

STUDY OF GASTRIC SECRETION WITH REFERENCE TO PREGNANCY IN INDIAN WOMEN

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Interest in gastric secretion with reference to pregnancy has been aroused by the clinical impression that pregnancy exerts a beneficial effect on the healing of duodenal ulcers in women and that exacerbations in this disease are common at menopause. An increase in gastric acid secretion has been reported by several investigators (7, 10, 11). Way (19) reported that gastric secretory response of a pregnant woman to test-meal increased during each trimester of pregnancy. A reduction in gastric acid secretion during pregnancy has been reported by several authors (1, 16, 18). On the other hand Mc-Carthy *et al.* (15) and Gryboski and Spiro (5) did not observe any consistent effect in either stimulation or inhibiting gastric secretion in female experimental dogs during pregnancy.

The relationship between pregnancy and gastric secretion is not well established. In the present study an attempt has been made to investigate the effect of pregnancy on gastric secretion in Indian women.

MATERIALS AND METHODS

Experiments were carried out on 338 female adults including 50 normal cases of identical age groups during pregnancy. The cases were drawn from low and middle classes of family from Kamlapur Hospital and maternity, child welfare centre, Kamlapur. After careful screening, healthy and normal cases were employed in the study. However, these cases had initial complaints of vomiting and other abdominal symptoms of vague dyspepsia during different phases of pregnancy. Gastric juice was collected by Ryle's tube method (9) and gastric analysis was done by the method described in Hawk's physiological chemistry (1947).

RESULTS

Perusal of Tables (I and IV) shows a significant reduction in gastric secretory volume in Group 1 (54%) which did not vary in different subgroups. Similar results were obtained in Groups 2 & 3 respectively. Free acid and total acid contents of gastric juice showed a significant reduction in all the three Groups (Tables II, III and IV). There was a steady increase in mean free and total acid contents in the first Group. The difference between successive phases was highly significant ($P < .01$ in all cases).

As a result of statistical analysis, no significant change was observed in gastric secretory activity due to parawise distribution of cases. Similar results were found due to food habits (Tables V and VI). Ten follow up cases did not show any change in different phases of pregnancy (Table VII).

Subgroups and age groups;	Group 1 1st trimester (12 weeks)		Group 2 2nd trimester (13-24 weeks)		Group 3 3rd trimester (25-36 weeks)	
	Number of cases		Number of cases		Number of cases	
	Vegetarian	Non-vegetarian	Vegetarian	Non-vegetarian	Vegetarian	Non-vegetarian
A(18-22 yrs)	14	5	62	11	8	Nil
B (23-27 yrs)	12	2	46	9	8	3
C (28-32 yrs)	7	Nil	78	8	29	4
D (33-37 yrs)	4	1	Nil	3	3	2
E (38-42 yrs)	3	Nil	4	1	1	Nil
TOTAL NUMBER OF CASES	40	8	201	31	49	9

50 normal cases were studied.

Ten cases were followed up through out pregnancy.

TABLE I

Chart showing mean values in normal and in different subgroups during different phases of pregnancy

Age Groups	First trimester	Second trimester	Third trimester
Volume in ml./15 mts.			
A	6.24±0.12 (19)	7.32±0.08 (73)	7.49±0.25 (8)
B	6.01±0.16 (14)	7.32±0.10 (55)	8.12±0.36 (11)
C	5.76±0.19 (7)	7.34±0.08 (86)	8.09±0.17 (33)
D	5.84±0.10 (5)	7.38±0.17 (13)	7.86±0.24 (5)
E	5.87±0.29 (3)	7.46±0.44 (5)	8.0±0 (1)
TOTAL CASES	(48)	(232)	(58)
All age groups			
Mean ± S.E.	6.040±0.078	7.337±0.048	7.993±0.127
S.D.	0.544	0.737	0.965
C.V. %	8.9	10.0	12.1
Control cases (50)—±S.E. 13.216, S.D. ±1.25, and C.V. % 1.28			

DISCUSSION

The results of this study, confirm the presence of low gastric secretory volume during different phases of pregnancy. Significantly low levels of gastric secretory volume were obtained in first trimester as compared to second and third trimesters (Tables I and IV). The present findings are in accord with those of Nakai (16), Arzt (1), Way (19) and Hunt and Murray (8), who reported a decrease in gastric secretory volume during the different trimesters of pregnancy. According to Murray *et al.*, the reduction in gastric secretory volume was maximum in the first 30 weeks of pregnancy and plasma histamine concentration did not affect it.

