PART III

Experimental, results, discussions, summary and conclusions.

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(1) Alcohol Meal

Experimental and Results:

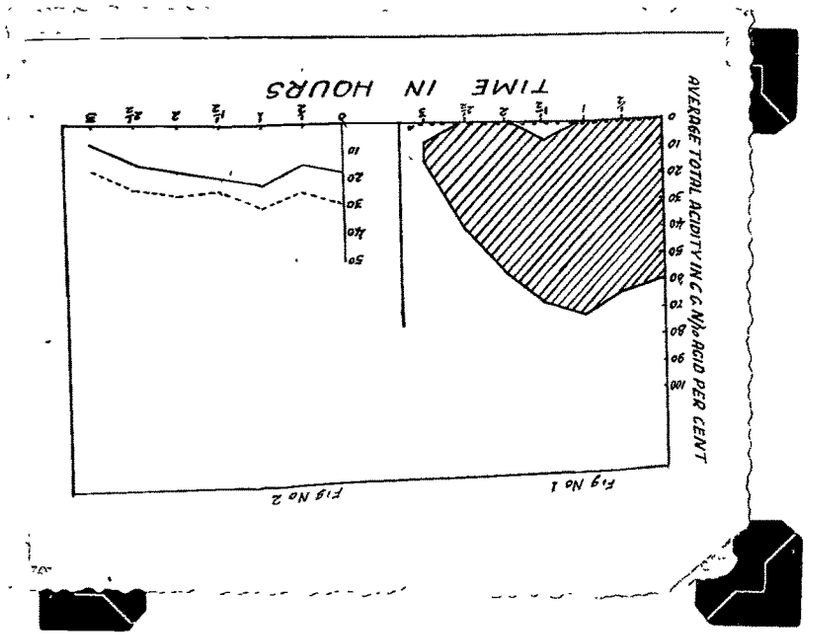
Thirty one healthy subjects, mostly medical students, with age varying between 18 and 24 years, have been studied for the examination of their fractional gastric analysis with alcohol meal. It was ascertained first that the subjects taken for this study had no history of serious disease in the past now had any digestive trouble; and they were also given a clinical overhaul before accepting them as normal subjects. Out of these thirty one subjects thirty were males and one (A.S.G. vide table in the appendix at the end) was a female subject. The fractional examination with alcohol meal was done by the method already described in part II, using 50 cc of 7 percent alcohol. The results of the analysis of the individual subjects are shown in the tables at the end in the appendix while the average results with the maximum, minimum, and the standard errors are shown in the table No.2. Two curves are drawn, one in figure No.1, in which the shaded area represents the limits of free acidity in about 75 per cent out of 31 total number of normal subjects and the curve A representing achylia gastrica in about 7% of the subjects, while in the second ,in figure No.2 average acidity (free and total both) of 31 normal subject, is shown.

(Vide table No.2)

Discussions:

Titration of free and total acidity:-

The primary objective in the titration of gastric acidity is to


TIME IN HOURS
AVERAGE TOTAL ACIDITY IN C.C. N/10 ACID PER CENT
Fig No 1
Fig No 2

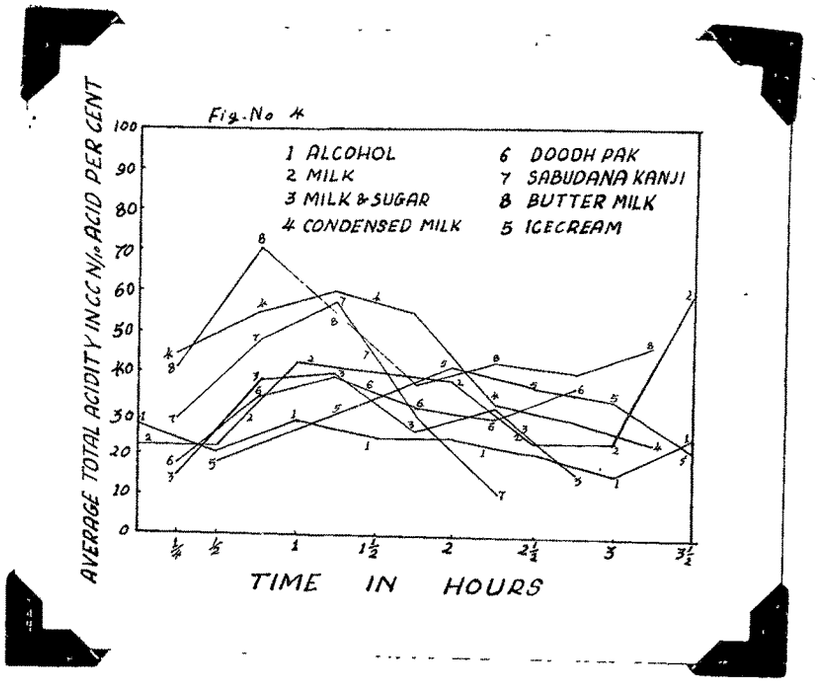


Fig. No 4
1 ALCOHOL
2 MILK
3 MILK & SUGAR
4 CONDENSED MILK
5 ICECREAM
6 DOODH PAK
7 SABUDANA KANJI
8 BUTTER MILK
AVERAGE TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS

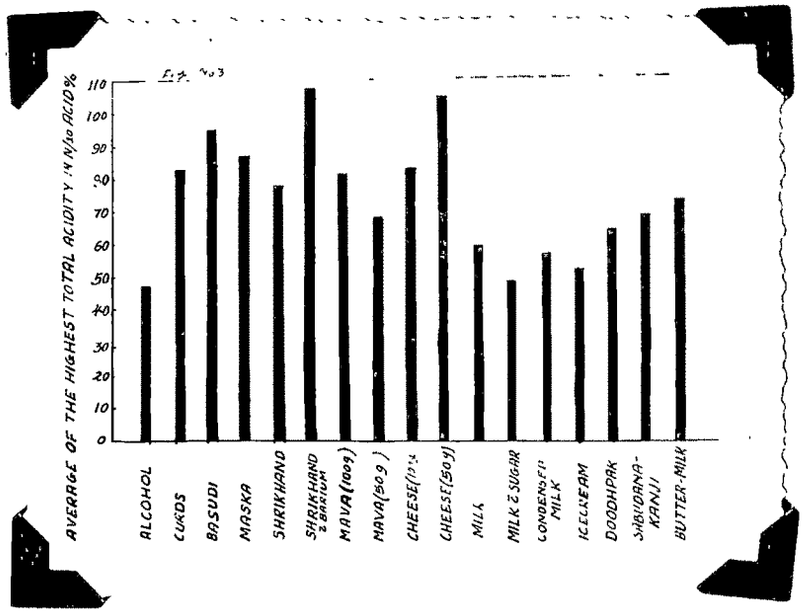


Fig. No 3
AVERAGE OF THE HIGHEST TOTAL ACIDITY IN N/10 ACID%
ALCOHOL
CURDS
BASUDI
MASKA
SHRIKHAND
SHRIKHAND & BARIUM
MAVA(100g)
MAVA(50g)
CHEESE(100g)
CHEESE(50g)
MILK
MILK & SUGAR
CONDENSED MILK
ICECREAM
DOODHPAK
SHABUDANA-KANJI
BUTTER-MILK

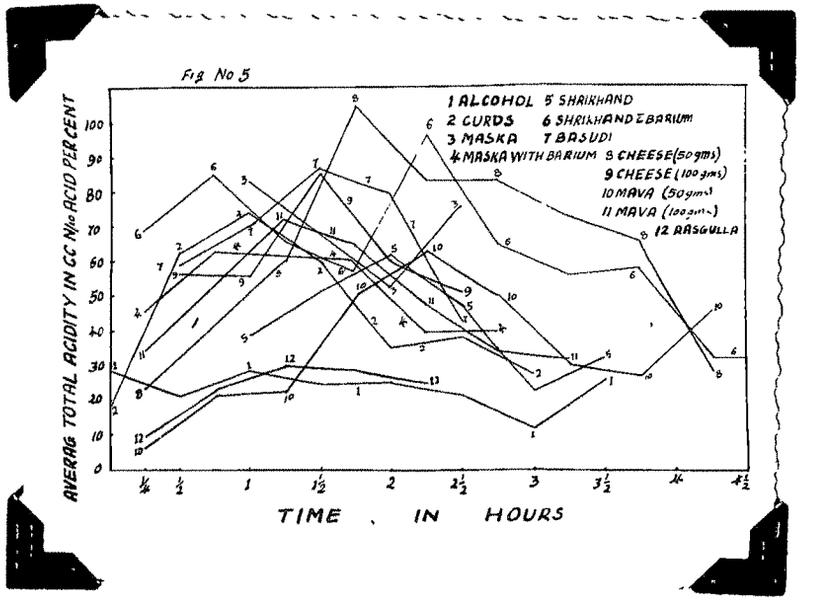


Fig No 5
1 ALCOHOL
2 CURDS
3 MASKA
4 MASKA WITH BARIUM
5 SHRIKHAND
6 SHRIKHAND & BARIUM
7 BASUDI
8 CHEESE(50gms)
9 CHEESE(100gms)
10 MAVA (50gms)
11 MAVA (100gms)
12 RASGULLA
AVERAGE TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS

Table No.2

Table showing the acidity in cc N/10 acid % after Alcohol meal 7% 50 cc.

	Fasting.		I		II		III		IV		V		VI		VII	
	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.
Maximum	60.0	76.0	64.0	68.0	72.0	80.0	68.0	80.0	56.0	64.0	44.0	52.0	12.0	20.0	16.0	24.0
Minimum.	0.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	5.0	16.0	24.0
Mean	19.0	28.5	15.0	22.6	22.0	30.53	20.0	25.7	18.0	26.0	15.5	23.4	7.0	16.2	16.0	24.0
Std.Error	±3.33	±3.38	±2.88	±2.84	±3.49	±3.55	±3.06	±3.24	±3.35	±3.50	±3.32	±3.63	±3.00	±3.75	..	..

54(e)

F = Free T = Total

determine the amount of unneutralized hydrochloric acid present ("free hydrochloric acid"), in the possible presence of other acids which while titratable are nevertheless so much less highly ionized than hydrochloric acid that they contribute little or nothing to the hydrogen concentration of the solution. It is the hydrogen ions concentration (i.e. the pH) of the gastric contents which to a large extent determines whether or not the physiological functions of the gastric secretion will be served, and hydrogen ions in concentration sufficient to maintain a normal pH can come only from a highly ionized acid such as hydrochloric acid. Thus gastric function can be evaluated in terms of the presence and amount of free hydrochloric acid.

It was as early as in the year of 1886 that Jaworski and Gluzinski introduced the present practice of estimating acidity in clinical units. They titrated the specimen with 0.1 N. alkali using litmus as an indicator. The proper choice of indicators, however, was a matter of great controversy. With the introduction of pH concept of acidity in 1909 by Sörensen, it became possible to define end points of titration in terms of pH units.

The establishment by titration of the presence and amount of free hydrochloric acid in the presence of other titratable acids is based on the fact that hydrochloric acid is completely dissociated in solution, the hydrogen ions from this dissociation reacting with the added OH ions before any undissociated acid present can ionize and so react. Thus the amount of alkali added up to the point of practically complete neutralization of the hydrochloric acid present should be distinguishable from that necessary for the remaining acid or acids.

If a mixture of hydrochloric acid and some weak acid or acids is being titrated with standard alkali, the burette reading at pH 3.5 or thereabouts will be a measure of the hydrochloric acid present, while

the reading at pH 8.5 will be a measure of the total acidity of the solution. It is thus possible to distinguish quantitatively between these two types of acidity provided that means of indicating the pH of the solution are available. It is much more common to select an indicator whose colour change lies at the pH range desired. Of the various indicators which have been proposed for this purpose in gastric analysis, Töpfer's reagent and phenolphthalein are almost universally used. Töpfer's reagent has a colour change from red to yellow over the pH range 2.0 to 4.0, the intermediate colour of salmon pink being noticeable at approximately pH 3.3. Thus if gastric contents are titrated with alkali to the colour change with Töpfer's reagent, a measure of the free hydrochloric acid present will be obtained, the value being uninfluenced by any weak acids which may be present. If the titration is then continued to the colour change with phenolphthalein (pH 8.5), the total acidity is determinable.

In actual practice the weak acids which may be found in gastric contents include protein hydrochloride (so-called "combined hydrochloric acid"), acid phosphates, and various organic acids such as lactic, citric, etc. after fermentation or the ingestion of certain foods. At one time the mistaken notion prevailed that by the suitable use of various indicators it was possible to differentiate between these components of the weak acid fraction of gastric contents. This is not true, since the titration curves of these various components overlap to such an extent that it is impossible to differentiate between the contribution of each to the total acidity and the concept should be abandoned. Even the distinction between free mineral acid and weak organic acids becomes less sharp if the organic acids have an appreciable ionization at pH 3 or so, as in the case for example with lactic acid. The presence of significant amounts of such organic acid in gastric contents is quite unusual; should it occur, the determination

of volatile chloride, is of value in establishing the extent of acidity due to hydrochloric acid.

Gastric acidity and Normals:

To ascertain the nature of normal acidity curve of gastric juice, has been the subject of study of many investigators, like Polland and Bloomfield (1931), Vanzant and Alvarez (1931), Davies and James (1930) and others. Much work has been done, in India, also, since Hay(1913) carried out some studies in this respect. Khatia, Patel and Dundas (1931) analysed the gastric secretion of 30 normal subjects, of whom 17 were non-vegetarian and 13 were vegetarian subjects, in Bombay. The main object of their study was to establish standard curve for normal Indians and to note the effect of diet on gastric secretion. No marked difference on gastric secretion was observed by them in the two groups. The average free hydrochloric acid content in those 30 normal subjects was found to be 20.23 cc and the average total acid content was 39.95 cc of N/10 acid %; while the maximum free hydrochloric acid and the maximum total acidity were 58 cc and 90 cc of N/10 acid % respectively.

Napier and Das Gupta (1941) established the following criteria for classifying acid curves according to the highest free acid readings per 100 cc of gastric juice:

1	Achlorhydria	0
2	Hypochlorhydria	less than 10
3	Isochlorhydria low	10 to less than 25
4	" medium	25 to 45
5	" high	45 to 65
6	Hyperchlorhydria	greater than 65

They found that above 80 per cent of normal individuals fall within the isochlorhydria range. Mangalik, Dool and Mangalik (1942) studied the gastric acidity curves in 161 normal individuals in U.P. and compared

them with those obtained by Napier et al (loc cit). They observed that the acid response in Indians in U.P, showed no immediate fall in acidity after alcohol test meal and that it gave higher maximum rise as compared with that in Bengalis.

The iso-secretory or normal curves of gastric acidity:

If in a normal person, the free and total acidities of the gastric contents be determined every 30 minutes for a period of about three hours after the ingestion of a test meal, and the results plotted with time along the base line and the acidity, both free and the total, in terms of cc of N/10 acid % in the vertical axis, a curve will be obtained as shown in the figure in No.2 representing average acidity in 31 normal subjects. The curve for total acidity commences to rise a short time after the meal and about one hour later reaches a maximum which varies in different persons. The curve maintains its maximal height for about half an hour or less and then commences to decline reaching the resting level again in from two and a half to three hours after the ingestion of the test meal. The curve of free acidity runs parallel to, but at a lower level than that for the total acidity, the values ranging differently in different normal persons. In case of 31 normal subjects of this series of ours the average highest total acidity has been found to be 30.55 cc ±3.55, while the average highest free acidity 25.00 ±3.49 cc of N/10 acid per cent. These values are well comparable with those of Hatia et al (loc cit), though, of course, the latter values are obtained after the fractional method of Rehfuss using oatmeal as the test meal. But in the article on "Haematological technique", by Napier et al (loc cit), the methods making use of both the test meals, namely, the toast-meal and alcohol meal, have been stated to be in common use. Napier et al (loc cit) have also stated that with alcohol meal the acid curve on the whole tends to be a little higher, which is very well noticeable in the fact that the initial drop due to neutralization

by the meal may be absent here in the case of alcohol meal, which is otherwise present in the case of other meals. So also the maximum acidity is reached earlier in time than the time taken in case of other meals.

