

The Effect of Pregnancy on Unstimulated Salivary Calcium and Magnesium Concentration

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ABSTRACT

Background and objectives: Gingivitis is the most prevalent oral problem associated with pregnancy, in addition to several salivary changes. This study was designed to find the effect of pregnancy on salivary chemical factors (calcium and magnesium concentrations) and flow rate, and compare the results with that of non-pregnant women.

Methods: The samples consist of (118) females with age ranged from (20– 40) years (84 pregnant and 34 control, non-pregnant women). After collection of unstimulated saliva, the concentration of calcium and magnesium, and salivary flow rate were measured.

Results: The means of salivary flow rate, calcium and magnesium concentrations of pregnant and non-pregnant women were statistically non significant. There were non-significant difference between the means of each parameter with the age group of pregnant women and the gestation age. Non-significant difference between the means of each parameter with the trimester of pregnancy.

Conclusion: All factors showed non-significant differences between pregnant and non-pregnant women.

Keywords: Salivary calcium, salivary magnesium, salivary flow rate.

INTRODUCTION:

Gingivitis has been reported to occur from 30% to 100% of all pregnant women. Gingival changes usually occur in association with poor oral hygiene and local irritants, especially bacterial flora of plaque. However, the hormonal and vascular changes that accompany pregnancy often exaggerate the inflammatory response to these local irritants^{1,2,3,4}. Unstimulated salivary flow rate is the mixture of secretions, which enters the mouth in the absence of exogenous stimuli. Information gained about the salivary physical and biochemical changes during pregnancy would be of interest to physiologists and endocrinologists and might also prove to be of value to the dentists and obstetricians^{5,6}. Saliva is composed of water, organic and inorganic molecules, but a large intra- and inter-subject variability in composition is reported, especially in pregnant women⁷.

Calcium is present in unstimulated whole saliva at (1.4 mmol / l). About (50%) of calcium in saliva is present in an ionic form, about (40%) is complexes with other ions and about (10%) bound by salivary proteins^{8,9,10}. Magnesium is a mineral, which present in whole unstimulated saliva, at about (0.32 mmol / l)¹¹. Pregnancy produce significant increase in salivary calcium and magnesium, and it decrease in third trimester of pregnancy and increase when labour occurs¹². Other study found that a non-significant difference is seen between each of the trimesters in saliva composition¹³. The aim of this study is to find the effect of pregnancy on salivary chemical factors (calcium and magnesium concentrations) and salivary flow rate, and compare the results with that of non-pregnant women.

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MATERIALS AND METHODS:

The oral examination was done for healthy, non smoking, (84) pregnant women and (34) married non-pregnant women, they visit the same medical center, but with negative pregnancy test, their ages ranged between (20 – 40) years. The patients were attending to the Maternity and Child Health Care and Family Planning Units, in four Medical Centers, Ministry of Health, which present in different regions of Erbil city. Examination was done within a period between March 2008, to May 2008, all the patients were asked about age, and for those pregnant women about gestation. The examination was performed in the dental clinic of the medical centers. The collection of unstimulated whole saliva was performed under resting conditions between (08.30 – 10.30) a.m., at least two hours after eating. The patient was instructed for tooth brushing with out using toothpaste after eating directly to remove the food depresses. Subjects were asked to sit passively and expectorate the saliva into measuring polythene tube for five minutes, after that the number of ml/min was measured, then the salivary samples were preserved on ice. Salivary samples then centrifuged (4400 rpm) for (40) minutes to remove extraneous materials and the supernatants were placed in a new polythene tubes, and stored frozen in deep freeze (-20 °C) for subsequent analysis which was carried out in a maximum period of two weeks. The chemical analysis of magnesium and calcium were done by atomic absorption technique (Alpha 4, UK) in Department of Chemistry, College of Education, University of Salahaddin, Erbil. For this purpose, the ready-made magnesium stock solution was prepared from dissolving (1.0) gm of magnesium metal in (50) ml of (5 M) hydrochloric acid. Dilute to one liter in a volumetric flask with deionized water and store in a polythene bottle. While for calcium level estimation, the ready made calcium stock solution was prepared from dissolving (2.7693) gm of calcium chloride in

(100) ml of deionized water. Dilute to one liter in a volumetric flask with deionized water and store in a polythene bottle. The instrumental conditions were performed according to instrument manufacturers specifications:

	Mg	Ca
*Principle line (wave length)	285.2 nm	422.7 nm
*Band pass	0.2 nm	0.5 nm
*Lamp current	4 mA	6 mA
*Flames	air / acetylene	air / acetylene

Prepare five standard solutions for magnesium (1, 2, 3, 4, 5) ppm and six standard solutions for calcium (2, 4, 6, 8, 10, 15) ppm. All standard solutions were prepared from certified stock solutions. The standard solutions concentration were covered the expected range of the element and established a working calibration curve. Data processing and analysis were carried out using SPSS, and ANOVA test was used for testing the significant differences between pregnant and non-pregnant women in all factors used in this study.