TABLE II

Chart showing mean values in normal and in different subgroups during different phases of pregnancy

Age groups	First trimester	Second trimester	Third trimester
Free Acid Meq/l/15mts.			
A	2.3618 ± 0.1376 (19)	3.0962 ± 0.0876 (73)	4.0168 ± 0.0312 (8)
B	2.4934 ± 0.1479 (14)	3.1811 ± 0.1068 (55)	3.8855 ± 0.2575 (11)
C	2.6139 ± 0.3479 (7)	3.1003 ± 0.0493 (86)	4.2223 ± 0.1781 (33)
D	2.2851 ± 0.2438 (5)	3.3373 ± 0.2301 (13)	3.6935 ± 0.4986 (5)
E	3.2688 ± 0.3753 (3)	3.0633 ± 0.4004 (5)	3.0127 ± 0 (1)
TOTAL NUMBER OF CASES	(48)	(232)	(58)
All age groups :			
Mean ± S.E.	2.4851 ± 0.0931 (48)	3.13045 ± 0.0438 (232)	4.0645 ± 0.13179 (58)
S.D.	0.6521	0.66719	0.100366
C.V. %	26.2	21.3	24.7
Control cases : (50) — S.E. = 4.3750 - 0.079	S.D. 0.3616	and C.V. % 1.65	
Total Acid Meq/l/15mts.			
A	3.2058 ± 0.1671 (19)	3.8497 ± 0.0931 (73)	5.0169 ± 0.27128 (8)
B	3.2688 ± 0.1123 (14)	3.7401 ± 0.1150 (55)	5.4197 ± 0.4274 (11)
C	3.5784 ± 0.3836 (7)	3.6688 ± 0.0685 (66)	5.0388 ± 0.02109 (33)
D	3.3763 ± 0.3644 (5)	4.2716 ± 0.3425 (13)	4.3894 ± 0.4904 (5)
E	4.1137 ± 0.400 (3)	3.5892 ± 0.03425 (5)	3.3927 ± 0 (1)
TOTAL NUMBER OF CASES	(48)	(232)	(58)
All age groups :			
Mean ± S.E.	3.3482 ± 0.1041	3.8488 ± 0.0526	5.0235 ± 0.15809
S.D.	0.7206	0.79432	0.1178
C.V. %	21.5	21.0	24.0
Normal (50) — S.E. 5.348 ± 0.0720, S.D. 0.0092 ± 0.2520	and C.V. % 1.37		

TABLE III

Comparative chart showing % changes in different groups (compared to each other). Duration of observation—15 minutes

	First Trimester	Second Trimester,	Third Trimester
Volume in ml. (15 mts.)	(6.040)*	+22%	+30.5%
	-18%	(7.337)*	+10%
	-22.5%	-8.4%	(7.993)*
	-48.7%	-37.8%	-32.7%
Free Acid Meq/l/15 mts.	(0.09070)*	+25.8%	+62.2%
	-20.5%	(0.11425)*	+30%
	-37.6%	-22.5%	(0.14834)*
	-47.5%	-32.5%	-14.5%
Total Acid Meq/l/15 mts.	(0.12220)*	+12.5%	+50%
	-10.5%	(0.13784)*	+32.5%
	-33%	-24.5%	(0.18334)*
	-43.5%	-33.8%	-12.7%

* = Base

TABLE IV

Comparative chart showing percentage changes amongst different groups as compared to normal

Duration=15 minutes.

Basis is control=13.216-0.1694 ml/15 mts.

Age groups		First trimester	Second trimester	Third trimester
Volume in ml. (15 mts.)	A	-52	-44	-43
	B	-54	-44	-38
	C	-56	-44	-38.8
	D	-55	-44	-40
	E	-55	-43	-39
	Mean	-54	-44	-39.5

Basis is control—A.375=0.0719 M.Eq/L/15 mts.

Free Acid Meq/l/15 mts.	A	-46	-29	-8.3
	B	-43	-27	-12
	C	-40	-29	-4
	D	-41.5	-24	-15
	E	-26	-30	-30
	Mean	-39.3	-28.6	-13.8

Contd.

	Age groups	First trimester	second trimester	Third trimester
<i>Basis is control = 5.348 - 0.0700 ml M.Eq/L/15 mts.</i>				
Total Acid Meq/l/15 mts.	A	-40	-27	-7
	B	-37.5	-30	+1
	C	-33	-31.5	-6
	D	-37	-20	-18
	E	-23	-32	-36
	Mean	-37	-29	-13.4

TABLE V

Chart showing mean values and range in vegetarian group of cases

Groups	No. of cases studied	Volume in ml./15 mts.	Free Acid Meq/l/15 mts.	Total Acid Meq/L/15 mts.
First Group (First Trimester)	40	6.02 ± 0.082	2.466 ± 0.01075	3.349 ± 0.01233
Second Group (Second Trimester)	201	7.25 ± 0.5078	3.127 ±	3.726 ± 0.005275
Third Group (Third Trimester)	49	7.86 ± 1.37	4.009 ± 0.0148	4.986 ± 0.01808
Total = 300 cases				

TABLE VI

Chart showing mean values and range in non-vegetarian group of cases

First Group (First Trimester)	8	6.14 ± 0.25	2.71 ± 0.1698	3.072 ± 0.352
Second Group (Second Trimester)	31	7.08 ± 0.1220	3.120 ± 0.1001	3.912 ± 0.1397
Third Group (Third Trimester)	10	8.63 ± 0.2547	4.33 ± 0.2466	5.126 ± 0.315
Total = 49 cases				