In the other graph in figure No.1 limits of free acidity in about 75 per cent of 31 total number of normal subjects have been shown by the shaded area. These limits are ranging from 0 to 72 cc of N/10 acid per cent, while those for the total acidity being 4 to 80 cc of N/10 acid per cent. In the same graph, the curve A has been plotted which is representing a condition of achylia gastrica in about 7 per cent of the subjects. Similar findings have been reported in European countries as well as in this country. Wright (1942) has stated that in less than 5% of normal subjects with no symptoms of indigestion, no hydrochloric acid whatever is secreted. Napier et al (loc cit) have quoted that amongst the normals 3 to 4 per cent can be achlorhydric.

Quantity of the residuum:

In these 31 normal subjects of our series the quantity of the fasting sample ranged from 2.5 cc to 88 cc with the average volume of of 30.1 cc. These values have been tabulated in the table No.3 and they have been compared with those of Khatia et al (loc cit).

Table No.3

Table showing the quantity of the residuum:--

	: In 31 subjects	: In 30 subjects (Khatia et al)
Maximum...	88.0cc	110.0cc
Minimum...	2.5 cc	2.7 cc
Mean...	30.1 cc	28.5 cc

No attempt has been made here in our series to classify the

subjects into the groups of 'vegetarian' and 'non-vegetarian', on the basis of their diet. Such rigid classification was not feasible because on enquiry from the subjects about their diet, it was given to understand that though the majority of the subjects was having a vegeta-ble type of diet, there were some subjects who were taking a vegetable type of food almost daily but on very rare occasions they might be taking meat or fish while on some occasions, which may not be so rare as in the case of taking meat or fish, they might be taking eggs.

Examination of residuum for mucus, bile, starch and blood:

Mucus was found to be present in about 50 per cent of the total number of subjects, either in all the gastric samples of theirs or in some of their gastric samples, while the bile was found to be present in about 60 per cent of the subjects, which too was either present in all the samples or in some of them. Of course no correlation could be found between the volume and the presence of bile, namely, the larger the volume the more so is the presence of bile and vice versa. In one subject where the volume was only 5 cc, the bile was found to be present in some of his gastric samples, while in case of some of the subjects where the volume was as high as 80 cc, there was no presence of bile in their stomach contents. Nor was the relation found that when bile is present, free HCl and total acidity will be higher, due to regurgi-tation of duodenal contents to neutralize high acidity, because in our series it was found that in many cases even a very low acidity of the order of about 15 cc per cent had been accompanied by the presence of bile. Starch in trace was found to be present in case of only 3 subjects in their gastric contents while the presence of blood in the gastric sample was detected only in case of one subject, which might be due to some trauma. Regarding the presence of lactic acid in the stomach contents, it was not detected in any of the samples of the subjects.

Summary and Conclusions:

(1) Thirty-one normal healthy subjects, with the age varying between 18 and 24 years, out of whom 30 were males and one was a female, have been studied for the fractional analysis examination of their gastric contents with the alcohol meal, using 50 cc of 7% alcohol.

(2) The average highest total acidity in these subjects has been found to be 30.53 ±3.55 cc of N/10 acid per cent while the average highest free acidity being 22.00 ±3.49 cc of N/10 acid per cent.

(3) The limits for the free acidity ranged from 0 to 72 cc of N/10 acid per cent while those for the total acidity ranged from 4 to 80 cc of N/10 acid per cent.

(4) The volume of the residuum in these subjects varied from 2.5 cc to 80 cc with the average of 30.1 cc.

(5) The mucus in the gastric contents was found to be present in about 50 per cent of these normals, while the presence of bile in the samples was detected in about 60 per cent of the total number of the normal subjects studied. No correlation could be found between the volume and the presence of bile in the samples; nor was the relation established that when bile is present free HCl and total acidity will be higher.

(6) Starch in trace in the samples was found to be present in case of only 3 subjects while the presence of blood in the gastric sample was detected in case of only one subject, which might be due to some trauma. No lactic acid was detected in any of the samples.

(7) The above findings have been compared with those of other workers.

(2) Milk and Milk Preparations

Experimental and results:

Milk and the following preparations of milk have been at first:-

(1) Milk, boiled in quantity of 100 cc.

(2) Milk, boiled, in quantity of 100 cc plus 50 gms of sugar, added and mixed.

(3) Unsweetened condensed milk (Nestle's) in quantity of 100 cc.

(4) Icecream (freezed milk plus sugar) in quantity of 100 gms.

(5) 'Doodhpak' (milk boiled till 75% left, then 1/5 part sugar added to it and a small amount about 1/40 part rice added and the whole thing cooked till rice softened), in quantity of 100 cc.

(6) 'Sabudanakanji' ('Sabudana' (sago - metroxylon sago) first boiled in two parts of water till softened and then equal amount of milk added and boiled), in quantity of 100 gms. (This preparation is often used in feeding the sick).

(7) Butter-milk (100 gms of non-sour curds to which a glass of water and a little salt to taste were added and mixed), in quantity of 100 cc.

(8) Curds, non-sour in quantity of 100 gms.

(9) 'Chaka' (non-sour curds from which whey is separated, approximately 400 gms of milk yield 100 gms of 'Chaka'), in quantity of 100 gms.

(10) 'Shrikhand' ('chaka' to which equal weight of sugar added and homogeneously mixed), in quantity of 100 gms.

(11) Same as in (10) plus 10 gms of barley added and mixed.

(12) 'Khava' (Milk boiled to semisolid consistency. About 100 gms of 'khava' can be had from approximately 500 gms of milk) in quantity of 50 gms.

(13) Same as in (12) in quantity of 100 gms.

(14) 'Basudi' (milk boiled for a long time, till half of the volume remained and then sugar 1/3 part added and mixed), in quantity of 100 gms.

(15) Cheese (Krafts) in quantity of 50 gms.

(16) Same as in (15) in quantity of 100 gms.

As has been already stated previously about the selection of subjects, sixteen subjects out of 20 apparently healthy persons after being chosen as normals by means of various types of examinations including the fractional analysis examination with alcohol as the test -meal, were given the articles of food as listed above, in quantities mentioned against each item, and the analysis of the gastric contents was made for the various constituents present in them in accordance with the methods already described in part II. The results of analysis of the gastric examination in case of the individual subjects are given in the tables at the end in the appendix, while the average results for the individual articles of food, are shown in the different tables given below. In table No.4, the average of the highest total acidity,

(Vide table No.4)

evacuation time etc. are shown for each of the article of food given to the subjects. A graph is also drawn which is shown in figure No.3 indicating the average of the highest total acidity (the highest acid response of the individual subjects is taken and then the average found) in cc N/10 acid per cent against each item of the article of food. In table No.5 are shown the results of analysis for the free acidity and the total acidity for the individual articles. The

(Vide table No.5)

average readings with the maximum, minimum and the standard errors are given in that table. The curves showing the average total acidity for each of the article of the food (average found in the various subjects which is given in table No.5) against the time in hours are drawn which have been shown in the figure No.4 and figure No.5. Last-

Table No. 4

Table showing the average of the highest total acidity etc.

Sl. No.	Article of food 100 g: unless otherwise stated	No. of obs. or va. ti. on. s	Average of the highest total acidity in cc N/10 acid %	Peptones appeared	Proteins disappeared	Evacuation time Hrs.	Evacuation time Mts.	Reducing Sugar In article	Reducing Sugar Disappeared
1	Alcohol 50 cc.%	20	48.0	-	-	-	-	-	-
2	Milk boiled 100 cc	7	59.0	Within 15 minutes	Proteins present in all samples	2	45	-	-
3	Milk boiled 100 cc plus 50 g. sugar	6	48.0	"	"	2	27	-	-
4	Unsweetened condensed milk 100 cc	5	56.0	"	"	3	15	-	-
5	Icecream	5	52.0	After 15 min. & before 30 minutes	"	3	00	-	-
6	'Doodhpak' 100 cc	2	64.0	Within 15 minutes	"	3	30	-	-
7	'Sabudana-kanji'	6	67.0	"	"	2	20	Present	Within 8½ hr.
8	Buttermilk 180 cc	4	72.0	"	"	3	20	-	-
9	Curds	8	85.0	After 15 min. & before 30 minutes	"	3	23	-	-
10	'Maska'	6	86.0	"	"	3	28	-	-
11	'Shrikhand'	4	78.0	"	"	4	08	-	-
12	'Shrikhand' 100 gm plus 10 gm barium	3	107.0	"	"	4	00	-	-
13	'Mava' 50 gm	3	68.0	"	"	3	33	-	-
14	'Mava' 100 gm	6	81.0	"	"	3	40	-	-
15	'Basudi'	5	95.0	"	"	Over 4 hrs		-	-
16	Cheese 50 gm	2	106.0	"	"	4	08	-	-
17	Cheese 100 gm.	3	84.0	"	"	Over 3 hrs.		-	-

Table No. 5

Table showing the acidity in cc N/10 acid % after the various articles of milk & its preparations.

	Fasting		I		II		III		IV		V		VI		VII		VIII		IX	
	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
Milk (boiled) 100 cc.																				
Maximum	28.0	40.0	20.0	56.0	36.0	72.0	44.0	80.0	48.0	64.0	28.0	40.0	28.0	36.0	56.0	68.0				
Minimum	4.0	8.0	0.0	4.0	0.0	8.0	0.0	8.0	12.0	20.0	0.0	12.0	8.0	16.0	44.0	52.0				
Mean	16.0	22.7	5.9	22.8	18.3	42.9	25.1	41.1	28.3	38.3	14.0	24.0	14.0	24.0	50.0	60.0				
Std.+ error -	6.93	9.34	2.87	6.74	5.71	7.79	7.13	10.17	5.02	5.79	5.77	5.88	4.76	4.32	6.00	8.00				
Milk boiled 100 cc plus 50 gms. of sugar																				
Maximum	-	-	0.0	32.0	40.0	56.0	48.0	72.0	32.0	40.0	35.0	50.0	24.0	36.0						
Minimum	-	-	0.0	8.0	0.0	20.0	0.0	12.0	0.0	12.0	0.0	12.0	0.0	4.0						
Mean	-	-	0.0	15.5	20.3	39.3	20.0	40.7	14.7	27.8	21.8	33.5	8.0	16.0						
Std.+ error-	-	-	-	3.61	5.66	6.14	6.36	8.22	5.23	4.92	7.94	8.53	8.00	10.06						

63(b)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
								Condensed Milk (unsweetened) 100 cc.														
Maximum	-	-	8.0	80.0	32.0	96.0	36.0	92.0	44.0	76.0	32.0	44.0	44.0	56.0	36.0	48.0						
Minimum	--	-	0.0	8.0	0.0	10.0	0.0	9.0	0.0	4.0	24.0	8.0	20.0	8.0	0.0	12.0						
Mean	-	-	2.0	44.0	8.0	55.8	12.0	61.5	30.0	56.0	21.0	32.0	21.0	30.0	13.3	25.3						
Std. Error ±	-	-	2.00	14.51	8.00	22.31	8.49	16.88	6.21	9.38	7.18	8.16	9.00	9.86	11.17	11.17						
								Icecream 100 gms.														
Maximum	-	-	16.0	32.0	16.0	44.0	40.0	56.0	52.0	72.0	52.0	64.0	40.0	48.0	40.0	44.0						
Minimum	-	-	0.0	4.0	0.0	9.0	0.0	8.0	0.0	8.0	8.0	16.0	20.0	24.0	0.0	4.0						
Mean	-	-	4.8	19.2	8.8	27.4	22.4	34.0	31.2	42.4	25.6	36.0	28.0	34.7	14.0	21.3						
Std. Error.+ -	-	--	3.20	5.57	3.67	6.72	7.22	8.94	10.07	12.35	7.63	8.76	6.11	6.94	13.88	11.87						
								"Doodhpak" 100 cc.														
Maximum	-	-	20.0	36.0	64.0	72.0	52.0	72.0	68.0	80.0	52.0	60.0	32.0	40.0								
Minimum	-	-	0.0	8.0	0.0	8.0	16.0	20.0	0.0	8.0	0.0	5.0	28.0	36.0								
Mean	-	-	5.3	18.7	22.0	34.0	27.7	41.3	25.3	34.0	23.8	30.7	30.0	37.3								
Std. Error. + -	-	-	3.54	4.99	10.82	11.85	7.22	8.27	9.57	10.72	8.91	9.53	..	..								

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
									"Sabudana - Kanji" 100 gms.													
Maximum	-	-	80.0	88.0	80.0	104.0	76.0	96.0	80.0	96.0	10.0	15.0										
Minimum	-	-	0.0	8.0	5.0	20.0	12.0	24.0	0.0	4.0	0.0	8.0										
Mean	-	-	15.8	31.3	34.8	48.7	43.5	56.7	23.7	32.7	2.5	10.3										
Std. + Error.-	-	-	13.07	13.99	10.88	12.99	6.67	9.80	12.21	13.59	2.50	1.65										
									Butter-milk 180 cc.													
Maximum	-	-	16.0	72.0	48.0	92.0	68.0	96.0	40.0	56.0	52.0	68.0	48.0	60.0	52.0	56.0						
Minimum	-	-	0.0	8.0	12.0	52.0	0.0	16.0	0.0	12.0	0.0	16.0	0.0	20.0	24.0	36.0						
Mean	-	-	6.0	41.0	31.0	71.0	35.0	54.0	24.0	38.0	30.0	43.0	30.0	41.0	37.3	46.6						
Std. + Error.-	-	-	3.83	13.30	8.06	9.14	14.00	16.37	7.09	9.59	11.61	10.75	10.39	8.22	8.12	10.82						
									Curds 100 gms.													
Maximum	16.0	44.0	24.0	80.0	48.0	92.0	52.0	120.0	44.0	100.0	44.0	68.0	28.0	40.0								
Minimum	0.0	8.0	0.0	24.0	0.0	56.0	12.0	28.0	0.0	8.0	0.0	8.0	0.0	10.0								
Mean	3.2	18.8	11.5	62.0	27.3	73.8	27.0	60.8	28.5	35.0	25.0	37.5	16.0	27.3								
Std. + Error. -	3.19	7.52	3.33	7.25	5.55	4.94	5.54	10.40	5.09	15.20	6.03	7.81	8.32	8.97								

