Results

It had been found that significant differences were found between the fourth visits for each material, there was significant reduction for the first three indices with significant increase for the fourth index (calculus index at  $P < 0.05$  level using paired Z-test). As it is clearly shown from the table differences were greater for CHX than for German chamomile in Table (1). While percentage differences from the first visit between two materials for the first three indices had been found with significant reduction ( $P < 0.01$ ) (Table 2), but for calculus index it couldn't be found because it couldn't be divided by zero since it include division by zero. Table (3) reveals mean and standard deviation of the difference from the first visit for the two applied materials for all indices applied in the study using Z-test for each visit and repeated measures F-test for all visits i.e.:

All = difference between 2 materials regardless of visits (2nd, 3rd, 4th visit)

$$\left. \begin{array}{l} \text{i.e: All} = 2\text{nd} - 1\text{st visit} \\ + 3\text{rd} - 1\text{st visit} \\ 4\text{th} - 1\text{st visit} \end{array} \right\} \text{repeated measure test}$$

It had been shown that there was significant difference for all visits for the fourth applied indices at  $P < 0.01$  level, there was significant difference between each visit for the two applied materials except for the fourth visit of CPITN, 2nd and 3rd visit of calculus index at  $P > 0.05$ .

As it is shown clearly from the table differences were greater for CHX than for GC. While percentage difference from the first visit between the two applied materials for the fourth applied indices had been found with significant reduction for the first three indices with significant increase for calculus index at  $P < 0.001$  level using unpaired Z-test analysis as clearly shown in Table (4). Figure (1) reveals the reduction in mean of the first three indices from the first visit for CHX mouthrinse. The reduction was greatest for CPITN followed by PI, GI respectively but it doesn't reach zero level at the last visit. While for calculus index there was significant increase from the first till the last visit. Figure (2) reveals the reduction in mean of the first three indices from the first visit for GC extract mouthrinse. The reduction was greatest for CPITN, PI, GI (0.99, 0.83, 0.68) respectively, while for calculus index there was significant increase from the first visit till the last visit (0.14), but it is clearly shown that the reduction was greater for CHX than for GC for all visits and between each visit.

1- The mean PI for control group is:  $1.20 \pm 0.48$

test group is:  $1.05 \pm 0.24$

So this mean is considered moderate (18).

2- The mean GI for control group is:  $1.0 \pm 0.34$

test group is:  $0.86 \pm 0.44$

So this mean is considered mild-moderate gingivitis (21).

3- CPITN mean for the control group is:  $1.30 \pm 0.45$

test group is:  $1.20 \pm 0.48$

So this mean is considered moderate (22,23,24).

4- The mean CA index for control group is:  $0.01 \pm 0.0$

test group is:  $0.01 \pm 0.03$

This mean is considered very low (20).



Table (1): Shows mean and SD between visits for the fourth applied indices

	Material type	Mean±SD			
		1 <sup>st</sup> visit	2 <sup>nd</sup> visit	3 <sup>rd</sup> visit	4 <sup>th</sup> visit
CPITN	CHX 2%	1.30±0.45a	0.50±0.26b	0.20±0.26c	0.05±0.07d
	GC 25%	1.20±0.48a	0.71±0.35b	0.42±0.19c	0.14±0.06d
PI	CHX 2%	1.20±0.48a	0.45±0.08b	0.15±0.06c	0.01±0.03d
	GC 25%	1.05±0.24	0.65±0.33b	0.48±0.14c	0.22±0.08d
GI	CHX 2%	1.00±0.34a	0.40±0.07b	0.18±0.07c	0.05±0.07d
	GC 25%	0.86±0.44a	0.45±0.08b	0.37±0.09c	0.18±0.07d
CAL	CHX 2%	0.01±0.03a	0.03±0.05b	0.15±0.06c	0.25±0.11d
	GC 25%	0.01±0.03a	0.05±0.07b	0.13±0.06c	0.15±0.06d

Means with different letters horizontally have significant difference at  $P \leq 0.05$  using paired Z-test.

Note CHX= Chlorhexidine 0.2%

GC= German Chamomile 0.25%

Table (2): Shows percentage difference from the first visit for the fourth applied indices for the two materials.