TABLE VII

Chart showing mean values and range of ten followup cases in two weeks interval/15 minutes (average of six observations in group 2 and 3, average of two observations in group 1)

Groups	Value in ml/15 mts.	Free Acid Meq/l/15 mts	Total Acid Meq/l/15 mts.	Mean changes between groups		
				Volume in ml.	Free Acid Meq/l	Total Acid Meq/l
First Trimester	7.55	2.7715	3.1644			
Second Trimester	8.876	3.196	3.709	1.272±0.054	0.444±0.014	0.537±0.014
				(Between 1st and IIrd groups)		
Third Trimester	10.489	4.265	5.306	1.613±0.116	1.70±0y005	1.576±0.015
				(Between 2nd and IIIrd groups)		

Free and total gastric acid contents showed maximum reduction in first trimester as compared to second and third trimesters (Tables II, III and IV). The present findings are supported by Strauss and Castle (18) who reported a decline of 50% in the maximum free acid content from 3 to 6 months of gestation with a rise in third trimester and after delivery. Goodall and Gocitlieb (4) also reported (after an analysis of 115 women) presence of hypochlorhydria in 1/3rd of women and return of acidity within one week of delivery in 3/4th of the cases. Low gastric acidity during pregnancy has also been reported by Nakai (16), Macon (14) and Way (19). Nakai (16) suggested that apparent hypochlorhydria was not caused by deficiency of gastric secretion itself but resulted from the neutralization of acid by alkaline salts regurgitating from the duodenum. However, this was disputed by Strauss and Castle (18) and Way (19), because they observed presence of bile in gastric juice in few specimens only. Labate (12) studied a group of 56 women out of which 9/10th were in last trimester and found that if alcohol was used as gastric stimulant, a normal acidity was found in 3/4th of them and 16% showed complete achlorhydria.

According to Way (19) there exists some relationship between free acid in the gastric juice and anterior pituitary like hormone secreted in the urine and thought that with an increase in this hormone, the gastric acidity decreased. There is enough evidence suggesting reduction in gastric acidity during pregnancy in the data presented by Way (19). On the contrary Clark and Tankel (3) failed to confirm low acid contents during pregnancy even after histamine induced secretions during pregnancy. This they attributed to a slowing of the gastric-emptying with greater dilution of secretion by the retained test-meal rather than the result of fall in the acid secretory rate. The reduction in gastric acidity is further confirmed due to the fact of infrequent occurrence of peptic ulcer during pregnancy and its beneficial effects on symptoms of peptic ulcer as demonstrated by Sandweiss *et al.* (17). Clark (2) reported abeyance of peptic ulcer symptoms in 90% of his cases during pregnancy but recurrence of symptoms occurred in almost all cases within two years after delivery. Mc-Donald (13) reported existence of some hormonal

relationship between female sex cycle and gastric acidity. The nausea and vomiting of early pregnancy may possibly be another reflection of a gastric hormonal link (15, 19). The level of free and total acidity in second and third trimester is not significantly reduced as compared to first trimester, shows that high output oestrogen and progesterone does not influence the gastric acid production, yet the sudden withdrawal of these hormones at parturition is followed by an increase in the gastric acidity (3).

During pregnancy, heart burn is a common symptom and it has been attributed to a high acid contents of stomach by several authors (5, 10). However, the results of present study do not support this contention as a significant reduction in free and total acid contents was noted in pregnant women (Table II, III, and IV). These findings are in agreement with those of Nakai (16) and Hunt and Murray (8).

The precise mechanism of heart burn during pregnancy is unknown. It could be due to combination of effects such as an alteration of the position of stomach, prolongations of emptying time and possibly reverse peristalsis which combine to allow the gastric contents to regurgitate in the lower oesophagus and so produce heart burn.

The differences between age groups are statistically insignificant. However, there seems to be some difference in highest paras within each age group.

The distribution of age in different paras, show clearly that the mean age advances steadily as the para increase. Hence if there were any differences between paras it would have been reflected clearly in the mean values for the age groups. The fact that these differences between age groups are statistically insignificant, showed that the differences between paras if any would be negligible. However, there seems to be some difference in highest paras within each age group possibly because in the higher paras the previous pregnancy would have occurred in most of the cases closer to the present one. If we take all age groups in each para, these differences are statistically insignificant.

A study of combined group of non-vegetarian cases was made and compared with that of combined group of vegetarian cases, in order to find whether removal of non-vegetarian vases would make any difference in the present conclusions. Statistically there was no appreciable increase in non-vegetarian group of cases as compared to vegetarian one.

SUMMARY

Experiments were carried out on 338 female adults excluding 50 normal cases of identical age groups during different phases of pregnancy. The effect of different paras, age groups and food habits was also studied. A significant reduction in gastric secretory volume was observed in first trimester as compared to second and third trimesters. There was also a statistically significant reduction in gastric free and total acid contents in first trimester as compared to second and third trimesters. Statistically no significant changes were found in gastric secretory activity due to different paras, age groups and food habits. A study of ten followup cases did not show any significant variations in gastric secretory response from identical cases in different groups.

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