RESULTS:

The total sample size was (118) females with age ranged from (20 – 40) years. A sample of (84) pregnant women (37 in the 1st trimester, 12 in the 2nd trimester and 35 in the 3rd trimester), as well as (34) non – pregnant women (control group). The calcium concentration of the saliva of pregnant women was (5.384 ± 2.68) ppm, and it was higher than that of the non – pregnant women, which was (4.751 ± 3.48) ppm, (Table 1). The magnesium concentration of the saliva of pregnant women was (2.650 ± 0.822) ppm, and it was nearly equal to that of the non-pregnant women, which was (2.775 ± 1.01) ppm, (Table 1). Statistical analysis showed that there were non – significant differences found regarding the calcium and magnesium concentration, between pregnant and non-pregnant women (P > 0.05). Figure 1 and Figure 2 showed the mean of calcium and magnesium concentration in each age group of

pregnant and non-pregnant women, differences were statistically non significant between them ($P > 0.05$). Figure 3 and Table 2 showed the mean of the concentrations of each parameter in each month of pregnancy. Differences were statistically non significant between them ($P > 0.05$) for both parameters. The highest mean of calcium concentration seen related to the first trimester, and the highest mean of magnesium concentration seen related to the third trimester. Statistical analysis showed non significant differences ($P > 0.05$) between the means of each parameters with the trimester of pregnancy, (Figure 4).

The results showed that the mean salivary flow rate of pregnant and non-pregnant women were (0.532, 0.477) ml / min respectively. Statistical analysis showed non-significant difference found in flow rate between pregnant and non pregnant women ($P > 0.05$). A negative correlation was seen between the salivary flow rate with the calcium and magnesium concentrations in non-pregnant women. While in pregnant women, there was no significant relation between the salivary flow rate with the calcium and magnesium concentration (Figure 5 and Figure 6).

Table(1): Calcium and magnesium concentrations in pregnant and non-pregnant women, with relation to age groups.

	(Group)	No.	Mean	S.D.	Std. Error	Minimum	Maximum
Ca conc. PPM	Control	34	4.75147	3.484354	0.59756	0.6	17.98
	Pregnant	84	5.38404	2.683698	0.29281	0.6	13.94
	Total	118	5.20178	2.935364	0.27022	0.6	17.98
Mg conc. PPM	Control	34	2.77558	1.019421	0.17482	1.74	5.89
	Pregnant	84	2.65071	0.822624	0.08975	1.45	5
	Total	118	2.68669	0.881135	0.08111	1.45	5.89
Ca conc. &Age group (Pregnant)	20 - 24	36	5.18666	2.902495	0.48374	0.6	13.94
	25 - 29	21	5.85619	2.845411	0.62092	1.04	13.48
	30 - 34	17	4.78529	2.265867	0.54955	1.75	8.51
	35 - above	10	6.121	2.14076	0.67696	3.44	9.56
	Total	84	5.38404	2.683698	0.29281	0.6	13.94
Mg conc. &Age group (Pregnant)	20 - 24	36	2.71861	0.854886	0.14248	1.69	5
	25 - 29	21	2.26	0.434431	0.09480	1.45	3.44
	30 - 34	17	2.95411	0.953507	0.23125	1.81	4.67
	35 - above	10	2.711	0.900215	0.28467	1.94	4.84
	Total	84	2.65071	0.822624	0.08975	1.45	5
Ca conc. &Age group (Non pregnant)	20 - 24	14	5.53	3.19379	0.85357	0.6	12.22
	25 - 29	5	3.608	1.565845	0.70026	2.48	6.21
	30 - 34	5	3.258	0.701156	0.31356	2.72	4.41
	35 - above	10	4.98	5.050505	1.59711	0.6	17.98
	Total	34	4.75147	3.484354	0.59756	0.6	17.98
Mg conc. &Age group (Non pregnant)	20 - 24	14	2.86928	1.166207	0.31168	1.89	5.89
	25 - 29	5	3.072	0.931622	0.41663	2.11	4.27
	30 - 34	5	2.62	1.184145	0.52956	1.74	4.68
	35 - above	10	2.574	0.846144	0.26757	1.89	4.11
	Total	34	2.77558	1.019421	0.17482	1.74	5.89