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
								"Maska" 100 gms.														
Maximum	-	-	60.0	128.0	44.0	112.0	36.0	68.0	60.0	96.0												
Minimum	-	-	0.0	12.0	0.0	8.0	16.0	44.0	18.0	60.0												
Mean	-	-	20.0	82.7	20.0	68.0	22.7	53.3	36.7	76.0												
Std. + Error.-	-	-	20.00	35.75	12.86	31.07	6.58	7.44	12.27	9.76												
								"Maska" 100 gms with 10 gms.of barium														
Maximum	-	-	0.0	88.0	28.0	80.0	32.0	88.0	36.0	72.0	28.0	44.0	40.0	68.0								
Minimum	-	-	0.0	4.0	16.0	48.0	16.0	36.0	24.0	48.0	16.0	36.0	8.0	12.0								
Mean	-	-	0.0	46.0	22.0	64.0	24.0	62.0	30.0	60.0	22.0	40.0	24.0	40.0								
Std. + Error.-	-	-	-	-	-	-	-	-	-	-	-	-	-	-								
								"Shrikhand" 100 gms.														
Maximum	-	-	40.0	100.0	60.0	96.0	56.0	120.0	44.0	64.0	24.0	32.0	36.0	48.0								
Minimum	-	-	0.0	6.0	0.0	6.0	0.0	12.0	0.0	12.0	4.0	8.0	8.0	12.0								
Mean	-	-	15.0	39.5	28.0	53.5	30.0	61.0	27.0	46.0	13.3	22.7	21.3	30.7								
Std. + Error.-	-	-	9.57	21.97	12.54	22.62	11.61	23.17	9.98	12.11	5.85	7.38	8.14	10.32								

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
"Shrikhand" 100 gms. with 10 gms of barium.																						
Maximum.	-	-	24.0	96.0	40.0	92.0	56.0	88.0	56.0	84.0	104.0	116.0	56.0	76.0	52.0	56.0	60.0	72.0	40.0	50.0	32.0	45.0
Minimum.	-	-	0.0	52.0	19.0	76.0	32.0	48.0	24.0	40.0	8.0	60.0	28.0	56.0	36.0	56.0	24.0	44.0	0.0	12.0	4.0	12.0
Mean	-	-	8.0	69.3	27.7	86.0	46.7	66.7	38.7	56.0	54.0	97.3	42.7	65.3	45.3	56.0	42.7	57.3	20.0	31.0	18.0	28.5
Std. + Error.-	-	-	8.00	13.51	6.26	5.04	7.26	24.97	9.25	14.05	26.04	4.32	7.94	5.92	4.97	-	-	-	-	-	-	-
"Maya" 50 ~~xx~~ gms.																						
Maximum	-	-	0.0	16.0	20.0	40.0	24.0	40.0	28.0	68.0	36.0	84.0	36.0	64.0	32.0	40.0	40.0	44.0	44.0	52.0		
Minimum	-	-	0.0	4.0	0.0	8.0	0.0	12.0	0.0	20.0	12.0	32.0	24.0	32.0	0.0	12.0	0.0	8.0	36.0	40.0		
Mean	-	-	0.0	8.0	6.7	24.0	8.0	23.3	13.3	50.7	22.7	61.3	30.7	49.3	20.0	29.3	20.0	26.7	40.0	46.0		
Std. + Error. -	-	-	-	4.00	6.65	9.24	8.00	8.55	8.35	15.30	6.98	15.42	3.26	9.42	10.06	8.78	11.55	10.36	-	-		
"Maya" 100 ~~xxx~~ gms.																						
Maximum	-	-	60.0	80.0	44.0	28.0	64.0	128.0	76.0	112.0	68.0	76.0	60.0	70.0	40.0	52.0						
Minimum	-	-	0.0	5.0	0.0	16.0	8.0	40.0	0.0	28.0	0.0	12.0	0.0	8.0	0.0	8.0						
Mean	-	-	15.3	34.2	21.0	52.7	31.3	70.7	33.3	62.7	24.0	46.4	22.4	32.6	20.0	30.0						
Std. + Error.-	-	-	9.68	12.02	7.72	12.91	9.15	14.36	11.55	7.90	11.93	12.35	11.77	11.11	11.55	12.70						

1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
									"Mava" 100 gms (repeated)													
Maximum	-	-	0.0	12.0	10.0	40.0	48.0	56.0	48.0	60.0	68.0	76.0	40.0	45.0								
Minimum	-	-	0.0	5.0	0.0	16.0	8.0	40.0	8.0	36.0	8.0	44.0	0.0	8.0								
Mean	-	-	0.0	9.6	4.6	25.3	21.3	46.6	26.6	50.6	34.6	64.0	14.6	24.3								
Std. + Error.	-	-	-	2.34	2.90	7.43	13.33	5.11	11.84	7.64	17.70	10.06	12.61	11.24.								
									"Basudi" 100 gms.													
Maximum	-	-	24.0	88.0	48.0	88.0	60.0	104.0	64.0	116.0	52.0	60.0										
Minimum	-	-	0.0	38.0	0.0	56.0	0.0	72.0	0.0	20.0	0.0	16.0										
Mean	-	-	10.0	59.0	21.0	69.0	41.0	84.0	28.0	78.0	19.0	41.0										
Std. + Error.	-	-	6.00	12.58	12.37	11.62	14.18	6.92	16.49	20.68	11.47	9.71										
									Cheese 50 gms.													
Maximum	-	-	0.0	32.0	0.0	68.0	12.0	88.0	28.0	116.0	28.0	104.0	56.0	92.0	48.0	72.0	48.0	64.0	24.0	32.0		
Minimum	-	-	0.0	16.0	0.0	16.0	0.0	32.0	24.0	96.0	28.0	64.0	40.0	76.0	40.0	72.0	40.0	64.0	12.0	20.0		
Mean	-	-	0.0	24.0	0.0	42.0	6.0	60.0	26.0	106.0	28.0	84.0	48.0	84.0	44.0	72.0	44.0	64.0	18.0	26.0		
Std. + Error.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
									Cheese 100 gms.			
Maximum	-	-	32.0	84.0	40.0	92.0	60.0	100.0	68.0	76.0	64.0	72.0
Minimum	-	-	0.0.	30.0.	0.0	20.0	28.0	68.0	16.0	44.0	0.0	24.0
Mean	-	-	16.0	57.0	20.0	56.0	44.0	84.0	42.0	60.0	32.0	48.0
Std. Error.	-	-	-	-	-	-	-	-	-	-	-	-

F= Free T= Total

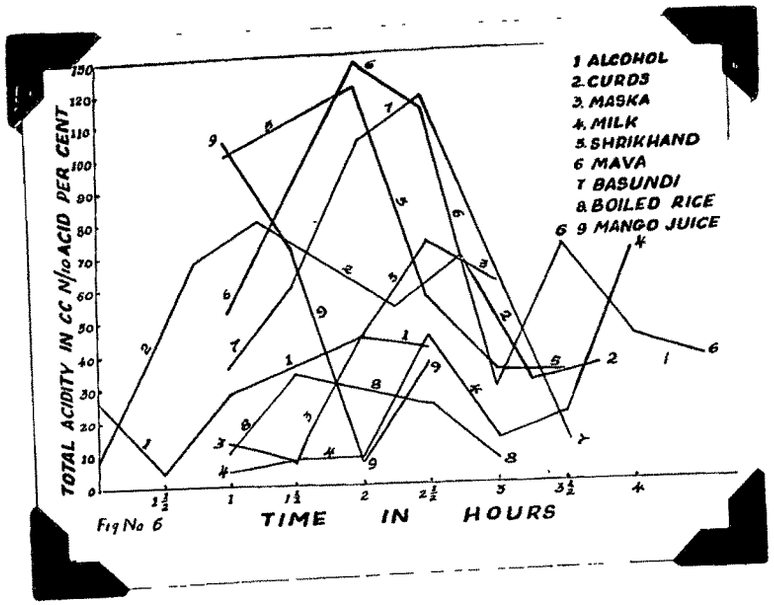


Fig No 6

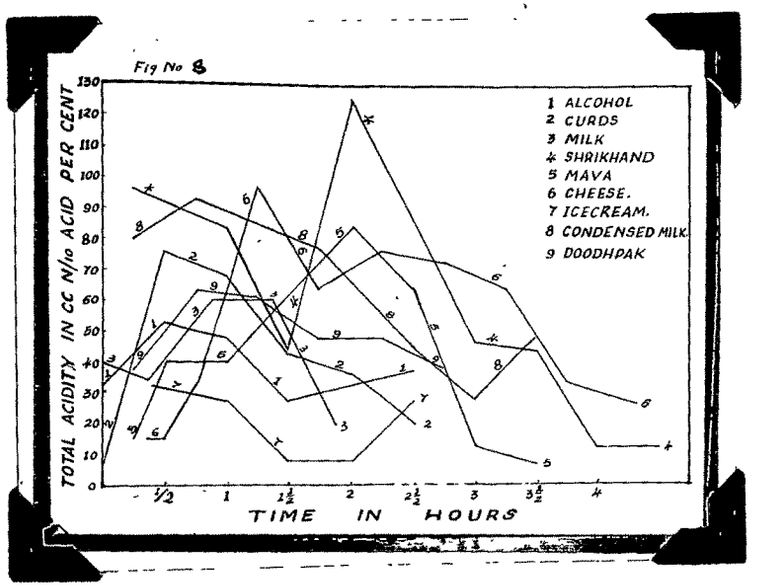


Fig No 8

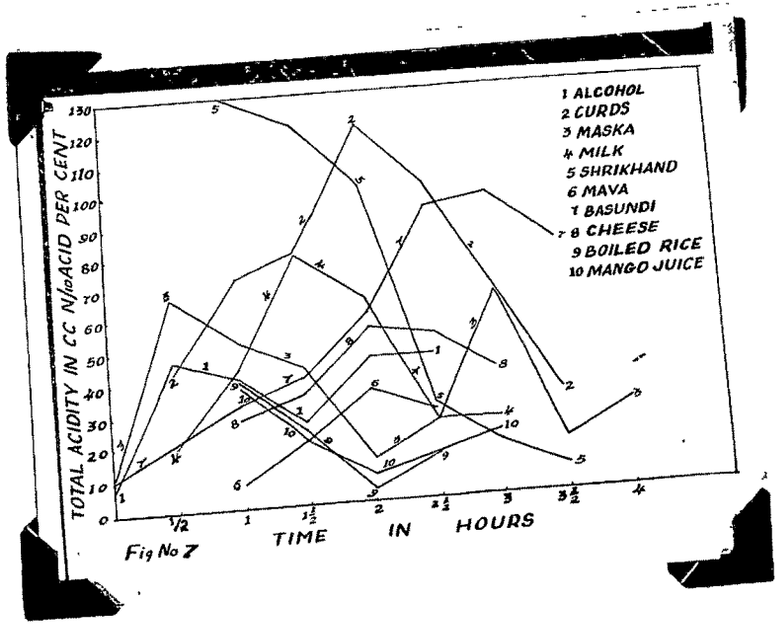
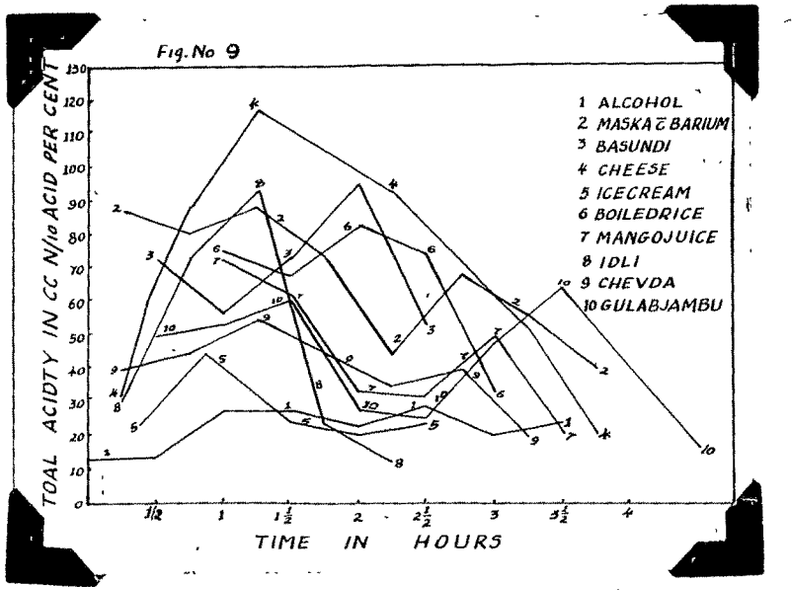


Fig No 7



ly the various curves showing the total acidity for each of the article of the food in the individual subjects are also drawn and they have been shown in figure Nos. from 6 to figure No.16. Total number of observations made on 16 subjects for testing of the milk and milk preparations is 75.

Discussions:

Gastric response:-

Free and total acidity:--

It is the occasional practice in the titration of relatively pure gastric contents to subtract the value for the free acidity from that of the total acidity and call the difference the "combined acid". The validity of this is questionable; even assuming that the difference between free and total acid is partly due to acid which has reacted with protein to form protein hydrochloride, it is clear that the amount of acid which has so reacted is measurable only by titrating the solution to the isoelectric point of the protein; further titration beyond this pH represents the formation of alkali salt of protein and will depend on the amount and nature of protein present, without reference to how much hydrochloric acid has been "combined" with the protein. Actually, the difference between free and total acid is more a measure of the buffer power of the gastric juice than anything else.

In figure No.3, the milk and the milk products which are liquid in form and which have been given in quantity of 100 cc or the quantity thereabout, have been taken together for the sake of comparison. These products are milk, milk C sugar, condensed milk, icecream, 'doodhpak', 'srikhandkanji', and butter milk. In the case of these articles the quantity of water present in the articles themselves is not much differing and hence comparable as opposed to the case where the solid product like cheese though given in more or less an equal amount, i.e. 100 gms,

but containing no water, is compared with milk. There are two factors that may be involved here, one, the water content which might cause the dilution of the gastric juice and the second, the varying quantities of the solids, containing the proteins, may themselves cause difference in the secretion of the gastric juice and the acidity too. The solid or the semi-solid products like curds, 'shrikhand', 'mava', cheese, 'basundi' etc. are therefore, taken together and for these products, the vertical columns representing the acidity are drawn first in the figure No.3. This very principle is also taken into consideration while drawing the curves for average total acidity against time in the figure Nos. 4 and 5. In figure No.4, the curves for the liquid type of products are drawn while in figure No.5, the curves for the solid or the semi-solid type of products are shown.

In this series, the acid response after an article of food is compared with that obtained on alcohol fractional meal examination. As Klumpp and Bowie (1933) have shown, this 'alcohol' meal evokes more acid as well as larger amount of secretion than the old ground meal, but it is more convenient for the reasons which have already been discussed in the previous pages.

Gastric response could be divided into three phases, as has been stated in the part I on introduction, (1) psychic, (2) chemical or humoral and (3) duodenal or intestinal. The psychic secretion is evoked by vagal stimulation and lasts for a short time in human. This is associated with increased motility of the organ. This conditioned reflex is very valuable in initiating the gastric response, preparatory to the arrival of the food in the stomach. One may justifiably attribute the difference in responses in respect of different foods to the second chemical phase, to the article itself and not to the psychic factors.

