

Pregnancy-related changes in oral health and human unstimulated whole saliva

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ABSTRACT

This study was conducted on 200 women. One hundred fifty pregnant women at different stages of pregnancy, fifty women in each group, first, second and third trimesters were included in the study. The other fifty non-pregnant women with comparable age were used as a control group. The sample was taken from Al-Batool Teaching Hospital and Antenatal Care Unit of Al-Hadbaa Health Center, Mosul during the period from June 2001 to March 2002.

The study was done to assess the changes in the concentration of certain compounds of human unstimulated whole mixed saliva; study the frequency and severity of Gingival Index, evaluate Decayed, Missing and Filled Teeth Index (DMFTI) during pregnancy and also to correlate the pregnancy related changes (if any) in human unstimulated whole mixed saliva with oral manifestation during different stages of pregnancy.

The result of this study during pregnancy included decreased salivary flow rate, pH, total protein and calcium concentrations, while increased α -amylase activity, sodium concentration, severity of gingival inflammation and DMFT Index were identified compared with the controls.

In conclusion, the pregnancy involves complex changes with every system in even healthy women is altered to some degree during pregnancy. It modifies oral health and saliva composition.

Key Words: Pregnancy, unstimulated sa-

liva, oral health.

الخلاصة

شملت الدراسة ٢٠٠ امرأة، مائة وخمسون منهم من الحوامل في مراحل مختلفة من الحمل، ٥٠ امرأة في كل مجموعة: المرحلة الأولى، المرحلة الثانية والمرحلة الثالثة من الحمل و ٥٠ امرأة استخدمت كعينة ضابطة من النساء غير الحوامل. تم أخذ العينات من مستشفى البتول التعليمي ووحد الرعاية الصحية في المركز الصحي للحدايا في الموصل للفترة من حزيران ٢٠٠١ إلى آذار ٢٠٠٢.

أجريت الدراسة لمعرفة التغيرات التي تطرأ على مكونات اللعاب الكلي غير المخفف لدى الحوامل وتقييم دالة شدة التهاب اللثة ودالة تسوس سطوح الأسنان وكذلك دراسة أية علاقة -إن وجدت- بين الحمل والتغيرات الطارئة على صحة الفم خلال مراحل الحمل المختلفة.

ومن نتائج الدراسة لوحظ خلال الحمل قلة في معدل جريان اللعاب، الدالة الحامضية، تركيز البروتين الكلي، تركيز الكالسيوم مع زيادة في فعالية أنزيم ألفا أميليز وتركيز الصوديوم وشدة التهاب اللثة ودالة تسوس سطوح الأسنان عند مقارنتها مع المجموعة الضابطة.

وكمحصلة لهذه الدراسة لوحظ أن الحمل يتضمن تغيرات معقدة لكل جهاز حتى أن النساء الأصحاء يتأثرن إلى درجة خلال الحمل؛ مما يعني أن الحمل يحوّر في صحة الفم ومكونات اللعاب.

INTRODUCTION

Pregnancy is a physiological process associated with many functional and compositional alterations in almost all systems of the body to varying extents. It is a state of physiological stress which is accompanied by profound hormonal, biochemical and metabolic changes.

Many literatures are available on the changes which occur in almost all systems of the body during pregnancy.^(1, 2) However, the changes which occur in the salivary glands concerning their composition, secretion, function and regulation during pregnancy are poorly studied compared with other systems.

A variety of physiological changes occurring during pregnancy influence salivary secretion and composition and oral health. Since the oral cavity and its contained structures are important parts that serve as indicators for the general health status of the body; and oral health is a very important public health problem during pregnancy wide spread and endemic in most population, it is worth wise to study this problem.^(3, 4)

Saliva can be easily, non invasively and inexpensively collected and it can be used in the diagnostic tests as a natural ultrafiltrate of plasma.^(5, 6) The effect of female sex hormones especially progesterone on altering both the rate and pattern of collagen production in gingiva result in reduced ability to repair and maintain the gingiva, while estrogen appears to decrease keratinization of gingiva.⁽⁷⁻¹⁰⁾

The gingival condition in pregnant women should be considered a separate problem from simple gingivitis. The clinical picture may vary from a localized inflammation of gingival margin, particularly about the anterior teeth to a generalized involvement of the interdental papilla.