	Material type	Percentage reduction from 1 <sup>st</sup> visit (mean±SD)		
		2 <sup>nd</sup> visit	3 <sup>rd</sup> visit	4 <sup>th</sup> visit
CPITN	CHX 2%	59.74±20.34a	82.62±8.29b	95.06±7.25c
	GC 25%	30.90±43.11a	58.65±23.96b	86.11±9.31c
PI	CHX 2%	55.97±20.23a	85.39±9.32b	98.99±3.35c
	GC 25%	36.60±32.16a	51.22±19.78b	78.57±8.12c
GI	CHX 2%	55.73±24.32a	80.28±9.49b	94.62±7.40c
	GC 25%	31.66±37.30a	43.46±32.96b	72.37±18.22c

Means with different letters horizontally have significant difference at  $P \leq 0.01$  using paired Z-test.

Note CHX= Chlorhexidine 0.2%

GC= German Chamomile 0.25%

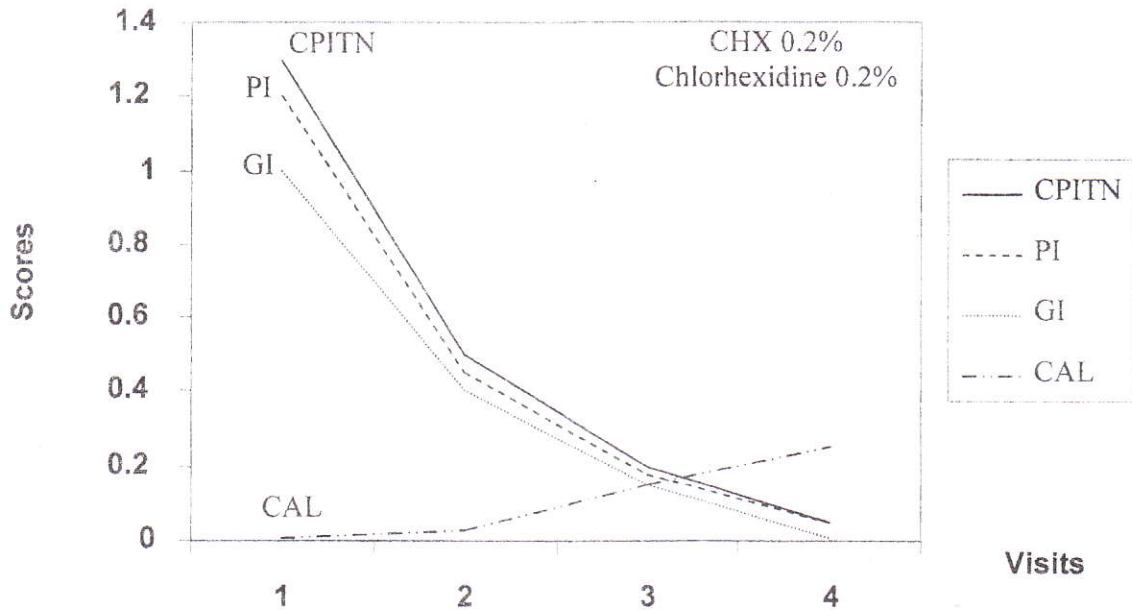
Table(3): Shows mean and SD between materials for the fourth applied indices.

	Visits	Difference from 1 <sup>st</sup> visit		P- value
		CHX 2%	GC 25%	
CPITN	2 <sup>nd</sup>	0.80±0.43	0.49±0.57	<0.01
	3 <sup>rd</sup>	1.10±0.44	0.78±0.52	<0.01
	4 <sup>th</sup>	1.25±0.46	1.06±0.48	>0.05(NS)
	All	1.05±0.46	0.78±0.46	<0.01
PI	2 <sup>nd</sup>	0.75±0.49	0.40±0.34	0.001
	3 <sup>rd</sup>	1.05±0.48	0.57±0.31	<0.001
	4 <sup>th</sup>	1.19±0.48	0.83±0.22	<0.001
	All	1.00±0.38	0.60±0.38	<0.001
GI	2 <sup>nd</sup>	0.60±0.35	0.41±0.44	=0.001
	3 <sup>rd</sup>	0.82±0.33	0.49±0.45	<0.001
	4 <sup>th</sup>	0.95±0.34	0.68±0.45	0.001
	All	0.79±0.39	0.53±0.39	=0.001
CIA	2 <sup>nd</sup>	0.02±0.06	0.04±0.06	>0.05(NS)
	3 <sup>rd</sup>	0.14±0.06	0.12±0.07	>0.05(NS)
	4 <sup>th</sup>	0.24±0.11	0.14±0.06	<0.001
	All	0.13±0.06	0.10±0.06	<0.01

Table(4): Shows percentage difference from the first visit for the fourth applied incidences for two materials.