Fig. No. 10

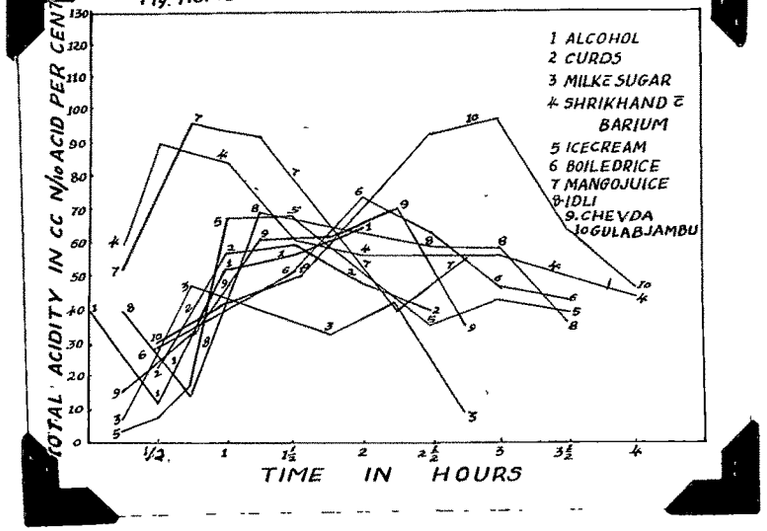


Fig. No. 12

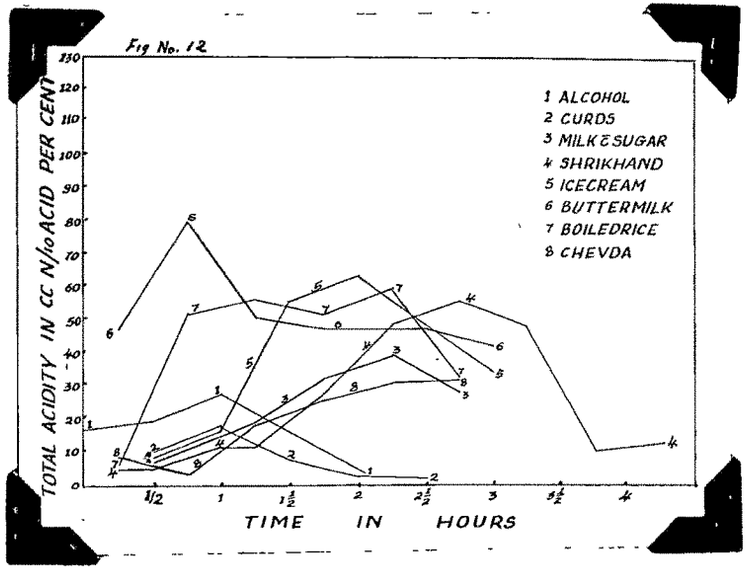


Fig. No 11

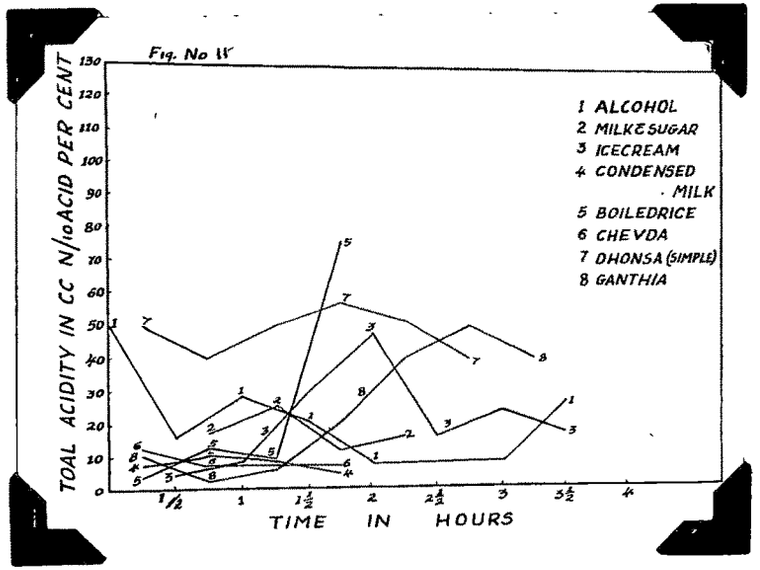
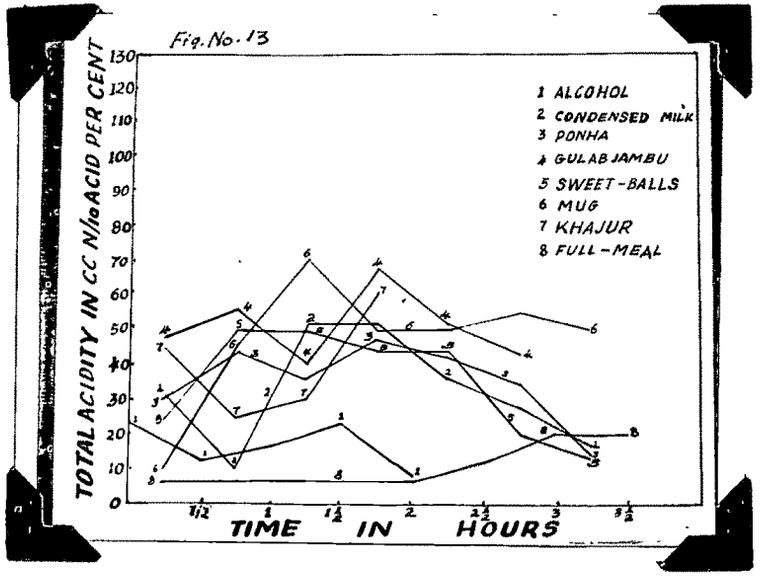


Fig. No. 13



The conditions regarding service, environment etc. were kept uniform as far as possible. No relation could be obtained between the degree of acidity and the like or dislike of the article. All preparations were relished with the exception of cheese which the subjects had not much tasted before and hence stomached with difficulty. However, as it can be seen, very high response was evoked by 'shrikhand' and 'basudi' which were relished very much, as also by cheese which was disliked. Besides, when the same article was repeated in the same subject on another occasion, the response was similar, in that subject. Moreover, as Pavlov (loc cit) has shown, the appetite juice, whatever the previous diet, has the same characters.

In these experiments the presence of the tube in the stomach was another constant factor. All subjects were thoroughly accustomed to the presence of the tube. How far was its presence responsible for acids secreted? Beaumont (loc cit) could not find acid test when he applied his tongue to the stomach of Alexis St. Martin. The presence of acid in aspirated samples was attributed by him to the presence of the tube. However, in Pavlov's (loc cit) experiments, the mechanical factor of the tube had no effect. As Wolf explains, possibly the tube did not evoke any acid secretion, but merely enabled one to reach the folds of gastric mucosa where acid was hidden and which Beaumont's tongue could not reach. Had it been that the mechanical factor of the tube was in some way responsible in the acid secretion, it would have been that at the first time when the subjects were new to the use of the tube and its presence in the stomach, the response obtained might have been different from that obtained on some other occasion later when the subjects now could have been thoroughly used to the presence of the tube in the stomach. That it was not so was obvious from the fact that more or less the same response was obtained after the same

article of food was given in the same subject on two different occasion -s under similar conditions.

From the considerations made above regarding the first phase, namely, the psychic phase, it would seem that the difference in response -s in respect of different foods may be attributed to the second, namely, the chemical phase. The variation in gastric response can therefore be attributed to the character of the article of the food itself, its chemical and physical nature.

Chemical phase:

The curves in the figure Nos. from 6 to 16 will show the responses of the subjects to different articles of food. These as well as the tables at the end in the appendix indicate that the free and total acidity were increased from 1 to 2½ hours after taking the food. In most of the cases, the acid levels fall after 2½ to 3 hours. The chemical phase continues as long as the food stays in the stomach. The fall in gastric acidity in the later part can perhaps be due to regurgi -tation of alkaline duodenal contents which neutralize it. When chlorides and not acids are estimated, the chloride level is said to be rising till the article is evacuated. In the study of the response to these articles of milk preparations chlorides estimation was not done. The estimation of the chlorides content has been done in case of the study of the response to other articles of food like preparations of eggs etc. and the results of these studies will be discussed later on.

The humoral excitant of this chemical phase is assumed to be 'gastrin', a poly-peptide, which is said to be produced in the presence of food in the stomach and absorbed in the blood. The character of gastric secretion, its pepsin and acid content vary with the type of the chemical stimulus of food. The current knowledge regarding the

Fig. No 14

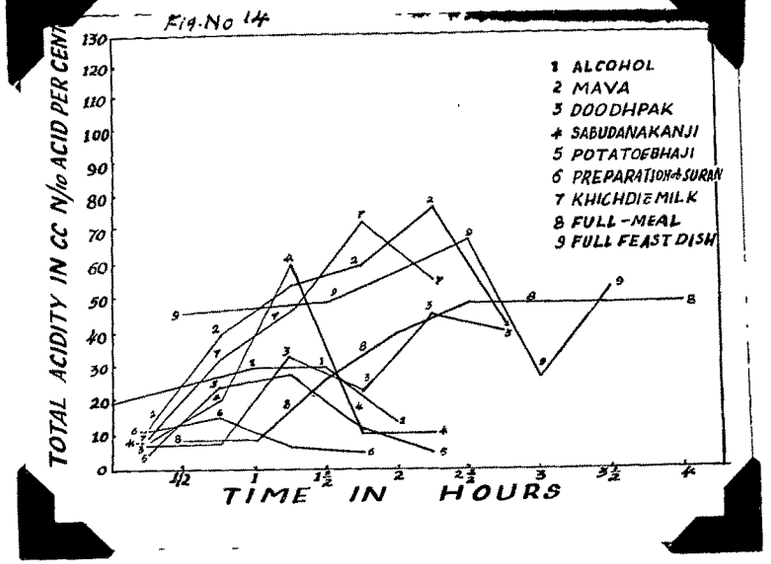


Fig No. 16

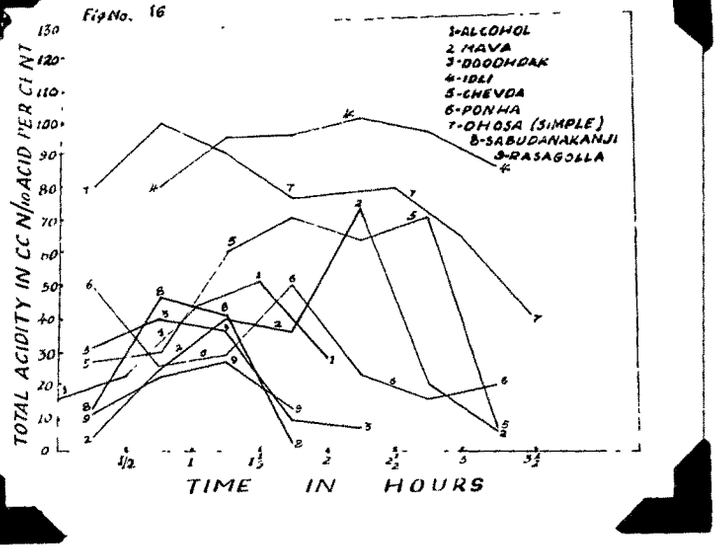


Fig No 15

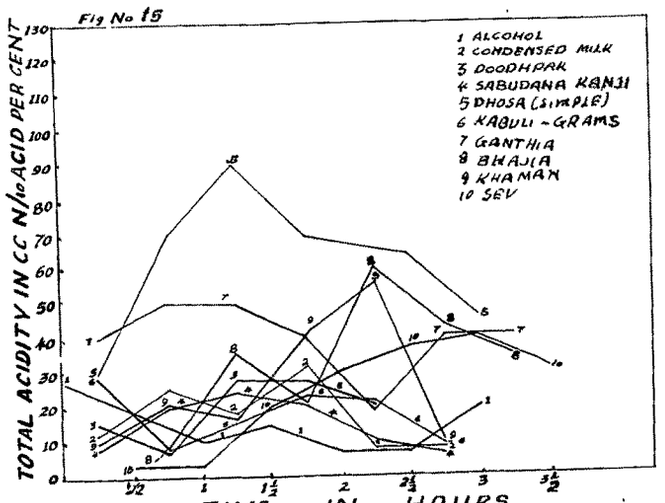
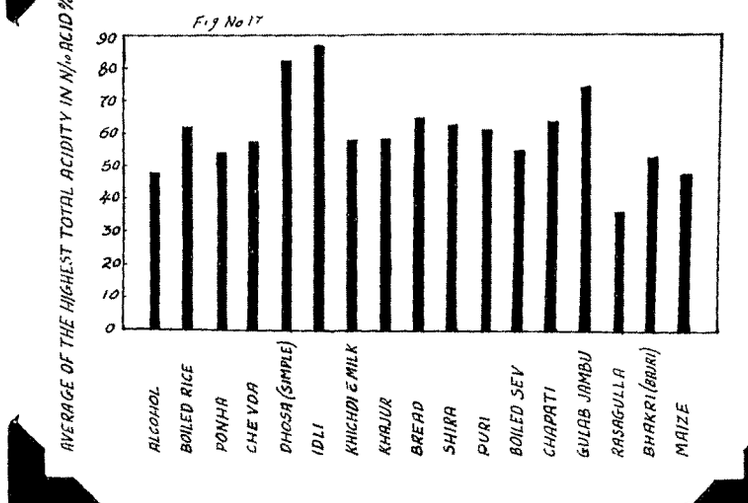


Fig No 17



chemical response has been summarised by Starling (1949) as under:-

'In the case of the chemical phase, there is considerable variation in the nature of the juice; whereas the secretion of juice is greatest in amount after a meal of meat, the digestive power is greatest after one of bread. The juice secreted in this phase must vary according to the quantity of humoral agents produced and therefore with the nature and amount of the substances produced in the preliminary digestion of the gastric contents, as well as with the initial composition of food. The composition and activity of the juice may vary with the intensity of the stimulus. Fats reduce the gastric secretion and prolong their stay in the stomach. Water, tea or coffee taken with food augment the gastric secretion and various articles of food such as vegetable juices contain powerful chemical excitants (e.g. histamine)'.

As can be seen from the table No.4, the response obtained with different preparations of milk when given to the subjects, mostly in quantities of 100 gms., is varying. The results have been compared with the figures obtained by Hawk et al (1936) in the similar studies of cholen, which have been given previously in part I on introduction, in the table No.1. Milk, milk with sugar, condensed milk and ice-cream gave a low acid response throughout. Curds, 'basudi', 'mashi', 'shrikhand', cheese, 'kava' produced high acidity which persisted long on. The free and total acidity readings were relatively close to each other in the case of milk, milk with sugar and ice-cream, whereas after 'shrikhand', 'basudi', curds, 'mashi' and cheese, the difference was more than 30 cc of N/10 acid per cent, especially in the early samples. This may be partly due to the acids present in the articles, which on chemical examination showed the presence of fair amount of lactic acid. The high acidity obtained in case of the sweet preparations is possibly not

caused by the sugar alone for when 50 gms of sugar were given with 100 gms. of milk, the acidity curve did not shoot above that which was obtain-ed with milk alone.

On one occasion, 10 gms of barium were added to 100 gms of shri-khand and the whole after properly mixing was given to the subjects. This was with the view to find out whether barium caused any difference in the emptying time of the articles of food from the stomach. This was in connection with an attempt being made in the beginning of our study to compare the evacuation time obtained by the fractional method with that obtained by the screening method. This latter part, however, is not discussed here as it does not form a part of this thesis.