The information gained about the salivary clinical, physical and biochemical changes during pregnancy would be of interest to physiologists and endocrino-

logists and might also prove to be of value to the practicing dentists and obstetricians.^(10, 11)

SUBJECTS AND METHODS

The records of Al-Batool Hospital and Antenatal Care Unit of Al-Hadbaa Health Center in Mosul, for the years 2001–2002 were reviewed. One hundred fifty pregnant women at different stages of pregnancy were selected and fifty non pregnant women were selected as a control group; their age ranged between 15–46 years.

All samples were numbered; the number on each sample corresponded to the same number on a form containing information about each subject.

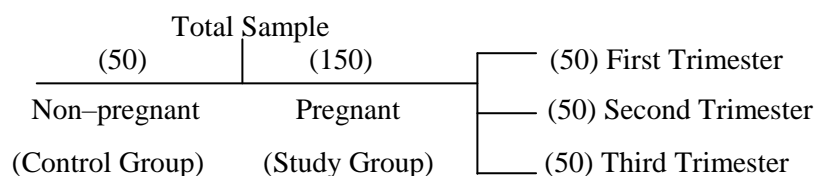
The following information were obtained as age, weight, occupation, education, family history and medical history. For clinical oral examination included Gingival Index (GI) and Decayed, Missing and Filled Teeth Index (DMFTI). For saliva analyses included flow rate, pH, α -amylase activity, total protein, calcium, sodium and potassium concentrations and sodium-potassium ratio.

Statistical analyses of the data were carried out using MINITAB program. The mean \pm standard deviation, range (minimum–maximum), median, student's t-test, analysis of variance (ANOVA) and correlation, coefficient of variability (CV) between the three trimesters and control group were done.

RESULTS

To minimize the effect of individual variation, diurnal effect and other general factors, the method of sample collection, the time of their collection and the posture of the women were standardized as possible to be the same for all subjects.

The sample distribution was as follows:



The grade of gingival inflammation during pregnancy increased especially in third trimester when compared with first and second trimesters and control group as listed in Figure (1) and Table (1). The mean value of DT, MT, FT increased in third trimester group when compared with first, second trimester group and control group as listed in Table (2).

Table (1): Mean \pm SD values of Gingival Index in all groups

Groups	Mean \pm SD
Control	1.33 \pm 0.47
First Trimester	1.42 \pm 0.53
Second Trimester	2.70 \pm 0.46
Third Trimester	2.20 \pm 0.63
Total Pregnant	2.10 \pm 0.54

SD: Standard deviation.