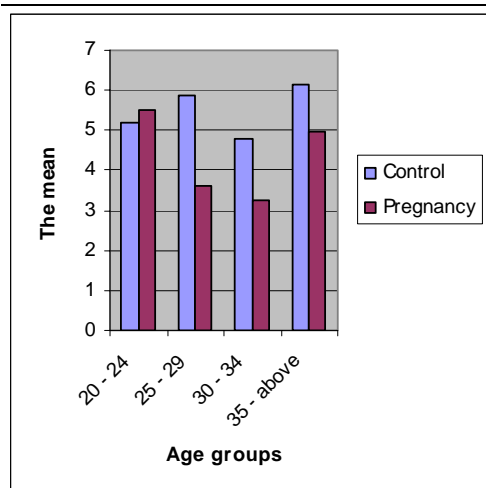


Figure (1): The mean of calcium concentration of control and pregnant women according to the age groups.

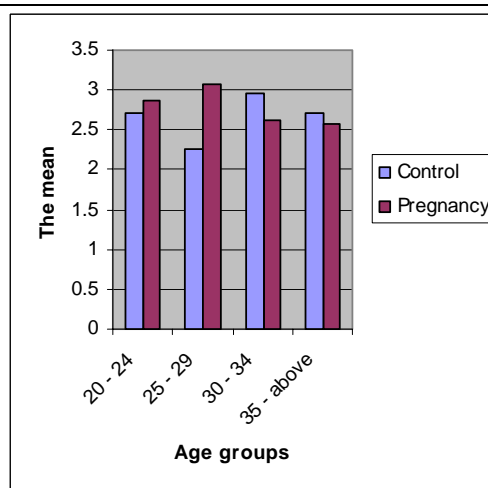


Figure (2): The mean of magnesium concentration of control and pregnant women according to the age groups.

Table(2): Calcium and magnesium concentrations in pregnant with relation to month and trimester of pregnancy.

	Month or trimester	No.	Mean	S.D	Std. Error	Minimum	Maximum
Ca conc. &month of pregnancy.	2	12	4.7875	2.40967416	0.695613	1.28	8.51
	3	25	5.9132	3.07563099	0.615126	2.17	13.94
	4	2	7.02	0.82024387	0.58	6.44	7.6
	5	3	2.96	1.73066461	0.9992	1.04	4.4
	6	6	4.823333	2.61846265	1.068983	2.24	9.56
	7	7	6.122857	1.62721351	0.615029	2.72	7.94
	8	15	5.227333	3.05177341	0.787965	0.6	12.21
	9	14	5.275	2.4678541	0.659562	0.6	10.48
	Total	84	5.384048	2.68369828	0.292815	0.6	13.94
	Mg conc. &month of pregnancy	2	12	2.785	0.96655433	0.27902	1.89
3		25	2.5448	0.69901192	0.139802	1.81	5
4		2	2.57	0.33941125	0.24	2.33	2.81
5		3	2.646667	0.75434298	0.43552	1.85	3.35
6		6	2.193333	0.55352206	0.225974	1.45	3.14
7		7	3.03	0.63516402	0.240069	1.81	3.67
8		15	2.766	1.11284577	0.287336	1.89	5
9		14	2.62	0.81501298	0.217821	1.69	4.35
Total		84	2.650714	0.82262405	0.089756	1.45	5
Ca conc. PPM		Control	34	4.75147	3.484354	0.59756	0.6
	1st trim.	37	5.54810	2.892397	0.47550	1.28	13.94
	2nd trim.	12	4.6675	2.487537	0.71809	1.04	9.56
	3rd trim.	35	5.45628	2.550692	0.43114	0.6	12.21
	Total	118	5.20178	2.935364	0.27022	0.6	17.98
Mg conc. PPM	Control	34	2.77558	1.019421	0.17482	1.74	5.89
	1st trim.	37	2.62270	0.790062	0.12988	1.81	5
	2nd trim.	12	2.53166	0.661511	0.19096	1.45	3.67
	3rd trim.	35	2.72114	0.915705	0.15478	1.69	5
	Total	118	2.68669	0.881135	0.08111	1.45	5.89