High acidity was obtained when the amount of protein in the article was high. Highest acid reading was given by cheese which in quantity of 100 gms contains over 25 gms of protein. 'Tava', (chemical composition of 'rava' was studied and the results are given later in table No.15), 'modak' and 'basudi' which contain 10 to 17 gms of protein in 100 gms of the article also show high acidity. Milk, sweet or otherwise, icecream containing, in quantities of 100 gms of the articles, about 3½ gms of protein, evoke less acidity. In case of curds and butter-milk, where the protein content is about 3½ gms per 100 c.c, same as that of milk, the high acidity evoked by them may be explained by the presence of other acids, like lactic and butyric, in the articles themselves. In case of the cheese, however, higher acidity was obtained when the amount of the article given to the subject was 50 gms, than when the amount of the article given was 100 gms. Of course, it must be admitted that the number of observations made here was only two in each of these two cases and hence not sufficient for the conclusion. Here the values for the protein content given are calculated from the tables, while our actual analysis will be referred to later on. Hawk et al (loc cit) had also noted that when large amount of milk was given

at one time, higher acid reading was obtained. Fat, the amount of protein alone, does not seem to be the sole factor in determining the degree of acidity. The size of particles too only cannot account for the levels of the acidity in the stomach. Milk and ice-cream have neutralising properties which can be made use of in hyperchlorhydria. The other preparations of milk like, 'rawa', 'bandi', 'shrikhand', ~~etc~~ cheese, curds etc. are unsuitable in such cases. In peptic ulcers, small quantities of milk, sweetened if desired or icecream prepared of milk only can be granted. All other preparations of milk seem to be unsuitable. Discussions regarding the preparations 'duodighi' and 'sabudana-khanji' will be taken later on along with cereals etc. because the former preparation contained rice and the latter 'sabudana' along with milk.

Digestion:

We had not the fortune of getting a subject who could regurgitate at will and who could then enable us to note the exact changes in the consistency of the articles swallowed, from time to time. The observations were made, however, in the samples taken out by means of the stomach tube, immediately on their withdrawal from the stomach; and from these observations some inferences could be drawn which are given here. It was seen that the milk was curdled in about 15 minutes of time in the stomach, after its introduction. The liquefaction of the curds was observed to be taking place after an hour or an hour and a half. Solid preparations like 'rawa', 'bandi'; etc. were rendered into small particulate form within an hour and were liquified in subsequent samples. Little need was about the physical changes which were observed.

The protein digestion was studied in the case of these preparations of food. In all of the preparations studied the peptone

transformation was observed to take place in the stomach in 15 to 30 minutes after the introduction of the articles of food. Thus the protein digestion commenced very soon whatever the preparation was. Proteins were detected in all the samples of the gastric contents including the last after the introduction of these articles, indicating thereby that all the proteins of the above articles, when given in quantities of about 100 gms, are not converted to peptones before they leave the stomach. Before drawing the above inferences it was ascertained in other ways that the proteins tested in the samples taken at the approaches of the emptying time were those derived from the food and that the positive test for protein obtained was not due only to the presence of the pepsin in the sample itself. This was done in subsequent studies also. Thus it seems from the above observations that the digestion of the proteins has to be completed in the intestine. The main function of the stomach is that of a container; its digestion function is rather a prologue to the changes that are to take place in the intestine which is the chief organ of digestion. The digestion of fats and carbohydrates in the stomach is held to be of more or less poor significance. The gastric digestion of these components of food has not been studied in case of these articles of food.

Evacuation time:

The evacuation time was estimated by the fractional method by means of the observation of the last clear sample which was taken as an index of the food having cleared from the stomach. Milk, milk with sugar and ice-cream left the stomach completely within three hours of time. Curds, 'manka' and 'mava' cleared out from the stomach in about 3½ hours of time, while 'shrikhand', 'basudi' and cheese took over 4 hours for clearing out from the stomach.

Many hypotheses have been put forth to explain the behaviour of the

pylorus and the evacuation time of various foods from the stomach. Thus acid control, consistency and size of food particles, degree of distension of the stomach, osmotic tension of the articles, chemical nature of food, mood of the subject etc. have been advanced to explain the difference in the evacuation time of different foods.

Ewald and Boas (1886) had hit the theory of acid control of the pylorus, which hypothesis was put forth clearly by Cannon (1906). In 1895 Scholi had noted that the highest acidity was obtained by the time the stomach was about to empty. The acid control theory does not hold much ground as the stomach evacuates with equal ease in achlorhydrias as in the case of normal stomachs. In our series it may be seen that most of the substances that evacuate with delay have produced lot of acid. It may be due to perhaps lack of regurgitation from the duodenal side.

Cannon 1901 had noted that articles, like rice, left slowly, if in hard form. Hirsch (quoted by Alvarez, 1948) later stressed this fact of constistency of the food particles. Articles like bandi and gruel with larger particles were evacuated with delay. In the aspirated samples, however, the articles seemed to be liquefied within an hour's time i.e. about 3 hours before they left the stomach in some cases.

The factor of distension of the stomach could not be examined for the reason that in most of the cases 100 gms of articles were given only. Harbaix, however, has observed that 250 cc of air plus water hastened the evacuation of water than when 250 cc of water alone was given.

Beaumont (loc cit) had put a great many foods into the stomach of his subject and removed samples of the gastric content at intervals for examination. He was interested not so much in the length of time

food remained in the stomach as in what happened to the food and how long it took for the foods to disintegrate. He did observe, however, that oily substances remained in the organ for a relatively long period of time. Leafy vegetables remained longer than meats and starches were the most rapidly evacuated. Cannon (loc cit) explained that carbohydrates left promptly because they were unable to combine with acid, which was allowed to remain in a free state. Proteins on the other hand, combined with acids and so no free acid was available till the disintegration had continued for an hour or so.

Though tests for carbohydrates were not made in case of these articles of food, namely milk and milk products, except in one article, subsequent studies on other articles, which will be discussed later on, do show that carbohydrates, like reducing sugars, leave earlier than proteins.

It has been shown by Wolf and Wolff (loc cit) that emptying of the stomach depends upon the occurrence of vigorous contractions in the stomach, which occur only in the company of accelerated acid secretion and hyperaemia of the mucosa. The duration of digestion in the stomach, therefore, would be expected to be relatively long when gastric function is inhibited, and short when it is enhanced.

McSwiney and Spurrel (1935) and Quigley, Zettleman, and Ivy (1934), have shown from their studies that the composition of a meal influences greatly the length of time it remains in the stomach. A nearly pure protein or carbohydrate meal is quickly discharged, while the presence of fat in a meal generally prolongs the emptying time. This retarding effect is due to the fact that the presence of fat in the duodenum causes the liberation of a hormone called enterogastrone into the blood stream (Gray, Bradley and Ivy (1937) . This material not only inhibits motility and thus delays gastric emptying, but its influence results in

pallor of the mucosa and decreased acid output.

The fat content of these articles of food given namely, milk and milk products, however, does not run parallel with their evacuation time. Thus curds and milk have more or less same fat content but the milk leaves the stomach earlier than the time taken by the curds to leave the stomach. The amount of fat in 'maska' and 'shrikhand' is almost the same, yet, the latter leaves with a delayed time. Other factors besides the difference in the fat content in the articles must be operating in these cases.

Moods of the subject do affect but possibly do not determine the exact time of evacuation of the articles of food from the stomach. Gantur$_{co}$(1933) could not satisfy that pleasure in any way promoted evacuation but saw that worry blocked the food for hours in the stomach. One would expect that wide variations in the duration of gastric digestion would occur during periods of emotional conflict. Cannon (loc cit) and Alvarez (1948) have shown that undigested food remained in the stomach for more than 12 hours in the presence of fear and certain other emotions.

The emotional factor was more or less standardized in our series of experiments and hence could not materially alter the evacuation time obtained in different cases. Then again, "basudi" and "shrikhand" which were relished well, took nearly the same time as chhoro which was disliked by the subjects. Thus like or dislike for an article did not determine early or late evacuation of the preparation.

The following are the names of the 11 subjects, out of the 16, whose acid curves are shown in the figures with numbers of the latter bracketted before the initials of the subject (the curves of the remaining 5 subjects are not drawn but their results are given in the tables at the end).

(6) D.S.S. (7) S.V.K. (8) S.T.V. (9) R.A.R. (10) S.R.P. (11) T.S.R. (12) T.A.L. (13) B.A.K. (14) P.G.J. (15) D.S.K. (16) D.R.D.

Nothing in particular can be said about these curves in reference to the individual subjects, other then what has already been discussed above in regard to those various articles of food given, namely milk and its products.

Out of these 11 subjects, about 7 subjects have been given the most of the milk preparations while in the remaining 4 subjects the responses of only a few of the milk preparations have been studied. Amongst the seven subjects, in one subject (T.S.R.) rather a low acid response was observed throughout in case of the preparations of milk given to him. The presence of mucus was observed in most of the samples taken from the stomach of this subject after these preparations of milk were introduced. In another subject also (T.A.L.) slightly lower acid response was observed compared to the response observed in case of other subjects. And here in his case also in some samples the presence of mucus was observed though not to the same extent as it was observed in case of the subject (T.S.R.).

Regarding the physical examination of the gastric contents e.g. the presence of mucus, bile, etc. in the samples withdrawn from the stomach of the subjects studied for the responses of the various preparations of milk, nothing in particular can be said other then what has already been discussed with regard to these findings in case of the alcohol meal given to the subjects.

Summary and conclusions:

(1) Gastric response, digestion and evacuation time of milk and the various products of milk have been studied in 16 normal healthy subjects chosen after their fractional gastric analysis examination

with alcohol meal was found to be normal. The total number of observations made in these subjects with the articles of food of milk and its products is 75.

(2) The articles of food, which were mostly given in quantities of 100 gms, when in form of solids or 100 cc when in form of liquids, gave varying responses in the subjects. The results are compared with those of Hewit et al (1926) from similar studies of theirs. Milk, milk with sugar, condensed milk and ice-cream gave a low acid response throughout. Curds, 'basudi', 'maska', 'shrikhand', cheese, 'mava' produced high acidity which persisted longer. The free and total acidity readings were relatively close to each other in the case of milk, milk with sugar and ice-cream, whereas after 'shrikhand', 'basudi', curds, 'maska' and cheese, the difference was more than 30 cc of N/10 acid per cent, especially in the early samples.

(3) The high acidity obtained in the case of sweet preparations is possibly not caused by the sugar content, alone, present in the preparations. High acidity was obtained when the amount of protein in the article was high. Cheese, 'maska', 'mava', 'basudi' containing a larger amount of protein gave a higher acid response; while milk, sweet or otherwise, icecream, containing a less amount of protein gave a lower acid response. In case of curds and butter-milk where the protein content was more or less the same as that of milk, the high acidity evoked by them may be due to the presence of acids, like lactic or butyric, in the articles themselves. The amount of protein alone, however, does not seem to be the sole factor in determining the degree of acidity. The size of the particles too only cannot account for the levels of the acidity in the stomach.

(4) The acidity was not related to the like or dislike of an article. All articles were relished except cheese and 'maska' which were accepted by the subjects with difficulty. Cheese was not much tasted by the subjects before, which therefore produced a little nausea.

'Basudi' and 'shrikhand' were enjoyed much by the subjects, yet all of these articles gave high acidity readings.

(5) Any article of food in the stomach stimulates gastric secretion. If the acid response to milk is the lowest as is so far the case, milk and icecream, having neutralising properties, can be stated to be the best nourishing as well as neutralising substances in hyperchlorhydrics.

This cannot be, however, said of the other milk preparations. The use of curds, 'maska', 'mava', evoking high acidity and 'basudi', cheese, 'shrikhand', giving highest acidity, may thus be contraindicated in gastric ulcers.

(6) Regarding digestion of these articles in the stomach, it was observed that milk was curdled in about 15 minutes. The liquefaction of the curds took place after an hour or an hour and a half. Solid preparations like 'mava', 'basudi', etc. were rendered into small particulate form within an hour and were liquefied in subsequent samples. So much was about the physical changes.

(7) Regarding the protein digestion, peptones appeared to have been formed from proteins of the food, in 15 to 30 minutes, with all preparations. Proteins were present in all samples including the last, thus indicating that all the proteins of the above preparations, when given in the quantities of about 100 gms, are not converted to peptones before the article leaves the stomach. Further digestion of proteins evidently takes place in the intestines.

(8) The last clear sample when obtained was taken to be the index that the article of food had cleared from the stomach. This formed the basis of the determination of the evacuation time of the articles of food by the fractional method. Milk, Milk with sugar and icecream left the stomach completely within three hours of time. Curds, 'maska' and 'mava' cleared out from the stomach in about 3½ hours of time, while 'shrikhand', 'basudi' and cheese took over 4 hours for clearing out from the stomach.

(9) The delay seems not to be due to the mechanical factor of the large size of the particles as the food was well liquefied in 1½ hours. The evacuation time for different articles apparently is not proportionate to their fat content either. As the curds with the same fat content as that of the milk, and the 'shrikhand' with the same fat content as that of the 'maska', are not cleared in the same time respectively.

(10) The satiety given by the articles was not experienced in proportion to their stasis in the stomach. Cheese, which was a new and unpalatable item to the subjects, stayed long in the stomach, yet it did not satisfy the subjects as much as the other correspondingly retained articles.

(11) The emotional factor was more or less standardized in our series of experiments and hence could not materially alter the evacuation time obtained in the different articles of food.

(3) Preparations of rice, wheat and other cereals, pulses, potatoes etc.

Experimental and results:

The following preparations have been studied:-

(1) Boiled rice - rice boiled in water till soft. This was given in quantity of 100 gms.

(2) 'Ponha' - paddy with husks is boiled in water and then the husks are removed by pressure. This is rather dry and hard in form. This was given in quantity of 50 gms only instead of 100 gms as the latter amount could not be taken by the subjects at one time, without water.

(3) 'Chevda' - 'Ponha' as obtained above is fried in oil, to which then groundnuts (baked), chilli-powder, condiments, and spices are added, to taste. This was also given in 50 gms measure as the larger amount could not be taken by the subjects at one time, without water.

(4) 'Dhosa' - soaked rice flour which is allowed to ferment on the previous night is fried, on the next day morning, in a very little quantity of oil. This was given in 50 gms quantity.

(5) 'Idli' - soaked rice flour which is allowed to ferment on the previous night, is cooked in steam, on the next day morning. This was given in 100 gms quantity.

(6) 'Khichdi' with milk - 'Khichdi' comprises of rice 70 parts and 'tuverdal' (red gram) 30 parts, which, after being mixed well, are boiled, on adding a little salt, till each grain is very soft. 100 gms of 'Khichdi' with 100 cc of milk were given to each subject.

(7) 'Khajur' - i.e. dates (Persian)(phoenix dactylifera) were given in quantity of 100 gms.

(8) Bread - usual brown bread given in 100 gms quantity.

(9)'Shira'- well pounded wheat grains are cooked in water after being first fried in ghee, on adding sugar and a little salt to taste, till soft. This was given in 100 gms measure.

(10) 'Puri' - Wheat flour is soaked in water and a little oil, to which a little salt is added to taste; from this dough a small cake is fried in large quantity of ghee. This was given in 100 gms quantity.

(11) Boiled 'sev' - wheat flour is soaked in water and a little oil and a small amount from this dough is made into small macaroni-like form, which is then dried in the sun-shine or warmed with heat. This is then boiled in water to which sugar is added till each grain is made soft. This was given in 100 gms quantity.

(12) 'Chapati' - wheat flour is soaked in water and a little oil, to which a little salt is added to taste; from this dough a small amount is thin rolled and is baked with a little quantity of ghee. This was given in 100 gms quantity.

(13) 'Gulab-jambu' - Two parts of 'mava' to which one part of wheat flour is added and are well mixed. This is made into a form of small balls which are then fried in ghee and sweetened with sugar syrup. This was given in quantity of 100 gms.

(14) 'Rasogolla' - 'Mava' to which rice flour, 3 times the weight of the former, is added and well mixed. This is fried in ghee in form of small balls and sweetened with sugar syrup. This was given in 100 gms measure.