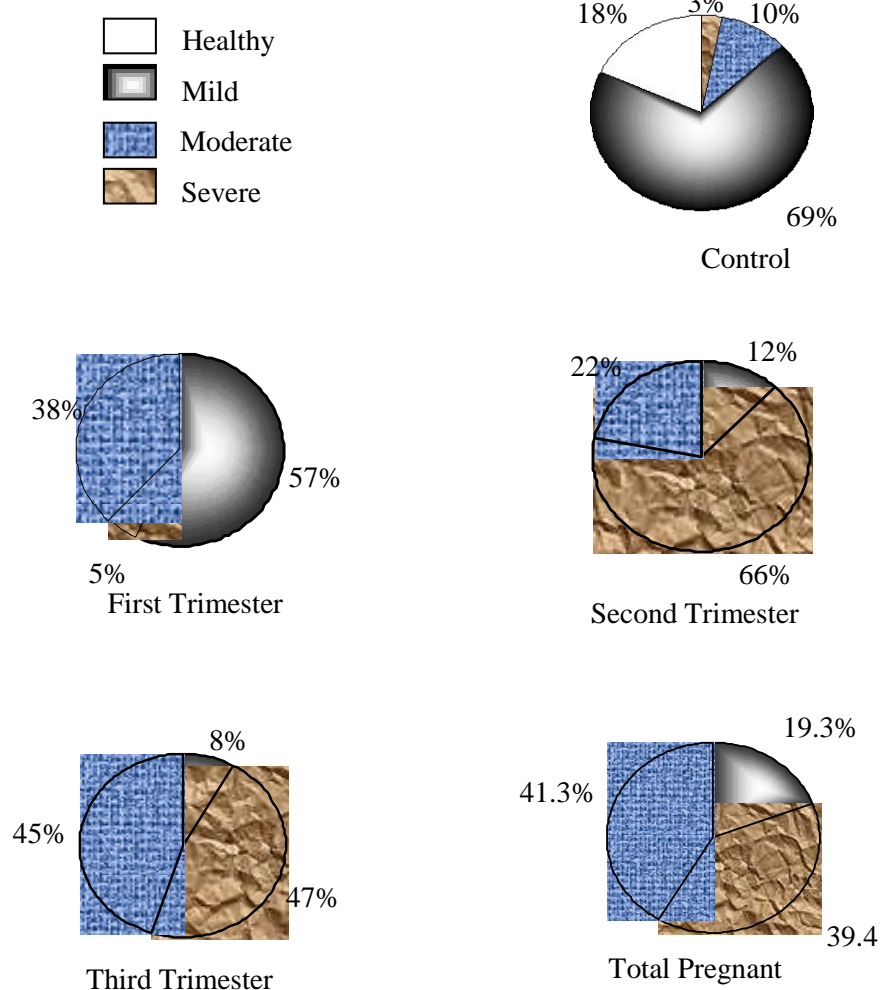


Figure (1): Distribution of the gingival level index in all groups

According to physical parameters of saliva (flow rate, pH) during pregnancy, a decrease in flow rate was found with minimum value in second trimester while for pH it continued to decrease till third trimester of pregnancy.

For biochemical parameters of saliva (the α -amylase activity) increased while total protein concentration decreased, but calcium concentration continued to decrease till third trimester of pregnancy as listed in Table (3). A significant positive relationship and a highly significant negative or inverse relationship was found between the flow rate and sodium concentration, and flow rate and potassium concentration respectively in all trimesters as listed in Figure (2). There is a positive relationship between calcium concentration with DMFTI and GI as listed in Table (4).

Table (2): Mean \pm SD values of the Decayed Teeth (DT), Missing Teeth (MT) and Filled Teeth (FT) in all groups

Groups	Mean \pm SD		
	Decayed Teeth	Missing Teeth	Filled Teeth
Control	2.46 \pm 0.95	1.12 \pm 0.79	1.06 \pm 0.73
First Trimester	3.80 \pm 1.22	1.86 \pm 0.78	1.50 \pm 0.95
Second Trimester	5.78 \pm 1.56	1.98 \pm 0.79	1.62 \pm 1.15
Third Trimester	7.82 \pm 1.72	2.78 \pm 1.28	2.24 \pm 1.04
Total Pregnant	5.80 \pm 1.50	2.20 \pm 0.95	1.78 \pm 1.04

SD: Standard deviation.

Table (3): Mean \pm SD values and range of all parameters in this study during the first, second, third trimesters and the control groups

Parameters	Control (n = 50)	First Trimester (n = 50)	Second Trimester (n = 50)	Third Trimester (n = 50)
	Mean \pm SD (Range)	Mean \pm SD (Range)	Mean \pm SD (Range)	Mean \pm SD (Range)
Flow Rate (ml/min.)	0.41 \pm 0.12 (0.28–0.76)	0.28 \pm 0.06 (0.12–0.43)	0.24 \pm 0.07 (0.10–0.66)	0.27 \pm 0.10 (0.06–0.70)
pH	6.50 \pm 0.25 (6.01–6.99)	6.18 \pm 0.34 (5.10–6.98)	6.04 \pm 0.34 (5.30–7.00)	5.83 \pm 0.37 (4.48–6.42)
α-amylase (S.U/dl)	100.80 \pm 21.70 (56.50–125.80)	253.00 \pm 111.00 (77.00–542.00)	261.00 \pm 107.00 (115.00–571.00)	81.20 \pm 18.60 (27.40–129.70)
Total Protein (g/l)	2.26 \pm 0.56 (1.13–4.26)	1.92 \pm 0.46 (1.08–2.94)	0.58 \pm 0.44 (0.11–1.90)	1.93 \pm 0.01 (0.32–3.60)
Calcium (mg/dl)	4.13 \pm 1.39 (1.29–6.88)	3.59 \pm 1.06 (2.07–6.16)	2.11 \pm 0.81 (0.11–3.62)	1.54 \pm 0.75 (0.10–3.14)
Sodium (mmol/l)	12.88 \pm 2.31 (6.00–25.00)	6.54 \pm 3.99 (2.40–19.00)	5.30 \pm 0.14 (2.00–10.80)	6.46 \pm 3.88 (2.20–21.50)
Potassium (mmol/l)	20.48 \pm 2.19 (17.00–25.00)	41.80 \pm 2.41 (38.00–46.00)	44.36 \pm 1.86 (42.00–48.00)	42.72 \pm 2.05 (38.00–47.00)
Sodium/ Potassium Ratio	0.71 \pm 0.15 (0.10–0.92)	0.15 \pm 0.09 (0.05–0.46)	0.11 \pm 0.01 (0.10–0.13)	0.16 \pm 0.12 (0.03–0.46)