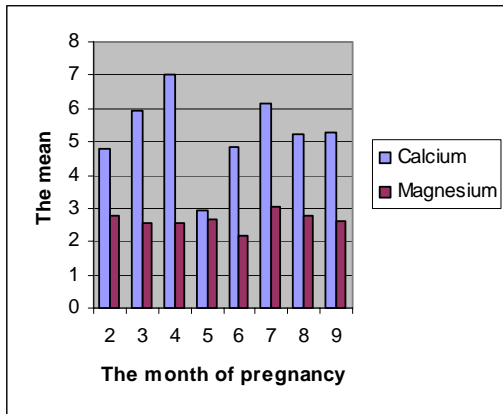


Figure (3): The mean of calcium and magnesium concentration according to the month of pregnancy.

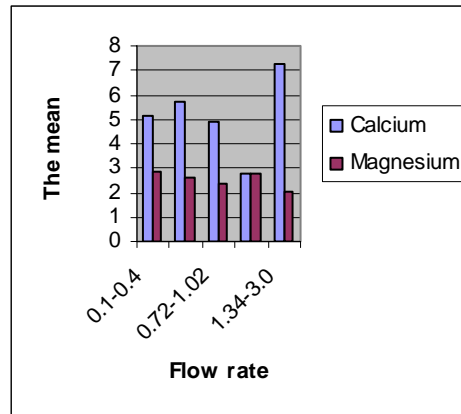


Figure (6): The calcium and magnesium concentrations of pregnant according to the flow rate.

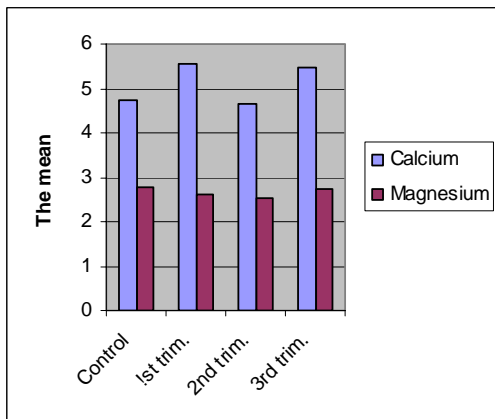


Figure (4): The mean of calcium and magnesium according to the trimester of pregnancy.

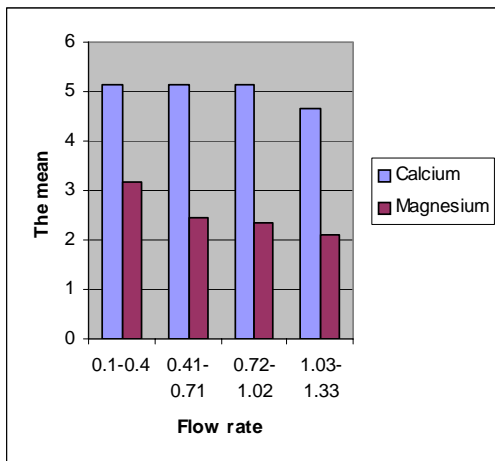


Figure (5): The calcium and magnesium concentrations of control group according to the flow rate.

DISCUSSION:

Pregnancy involves complex changes, every system is altered to some degree during pregnancy including saliva and oral cavity. The study showed that there were non significant difference between pregnant and non pregnant women in flow rate of saliva, this come in agreement with the results of other studies^{14,15}. Al-Taie (1994)¹⁶ observed significant highly flow rate of both resting and stimulated whole saliva in pregnant compared to non pregnant women, while Hugoson (1972) and Al- Nuaimy and Al-Doski (2003)^{17,18}, showed that during pregnancy, the salivary flow rate, and calcium concentrations were decreased. No statistical differences found between the calcium content of the saliva of non pregnant women and that of pregnant women, this come in agreement with the results of other studies^{19,20,21}. Al- Nuaimy and Al-Doski (2003)¹⁸ found that calcium concentration decreased significantly during pregnancy. While Salvolini et al (2005) found that the calcium concentration decreased at 21 and 40 weeks of gestation²¹. A negative correlation was seen between the salivary flow rate with the calcium and magnesium concentrations in non-pregnant women. While in pregnant women, there was no significant relation between the salivary

flow rate with the calcium and magnesium concentrations in the saliva, this may due to changes in salivary pH during months of pregnancy.

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