(15) 'Bajri' ('Bajri') - flour of'bajri' or bajra (pennisetum typhoideum,)is soaked in water and a little oil, to which a little salt is added to taste and baked with heat in thin rolled form. This was given in 100 gms quantity.

(16) Maize - This was given as baked after the cereal fruit was detached from efflorescence and when still warm in 50 gms quantity.

(17) 'Mug' - i.e. green gram (phaseolus radiatus) 'dal' was boiled in water, after adding a little salt to taste, till it was made soft. This was given in 100 gms measure.

(18) 'Val' - i.e. fried bean dry (dolichos lablab) 'dal' was boiled in water, after adding a little salt to taste, till it was made soft. This was given in 100 gms amount.

(19) 'Tuver dal' - i.e. red gram (cajanus indicus) 'dal' was boiled in water, after adding a little salt to taste, till it was made into a semi-liquid form. This was given in 100 gms measure.

(20) 'Kabuli' grams - Bengal grams (cicer arietinum) were given as baked in 50 gms amount.

(21) 'Khaman' - Bengal grams pounded in small particulate form are soaked in water and are allowed to ferment in the previous night. On the next day morning this is cooked in steam and after adding condiments and salts to taste, is fried in a little quantity of oil in form of small cakes. This was served in 100 gms amount each to the subjects.

(22) 'Sev' - Bengal gram flour is soaked in water and a little quantity of oil, to which condiments and a little salt are added to taste and a dough is prepared. A small amount from this is then fried in macaroni-like form, in oil which is taken in larger quantity. This was served in 100 gms measure.

(23) 'Ganthia' - the preparation of this is same as above except that a little fermentation is allowed, and that the form into which it is made is of a larger size. This was given in quantity of 100 gms.

(24) 'Bhajia' - Bengal gram flour is soaked in water and a little quantity of oil and after adding condiments, onions in small pieces and a little salt to taste, a dough is prepared. A small amount from this is fried in form of small balls, in a large quantity of oil. This was served to the subjects in 100 gms measure each.

(25) Sweet balls ('Bundi') - Bengal gram flour is soaked in water and a little quantity of oil, to which a little salt is added to taste, and a small amount from this dough, after being fried in the form of small balls, in a large quantity of oil, is sweetened with sugar syrup. This was given in 100 gms quantity.

(26) 'Jalebi' - This is more or less prepared in the same way as in the case of sweet balls ('bundi') with the difference in the shape, it being in the form of circumscribing layers & that wheat flour was admixed. This was given in 100 gms amount. (This is generally prepared from wheat flour only but due to rationing the mixture of the flour was used.)

(27) 'Kharising' - baked ground-nuts, to which a little salt was added to taste, were given in 50 gms quantity because more quantity could not be accepted by the subjects at one time without water.

(28) Ground-nut balls - baked ground-nuts are pulverised and some treacle and ghee are added and after well mixed, it is shaped into balls. This preparation is generally taken by the members of many families on this part of the country on a semi-fast day. On one occasion this was given in 75 gms amount, (while on the second occasion, in 100 gms as stated below).

(29) Ground-nut balls - on another occasion the above preparation was given in 100 gms measure.

(30) Potatoes -'Bhaji'- The potatoes were boiled soft and after adding condiments and a little salt to taste, they were served in 100 gms measure.

(31) 'Suran' preparation - 'Suran' a kind of tubers, is prepared in the same way as the preparation of potatoes - 'Bhaji' and was given also in 100 gms amount.

(32) Full-meal (Veg.) - this comprised of boiled rice, 'tuver-dal', 'chapati' with ghee, potatoes - 'Bhaji', a vegetable mixed with grams and cooked, 'mug', curds, salt and sour lime pieces. This was served to the subjects, ad lib, and at leisure and along with water to drink also.

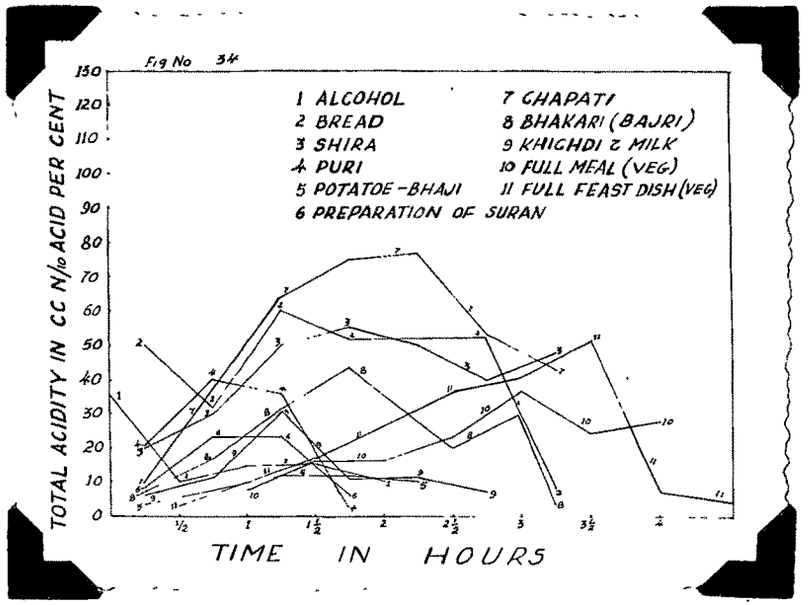


Fig No 34
1 ALCOHOL
2 BREAD
3 SHIRA
4 PURI
5 POTATOE-BHAJI
6 PREPARATION OF SURAN
7 CHAPATI
8 BHAKARI (BAJRI)
9 KHICHDI & MILK
10 FULL MEAL (VEG)
11 FULL FEAST DISH (VEG)
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS

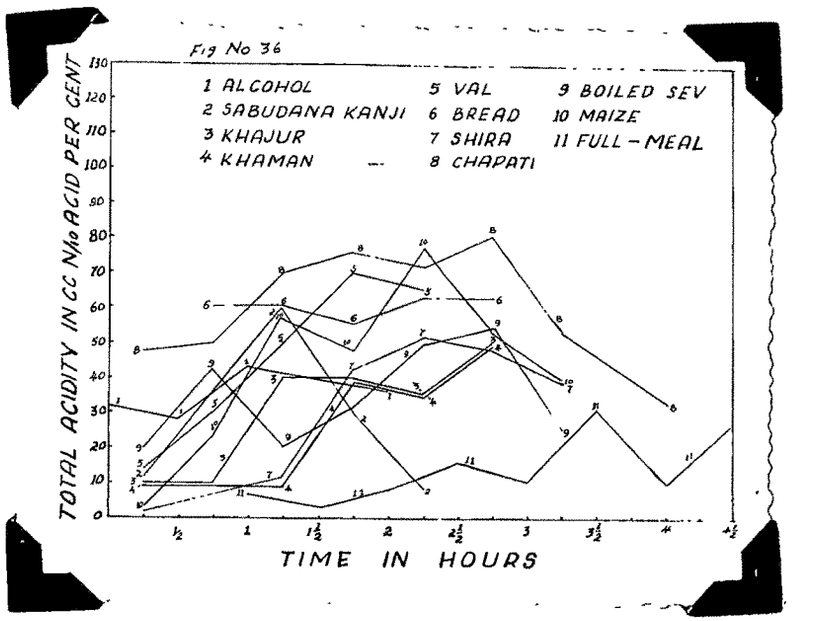


Fig No 36
1 ALCOHOL
2 SABUDANA KANJI
3 KHAJUR
4 KHAMAN
5 VAL
6 BREAD
7 SHIRA
8 CHAPATI
9 BOILED SEV
10 MAIZE
11 FULL-MEAL
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS

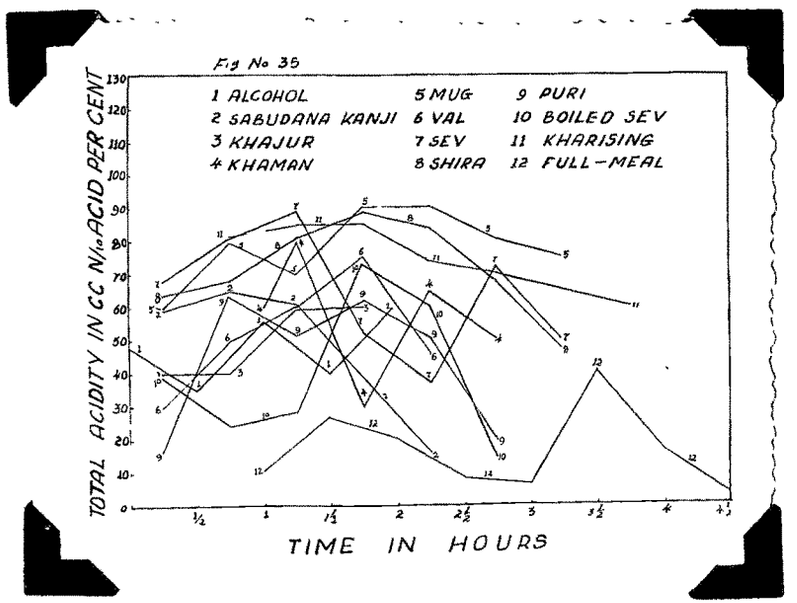


Fig No 35
1 ALCOHOL
2 SABUDANA KANJI
3 KHAJUR
4 KHAMAN
5 MUG
6 VAL
7 SEV
8 SHIRA
9 PURI
10 BOILED SEV
11 KHARISING
12 FULL-MEAL
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS

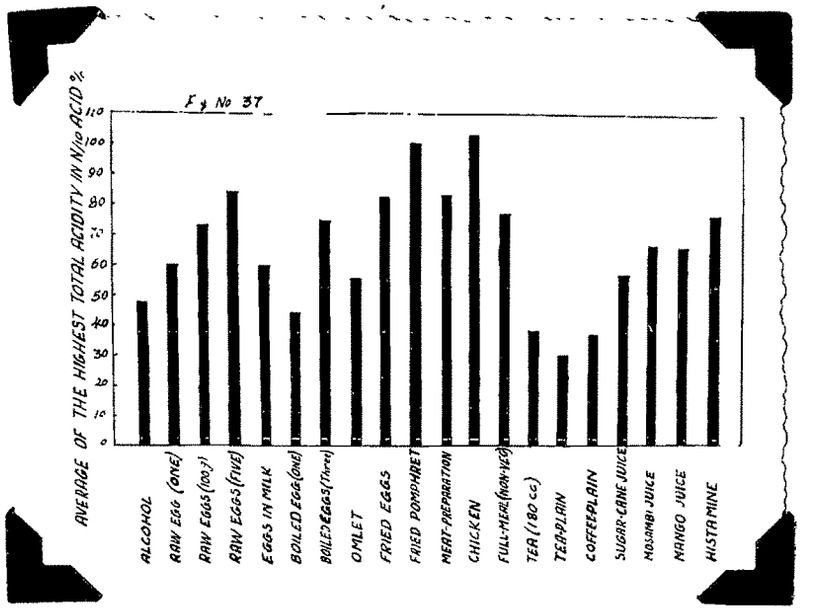


Fig No 37
AVERAGE OF THE HIGHEST TOTAL ACIDITY IN N/10 ACID %
ALCOHOL
RAW EGG (ONE)
RAW EGGS (two)
RAW EGGS (FIVE)
EGGS IN MILK
BOILED EGG (one)
BOILED EGGS (three)
OMLET
FRIED EGGS
FRIED POMPHRET
MEAT-PREPARATION
CHICKEN
FULL-MEAL (NON-VEG)
TEA (180 cc)
TEA-PLAIN
COFFEE-PLAIN
SUGAR-CANE JUICE
MOSAMBI JUICE
MANGO JUICE
HISTAMINE

the values of alcohol meal examination are falling within the rang of the latter examination. The average of the highest total acidity was 42.0 cc in case of the full meal while that in case of the full feast dish was 52.0 cc N/10 acid per cent. The acid response was in an average highest between 1½ and 2½ hours after taking the meals and fell after 3 hours. The association of full meals with the low acid response will have a significant bearing on the treatment of ulcer cases, which will be discussed later on.

Digestion:

In case of the items of rice (boiled) and the various preparations of rice, peptones appeared soon after the intake of the articles. The appearance of peptones after the articles, 'chevda', 'dhosa' (simple), 'idli' and 'khichdi' with milk, was found to be within 15 minutes after the intake of the articles while that after 'ponha' and boiled rice was within 15 to 70 minutes after their intake. Boiled or cooked articles like boiled rice, rice in 'doodhpak', 'idli', 'dhosa'(simple), become liquefied in 15 minutes. Large size particles, however, persis-ted for more than one hour in the case of 'ponha' and 'chevda'. In case of 'sabudana-kanji', the particles were liquefied easily and starch, from the milk used in cooking the preparation, appeared in ½ hour, which persisted for over an hour. The reducing sugar which was present in this article itself disappeared from the gastric samples within 2½ hours while the evacuation time of the article was a little longer. In case of 'khichdi' with milk also a similar observation was made. Regarding the starch, it was found to be present even in the last samples. Evidently a good amount of the starch of the rice remains to be digested in the intestines. As was observed in case of milk and its products regarding the appearance of proteins in the gastric samples, a similar observation was made in the case of these articles also, indicating thereby that all the proteins of the preparations, when given in quanti-

ties of about 100 gms, are not converted to peptones before they leave the stomach. Fats, wherever the articles contained them, were also seen to be present even in the last samples of the gastric contents, by physical examination. Thus it seems that the reducing sugars were evacuated earlier than the other components, like proteins, fats and starch, of the articles, as the latter are found to be present even in the last gastric samples.

The appearance of peptones, in case of the preparations of wheat, was also found to be within 15 minutes after the intake of the articles, except in case of 'chapati' and 'gulab-jambu'. It was within 30 minutes, that the peptones made their appearance in the gastric samples after the intake of the article, 'gulab-jambu'. The articles of wheat preparations were liquefied in ½ hour except in case of 'chapati' and 'puri', where large particles were recovered in the gastric samples upto 1½ hours after the intake of the articles. Reducing sugars were detected to be present in most of the articles of wheat preparations themselves and they disappeared from the gastric samples in an average of about 2½ hours of time after the intake of the articles, which time was a little earlier than the evacuation time of the article, indicating thereby that the reducing sugars were evacuated earlier, than the other components of the articles because starch, proteins and fats, when examined for, were detected to be present even in the last of the gastric samples.