SD: Standard deviation; n: Number.

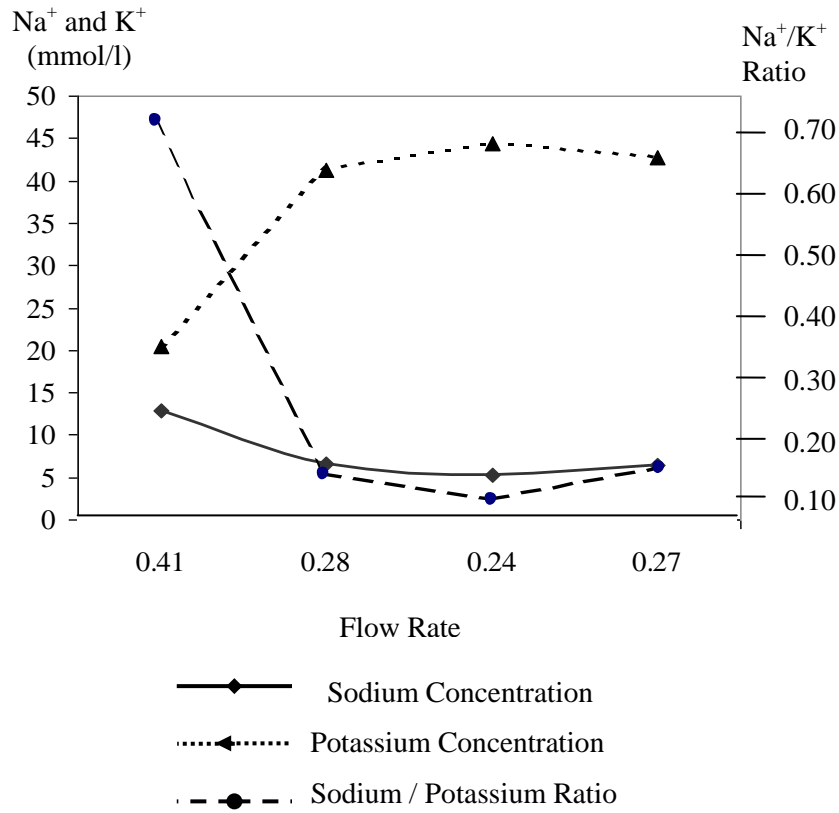


Figure (2): Sodium and potassium concentration and sodium / potassium ratio in unstimulated saliva at varying salivary flow rates

Table (4): Mean \pm SD values of calcium, DMFT Index and Gingival Index in all groups

Groups	Calcium (mg/dl)	DMFT Index	Gingival Index
	Mean \pm SD	Mean \pm SD	Mean \pm SD
Control	4.13 \pm 1.39	7.90 \pm 1.84	1.33 \pm 0.47
First Trimester	3.59 \pm 1.06	8.58 \pm 2.00	1.42 \pm 0.53
Second Trimester	2.11 \pm 0.81	9.43 \pm 2.67	2.70 \pm 0.46
Third Trimester	1.54 \pm 0.75	8.68 \pm 2.64	2.20 \pm 0.63
Total Pregnant	2.41 \pm 0.87	8.67 \pm 2.38	2.10 \pm 0.54

SD: Standard deviation.