	Visits	%Difference from 1 <sup>st</sup> visit		P- value
		CHX 2%	GC 25%	
CPITN	2 <sup>nd</sup>	59.74±20.34	30.90±43.11	<0.001
	3 <sup>rd</sup>	82.62±8.29	58.65±23.96	<0.001
	4 <sup>th</sup>	95.06±7.25	86.11±9.31	<0.001
PI	2 <sup>nd</sup>	55.97±20.23	36.60±32.16	<0.01
	3 <sup>rd</sup>	85.39±9.32	51.22±19.78	<0.001
	4 <sup>th</sup>	98.99±3.35	78.57±8.12	<0.001
GI	2 <sup>nd</sup>	55.73±24.32	31.66±37.30	<0.001
	3 <sup>rd</sup>	80.28±9.49	43.46±32.96	<0.001
	4 <sup>th</sup>	94.62±7.40	72.37±18.22	<0.001





Note: CHX= Chlorhexidine 0.2%, GC= German Chamomile 0.25%

Figure (1): Mean reduction of CPITN,PI, GI with increase of calculus index for CHX 0.2% mouthrinse.

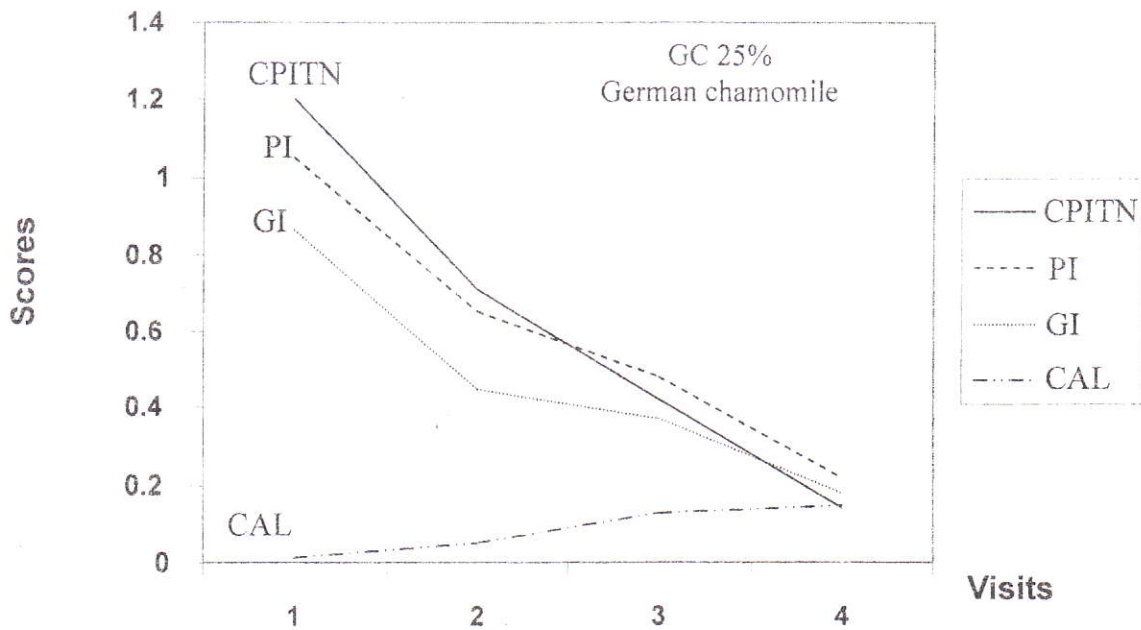


Figure (2): Mean reduction of CPITN,PI, GI with increase of calculus index for GC 0.25% mouthrinse