Regarding the digestion of proteins in the stomach after the intake of the preparations of pulses, peptones appeared in the gastric samples within 15 minutes, in all cases, except in the case of 'bhajia', where the peptones appeared in 30 minutes, thus indicating that the digestion of proteins commenced soon in the stomach, within 15 to 30 minutes of time after the intake of these articles of food. The articles were liquefied within 15-30 minutes of time after their intake, except in

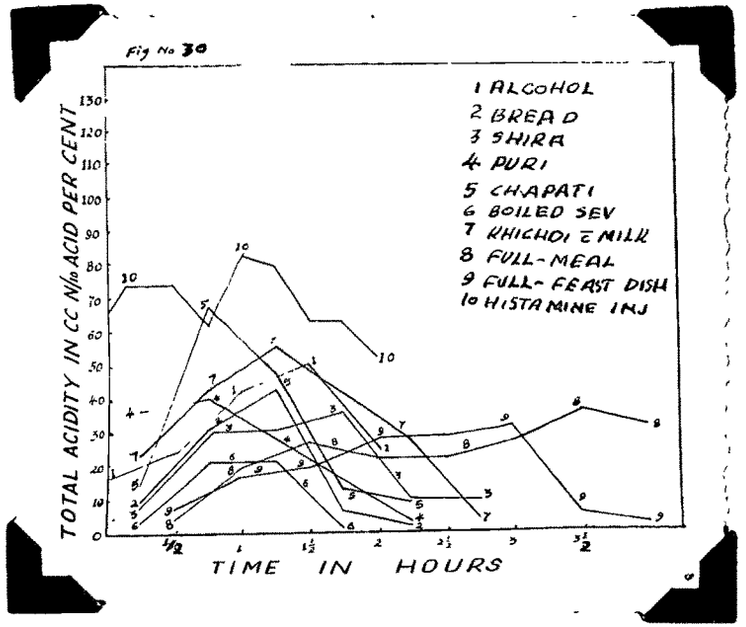


Fig No 30
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 BREAD
3 SHIRA
4 PURI
5 CHAPATI
6 BOILED SEV
7 KHICHDI & MILK
8 FULL-MEAL
9 FULL-FEAST DISH
10 HISTAMINE INJ

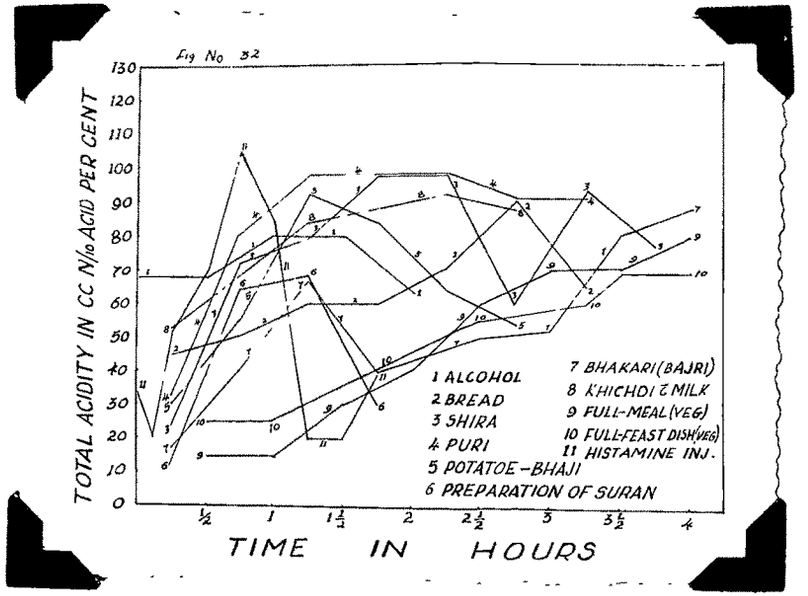


Fig No 32
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 BREAD
3 SHIRA
4 PURI
5 POTATOE-BHAJI
6 PREPARATION OF SURAN
7 BHAKARI(BAJRI)
8 KHICHDI & MILK
9 FULL-MEAL(VEG)
10 FULL-FEAST DISH(VEG)
11 HISTAMINE INJ.

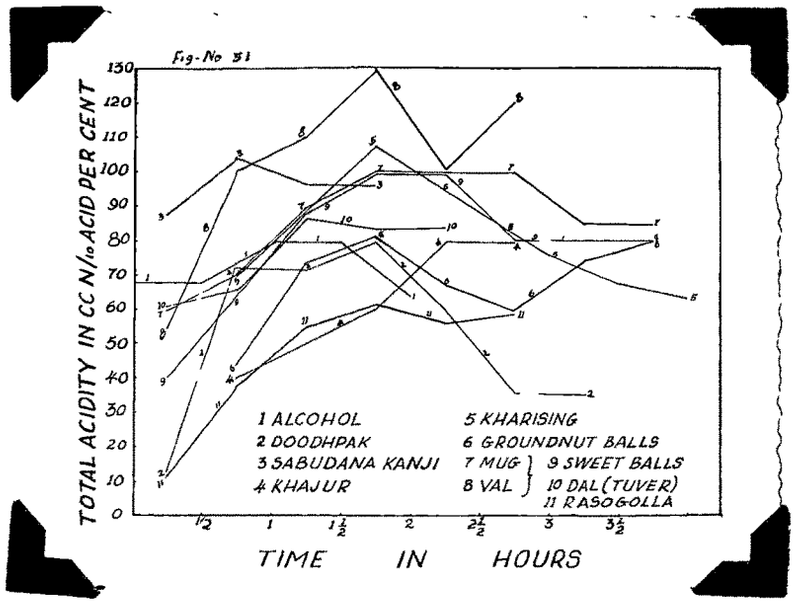


Fig-No 31
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 DOODHPAK
3 SABUDANA KANJI
4 KHAJUR
5 KHARISING
6 GROUNDNUT BALLS
7 MUG
8 VAL
9 SWEET BALLS
10 DAL(TUVER)
11 RASOGOLLA

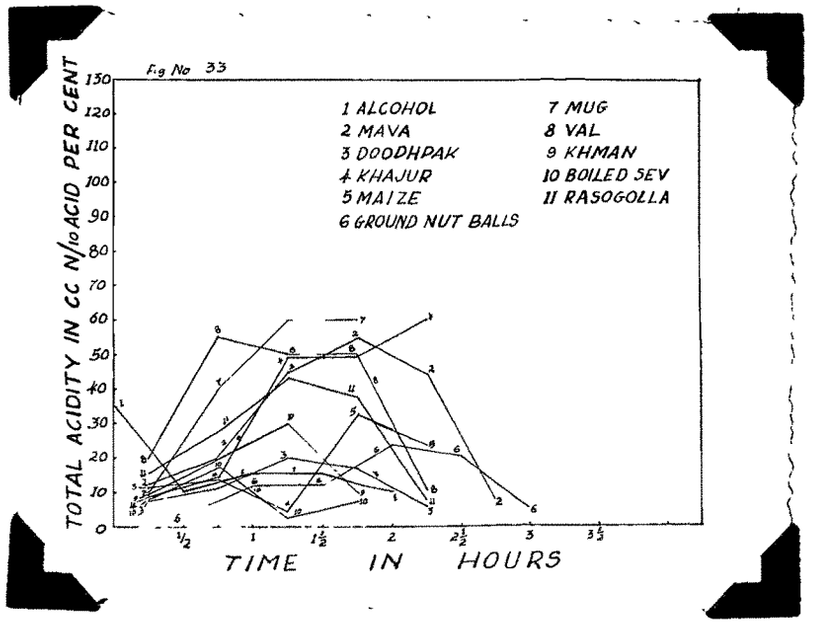


Fig No 33
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 MAVA
3 DOODHPAK
4 KHAJUR
5 MAIZE
6 GROUND NUT BALLS
7 MUG
8 VAL
9 KHMAN
10 BOILED SEV
11 RASOGOLLA

As can be seen from the table No.6 as also from the figure No.31, the acid response in most cases of these preparations of pulses was within normal limits, average of the highest total acidity being of the order of 60 cc N/10 acid per cent in all cases except 'mug' and 'jalebi' In case of the preparation of 'mug', the average of the highest total acidity was 72.0 cc N/10 acid percent and that in case of 'jalebi' was 80.0 cc N/10 acid per cent, which readings fall on the border of hyper-acidity. In case of the gastric samples obtained after the preparation of 'gentlis', there was much difference in free and total acidity readings, the difference being of the order of about 30 cc N/10 acid per cent, especially in the early samples. This may be partly due to the fact that acids were present in the preparation itself because on testing for the presence of lactic acid by chemical qualitative test, the preparation showed that it contained lactic acid in its water extract, which naturally might have caused the presence of lactic acid in the gastric samples as the latter also showed the presence of that acid on testing. In case of other preparations the readings of free acid and the total acidity were closely paralled with one another.

Nuts and the preparation of nuts comprised of 'Kharising' i.e. baked ground nuts mixed with a little salt to taste and ground-nut balls. 'Kharising' was taken by the subjects in quantity of 50 gms only as a larger quantity than this amount could not be accepted by the subjects at one time without water to drink. Ground-nut balls were given in two portions to the subjects, on one occasion the amount given being 75 gms and on another occasion it being 100 gms, to two subjects each time. 'Kharisingh' evoked higher acid response, the average of the highest total acidity being 72.0 cc N/10 acid per cent, which seemed to be falling on the border of hyperacidity. In case of the preparations of ground-nut balls given in two different portions, however, the acid response was well comparable with that of alcohol meal. The

average of the highest total acidity in case of the ground-nut balls given in 75 gms measure was 48.0 cc N/10 acid per cent while that with the same article but in the portion of 100 gms was 52.0 cc N/10 acid percent, both of which readings are thus comparable with the correspond -ing reading of 48.0 cc for the alcohol meal.

The preparations of tubers included potatoes - 'bhaji', and 'suran' preparations, both of which were given in 100 gms measure. The acidity readings were well comparable with those obtained after alcohol meal. The average of the highest total acidity in case of potatoes- 'bhaji' was 38.8 cc while that obtained after 'suran' preparation was 38.0 cc N/10 acid per cent.

Maize which was baked and given in 50 gms quantity only as a larger amount could not be accepted by the subjects at one time without water to drink, also produced a normal acid response, the average of the highest total acidity being 48.0 cc N/10 acid percent.

Amongst the fruits, dried fruits, 'khajur' i.e. dates (Persian) were given in 100 gms measure. The acid response given by this article was also well comparable with that of alcohol meal. The average of the highest total acidity was 58.0 cc N/10 acid per cent.

Regarding the full meals, two types of dishes, one the full meal and the other full feast dish, both of which were vegetarian dishes, were given to the subjects ad lib. and at leisure. The constituents of these dishes were as per description given already in the previous pages. These dishes were given to seven subjects who were all present at the time of the full meal, while out of these 7 subjects only 4 subjects were present at the time of the full feast dish. These full meals were taken by the subjects to their satisfaction.

As can be seen from the table No.6 as also from the figure No.22, the values for the acidity in case of both the dishes when compared with

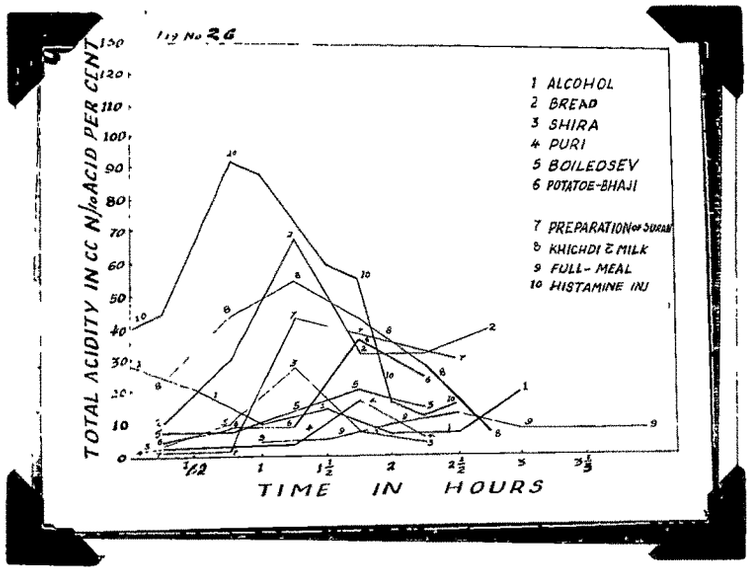


Fig No 26
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 BREAD
3 SHIRA
4 PURI
5 BOILEDSEV
6 POTATOE-BHAJI
7 PREPARATION of Sukali
8 KHICHDI & MILK
9 FULL-MEAL
10 HISTAMINE INJ

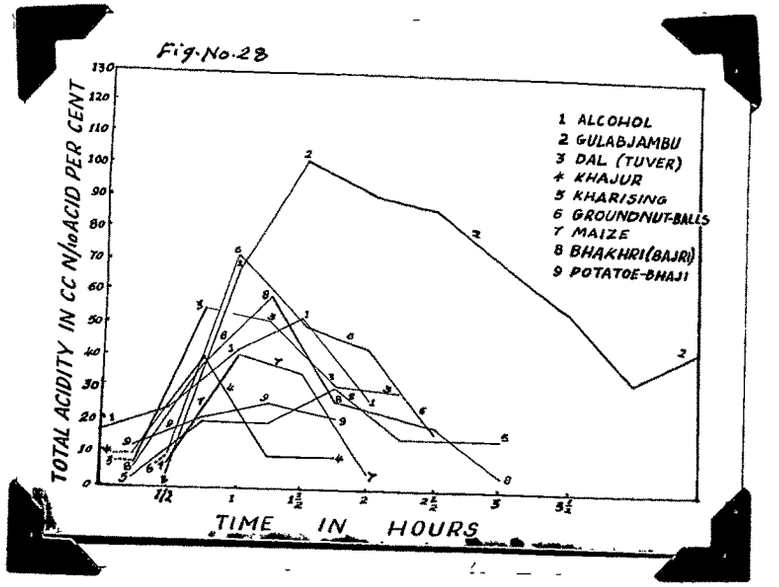


Fig. No. 28
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 GULABJAMBU
3 DAL (TUVER)
4 KHAJUR
5 KHARISING
6 GROUNDNUT-BALLS
7 MAIZE
8 BHAKHRI (BAJRI)
9 POTATOE-BHAJI

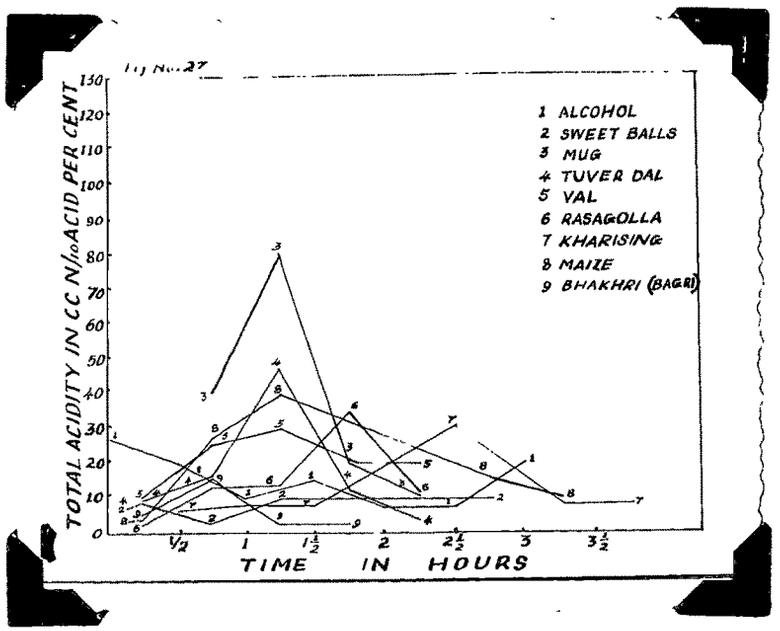


Fig No. 27
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 SWEET BALLS
3 MUG
4 TUVER DAL
5 VAL
6 RASAGOLLA
7 KHARISING
8 MAIZE
9 BHAKHRI (BAGRI)

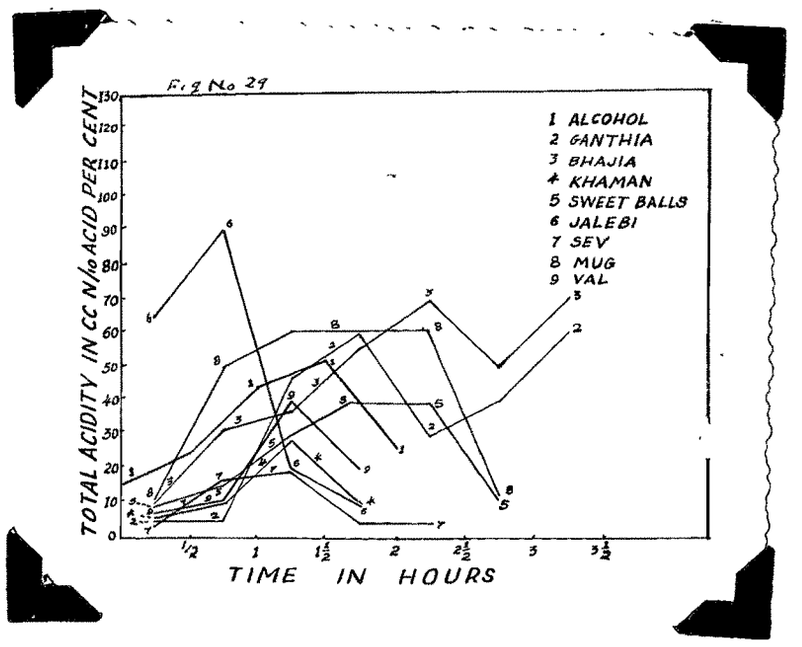


Fig No 29
TOTAL ACIDITY IN CC N/10 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 GANTHIA
3 BHAJIA
4 KHAMAN
5 SWEET BALLS
6 JALEBI
7 SEV
8 MUG
9 VAL

showing the total acidity for each of the article of the food in the individual subjects are also drawn and they have been shown in the figure Nos. from 23 to 30. The total number of observations made in 19 subjects for studying the gastric response, digestion and evacuation time of the preparations listed above is 162.