DISCUSSION

Pregnancy involves complex changes; every system in even healthy women is altered to some degree during pregnancy including saliva and oral cavity. The increased degree of gingival inflammation and DMFT Index in subjects with low calcium concentration including the pregnant women who belong to high risk

group in relation to GI and DMFTI. An interesting implication on the oral health of the pregnancy had been noticed and attributed to the reduction of serum IgA immune response.⁽¹²⁻¹⁴⁾ The local effect of pregnancy in the oral cavity due to changes in the pH, flow rate of saliva and decrease in calcium concentration increases GI and DMFTI as listed in Table (5).

Table (5): Mean \pm SD values of flow rate, pH, DMFT Index and Gingival Index in all groups

Parameters	Flow Rate	pH	DMFT Index	Gingival Index
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Control	0.41 \pm 0.12	6.50 \pm 0.25	7.90 \pm 1.84	1.33 \pm 0.47
First Trimester	0.28 \pm 0.06	6.18 \pm 0.34	8.50 \pm 2.00	1.42 \pm 0.53
Second Trimester	0.24 \pm 0.07	6.04 \pm 0.34	9.43 \pm 2.67	2.70 \pm 0.46
Third Trimester	0.27 \pm 0.10	5.83 \pm 0.37	8.68 \pm 2.64	2.20 \pm 0.63
Total Pregnancy	0.26 \pm 0.07	6.02 \pm 0.35	8.89 \pm 2.43	2.10 \pm 0.54

SD: Standard deviation.

For physical properties, the reduction in flow rate during pregnancy due to hormonal effect especially Human Chorionic Gonadotropin (HCG) decreases markedly in second trimester, while Human Chorionic Somatomammotropin (HCS) and prog-esterone increases markedly and flow rate decreases up to its half value compared with the control.^(15, 16) For the reduction in pH value during pregnancy, is related to the effect of progesterone hormone, which is known to decrease plasma bicarbonate level during pregnancy resulting in a decrease in the pH.^(17, 18)

For α -amylase activity this increase could induce a rise in the substrate of acidogenic microorganisms; thus contributing to the decreased pH observed during

pregnancy.^(19, 20) For total protein concentration the significant lower level was found in the first trimester and second trimester groups, and then gradually increased to retain approximately its normal value in the third trimester. This may be explained on the fact that serum total protein falls within the first trimester and reaches a plateau at about mid-pregnancy.⁽²¹⁾

For calcium concentration the reduction in pregnant women may be due to low dietary calcium intake, increased number of children and rank of the mother in her family, or due to fact that submaxillary calcium concentration is approximately twice that found in the parotid so that whole saliva analysis may partially mask changes

occurring in either gland.^(3, 22)

For sodium concentration the positive relationship of sodium concentration and flow rate in unstimulated whole saliva may be due to hormonal estrogen effect and progesterone believed to have sodium-retaining properties.⁽²³⁾ The negative relationship between potassium and flow rate in pregnant unstimulated whole saliva may be due to the fact that potassium secretion is dependent on flow rate. Such relationship has been observed in saliva of pregnant women because of decreased salivary flow rate.^(20, 24)

For sodium/potassium ratio the significant reduction in pregnant women was observed in the second trimester of pregnancy than the first and the third trimester groups. This result is in agreement with mechanism of salivary secretion, that when sodium-content of salivary secretion decreased, the potassium level increased and vice versa.⁽²⁵⁾

CONCLUSIONS

Pregnancy modifies saliva composition. This could play a pivotal role in the incidence of pregnancy induced dental caries.

During pregnancy, decreased salivary flow rate and pH have been reported reaching their lower values during the third trimester. Significant changes in salivary total protein content and salivary α -amylase activity during the second trimester, and highly significant decrease in calcium concentration in all trimesters were found. The positive relationship between high salivary calcium content and the number of intact teeth were determined.

A significant positive relationship and a highly significant negative or inverse relationship were found between flow rate and sodium concentration, the flow rate and potassium concentration respectively in all trimesters.

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