## Discussion

Plaque develops within 24-48 hours without brushing, gingivitis develop within 2-3 weeks(25) that is why we use it for eight weeks continuously to be so effective. Combinations of non specific plaque control program have been so effective against gingivitis, plaque and periodontitis(26,27). Combination products with chamomile as tooth paste or oral rinse have demonstrated beneficial effects on the status of oral hygiene (11,13,28).The present study showed that plaque scores reduction for control rinse was 99% reduction, this result was higher than other studies which reported 60%reduction (29,30,31) and other studies reported 77% reduction (32,33) , but for GC mouthrinse the reduction was 78% which is much lower than for CHX, this result was in contrast with that reported by Reza Pourabbas et al. (34) who reported GC percentage plaque reduction (22%) was significantly higher than CHX rinse (percentage not mentioned), the percentages reported in this study is much higher than that study which might be related to the intermittent-wash-up -period during their study which might be attributed to subconscious motivation by the subjects to intensify their oral hygiene during their application time(34) , and might be due to the continuous application of the rinse for long period during our study. These differences in percentage reduction of the two indices findings could be attributed to many factors like acceptance of the subjects to the rinse, their exact application, dosage frequency, timing, concentration variabilities. The present study showed that CHX mouthrinse resulted in 0.95 reduction in the mean gingival index scores between baseline and final examination while for GC mouthrinse it was 0.68 reduction in mean which was apposite to what had been reported by Reza Pourabbas et al.(34) that for GC mouthrinse mean reduction was 0.31 while for control rinse was 0.03. The higher reduction reported in this study may be due to the long period application of the material which lead to this reduction and the intermittent application of the material and wash-up-period in their study(34).Anti-inflammatory effects of

chamomile extract have been investigated in numerous studies(35), and it could be attributed to a particular component of the mouthrinse. As GC contains bisabolol and its derivatives contribute to the anti-inflammatory effects, other active compounds that contribute to chamomile's effectiveness include the flavonides, while they are not considered vital nutrients, several of them are believed to help strengthen capillaries and other connective tissues, such as apigenin, leuteolin and quercetin may be responsible for chamomile's long history of use as anti inflammatory agent due to interfering with arachidonic acid pathway i.e. GC is used to treat gum disease (36). This would confirm the previous studies which have stated the ability of herbal extracts to reduce the gingival inflammation parameters (11,12,28,37) .The present study showed that percentage reduction for periodontal pocket depths for CHX rinse was (95%) higher than that of GC (86%) with no significant difference between 2 materials, the result for CHX is in agreement with that of Westfelt et al. who stated that CHX inhibit the growth of 99% of pocket microflora since the prevalence of moderate periodontal treatment needs CPITN scores (1-3) is much higher in developing countries (CHX mean  $1.30 \pm 0.4$ , GC  $1.2 \pm 0.48$ ) which is considered moderate than in industrialized countries (22,23,33). For GC rinse the result is in accordance with various studies such as Pistoriun et al.(28) which have shown that plant extract can suppress the subgingival pathogen. Concerning calculus index scores the increase for CHX was higher than GC with significant difference between each visit and for all visits for the two materials, this result for CHX is in agreement with that of Miyazaki et al.(24) who declared that among the adverse effects of CHX is to increase calcific deposition on teeth, and it does not prevent plaque and tartar from forming, proper tooth brushing and flossing are still necessary, which is probably due to the easily assimilable form of calcium found in it (38).The presence of calculus and periodontal pockets greater than 3mm reduce the efficacy of mouthrinse these factors would



hamper access to vulnerable sites. Their effect is greatly enhanced by supra and subgingival scaling and correction of defective margins(39).Among the adverse effect of GC mouthrinse, a yellowish discoloration of the

labial surface of upper anterior teeth and lingual surface of lower anterior teeth, may be due to apigenin ingredient which is a yellow dye(40).

### Conclusions

- 1- GC extract mouthrinse is effective in reducing mean PI, GI, PD pocket depths of CPITN index scores with significant differences between each visit and for the total. It is much lower in effectiveness when it is compared with the control rinse.
- 2- Among adverse effect it increases calcific deposits but to a lesser degree than control rinse with yellowish discoloration of labial surface of upper anterior teeth and lingual surface of lower anterior teeth.

Based on these results, GC mouthrinse can be applied twice daily for 8 weeks to reduce plaque accumulation, gingival inflammation, moderate PD pocket depths, it could be prescribed as an adjunct to daily oral hygiene measures.

### Suggestions

- 1- Further studies should be carried out concerning the clinical application of the mouthrinse on pocket microflora.
- 2- Long term studies should be carried out for percentage reduction on pocket depth > mm (score 4 of CPITN).
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