Discussion:

Gastric response:-

Free and total acidity:--

The rice item included mainly boiled rice, 'pongi', 'chorda', 'dhosa'(simple), 'idli', 'khichdi' with milk. The acidity obtained in this series also is compared with the acid response obtained on alcohol fractional meal examination. As can be seen from the figure No.19, the acidity produced by these items was within normal limits in all cases; 'idli' and 'dhosa'(simple) though the latter given in 50 gms. amount, produced a response almost on the border of hyperacidity. The difference between the free acidity and the total acidity for most of the gastric samples obtained after the intake of the articles of food was of the order of about 30 cc N/10 acid, per cent, especially in the early samples, in case of 'idli' and 'dhosa'(simple). This may possibly be due to the fact that the articles themselves contained acids because the chemical examination of the articles showed the presence of lactic acid. The gastric samples obtained after the intake of 'idli' and 'dhosa'(simple), especially the early samples, when tested for the presence of lactic acid by chemical qualitative tests, showed also that the samples contained lactic acid.

The two articles of food, one, the 'doodhpak' a preparation of rice and milk and the second, 'sabudana kanji', a preparation of 'sabudana' and milk, have been included in the list of articles of milk products, discussed previously because they contained milk as one of

their components. The acid response given by these two preparations was similar to that given by boiled rice i.e. it was normal.

The articles, 'chevda' and 'ponhe' were given in 50 gms quantity instead of the 100 gms measure because the subjects could not accept a larger amount than 50 gms quantity at a time without water to drink and hence their gastric response, though fairly high, cannot, however, be compared with that of other articles which were given in 100 gms measure.

The wheat preparations included 'chapati', bread, 'shira', 'puri', boiled 'sev'. The acid response given by these articles of food, when taken in quantities of 100 gms each, was within normal limits; the average highest total acidity being of the order of about 60 cc N/10 acid per cent (see figure No.20).

'Gulab-jambu' which is a preparation of a mixed type containing both 'mava' and wheat flour, and admixed with sugar also, gave a little higher acid response, the average of the highest total acidity being 74.6 cc N/10 acid, percent, than the acid response obtained after the wheat preparations mentioned above. This would be in accordance with the expectations because the article contained 'mava', which has been shown to be a preparation of milk, giving a higher acid response, as has been already described in connection with the discussions of milk and its preparations in the previous pages.

The pulses and the preparations of pulses included 'mug', 'val', 'tuver dal', 'kabuli' grams, 'khaman', 'sev', 'ganthia', 'bhajia', sweet balls and 'jalebi'. These were given in varied but usual dishes, after being cooked, boiled, baked or fried, and in quantities of 100 gms with the exception of 'kabuli' grams which were given in 50 gms measure instead of 100 gms quantity, as the latter amount could not be accepted by the subjects at one time without water to drink.

Fig No 22

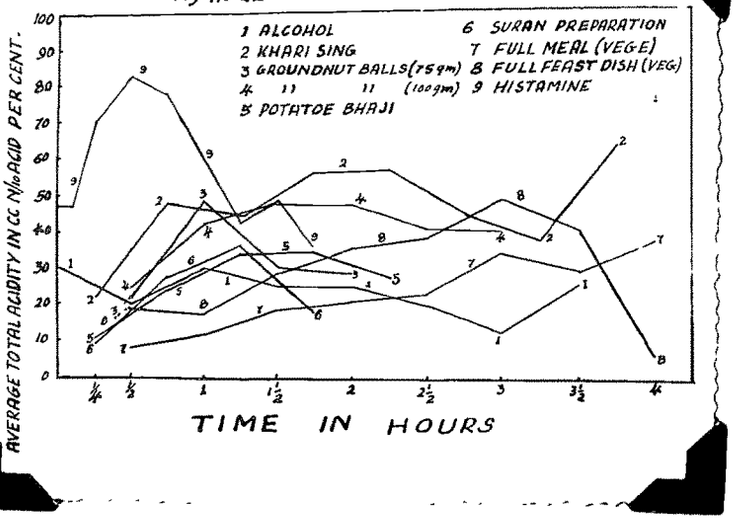


Fig No 24

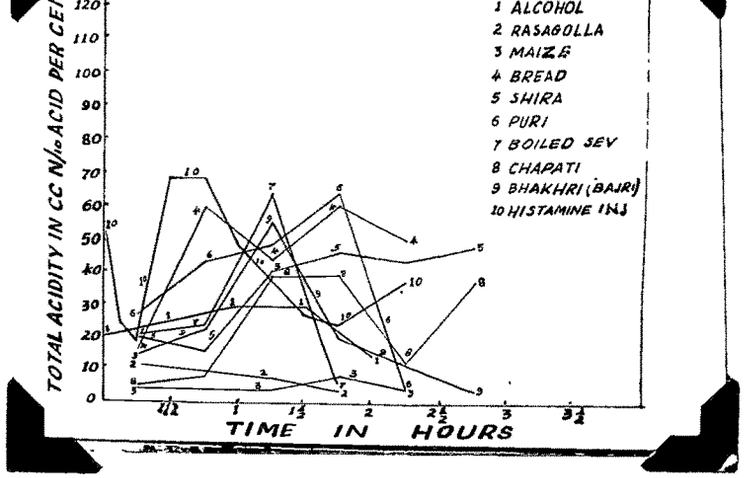
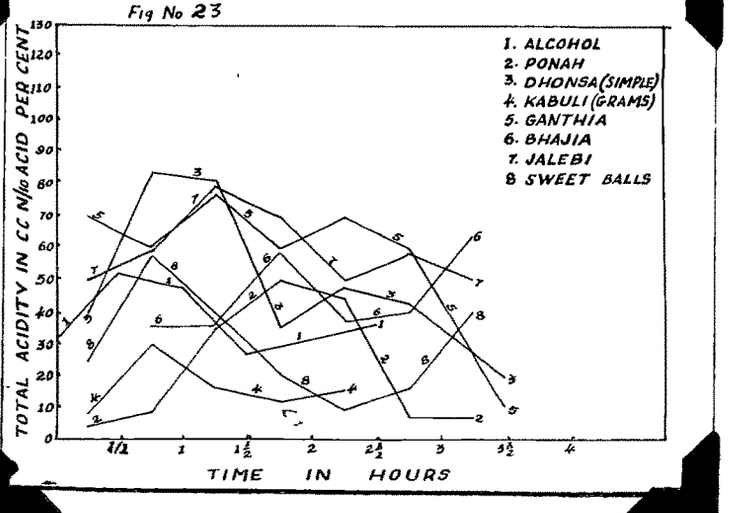


Fig No 23



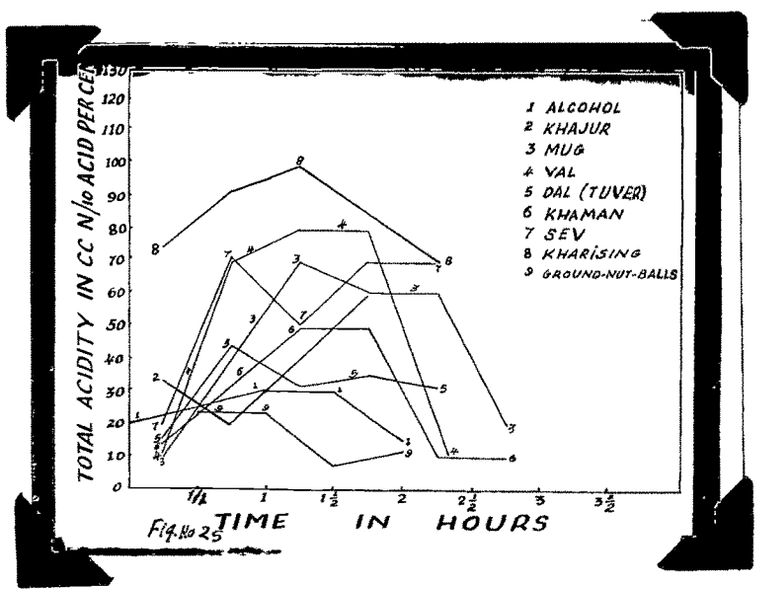


Fig. No 25

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Full Meal (Veg.) Ad lib.																						
Maximum	-	-	8,0	15.0	20.0	28.0	20.0	30.0	24.0	40.0	30.0	60.0	50.0	70.0	45.0	70.0	50.0	80.0				
Minimum	-	-	0.0	4.0	0.0	4.0	0.0	8.0	0.0	8.0	0.0	6.0	0.0	8,0	0.0	8.0	0.0	5.0				
Mean	-	-	1.6	8.0	4.4	12.0	8.8	18.5	10.0	20.5	12.8	24.0	25.3	35.3	18.9	28.9	24.3	36.2				
Std. Error.	-	-	-	1.10	1.37	2.90	2.96	2.85	3.30	3.38	4.62	5.02	7.06	5.34	6.54	6.66	7.56	7.03	12.97			
Histamine inj.																						
Maximum	64.0	68.0	64.0	72.0	68,0	72.0	100.0	104.0	80.0	88.0	76.0	80.0	60.0	64.0	56.0	64.0	48.0	52.0				
Minimum	20.0	32.0	16.0	20.0	60.0	68.0	60.0	64,0	44.0	48.0	12.0	20.0	12.0	20.0	20.0	24.0	12.0	16.0				
Mean.	40.0	47.0	41.0	47.0	64.0	69.0	77.0	82.0	71.0	76.0	52.0	57.3	37.0	43.0	39.0	46.0	30.0	34.0				
Std. Error.	9.38	8.22	9.85	10.75	1.61	1.00	10.11	9.52	9.00	9.31	20.13	18.86	12.26	11.12	7.93	8.87	-	-				

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23
								Potatoes -"bhaji" 100 gms.														
Maximum	-	-	10.0	30.0	44.0	56.0	84.0.	92.0	76.0	84.00	60.0	64.0										
Minimum	-	-	0.0	4.0	0.0	8.0	4.0	10.0	8.0	12.0	0.0	5.0										
Mean	-	-	2.8	11.0	15.2	24.4	25.6	33.6	28.4	33.4	20.0	25.8										
Std. + Error. -	-	-	1.96	7.06	8.03	8.57	14.93	15.02	12.61	13.36	14.15	13.33										
								"Suran-preparation" - 100 gms.														
Maximum	-	-	0.0	12.0	56.0	64.0	64.0	68.0	20.0	30.0												
Minimum	-	-	0.0	4.0	0.0	4.0	0.0	7.0	0.0	5.0												
Mean	-	-	0.0	9.0	20.0	27.0	30.0	35.7	8.7	17.5												
Std. + Error. -	-	-	.-0	1.91	12.43	13.00	13.51	13.12	5.15	7.20												
								Full-feast dish (veg.) ad.lib.														
Maximum	-	-	30.0	45.0	20.0	25.0	32.0	48.0	40.0	56.0	40.0	60.0	50.0	70.0	40.0	70.0	0.0	8.0				
Minimum	-	-	0.0	4.0	4.0	10.0	8.0	16.0	24.0	28.0	16.0	20.0	20.0	32.0	0.0	8.0	0.0	4.0				
Mean.	-	-	12.5	20.5	10.0	17.7	16.0	28,0	31.0	35.3	24.0	37.5	34.5	48.5	23.0	39.5	0.0	6.0				
Std. + Error. -	-	-	7.50	9.35	5.03	4.25	8.00	10.06	4.12	15.77	5.41	7.77	8.40	8.18	8.70	13.57	-	-				

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
									"Bhajia" 100 gms.													
Maximum	-	-	24.0	36.0	24.0	36.0	40.0	60.0	60.0	70.0	40.0	50.0	60.0	70.0								
Minimum	-	-	0.0	8.0	20.0	35.0	10.0	20.0	28.0	36.0	32.0	40.0	25.0	35.0								
Mean	-	-	13.3	25.3	21.3	35.7	30.0	45.3	44.0	55.3	36.0	44.7	47.0	57.3								
Std. Error.	-	-	7.08	8.78	1.49	1.58	10.00	12.77	9.24	10.03	2.31	2.55	11.08	11.29								
									Sweet-balls 100 gms.													
Maximum	-	-	30.0	40.0	50.0	65.0	70.0	90.0	90.0	100.0	90.0	100.0	70.0	80.0	65.0	80.0						
Minimum	-	-	0.0	10.0	0.0	4.0	0.0	10.0	0.0	10.0	0.0	10.0	0.0	10.0	0.0	15.0						
Mean.	-	-	11.0	22.0	20.0	38.8	30.0	45.0	33.0	43.0	29.0	41.0	16.0	27.0	31.7	45.0						
Std. Error.	-	-	5.57	5.61	9.35	12.30	14.72	17.08	15.62	15.62	16.46	16.46	13.64	13.38	14.88	18.93						
									"Jalebi" 100 gms.													
Maximum	-	-	50.0	65.0	60.0	90.0	60.0	80.0	50.0	70.0												
Minimum	-	-	30.0	50.0	40.0	60.0	10.0	20.0	0.0	10.0												
Mean	-	-	40.0	57.5	50.0	75.0	35.0	50.0	25.0	40.0												
Std. Error.	-	-	-	-	-	-	-	-	-	-												

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
								"Kharising" 50 gms.														
Maximum	-	-	35.0	75.0	50.0	92.0	50.0	100.0	60.0	108.0	80.0	95.0	64.0	76.0	60.0	68.0	60.0	64.0				
Minimum	-	-	0.0	4.0	0.0	8.0	0.0	4.0	0.0	5.0	8.0	16.0	0.0	8.0	0.0	8.0	40.0	60.0				
Mean	-	-	8.8	23.0	25.0	47.0	21.6	43.4	32.2	55.8	44.2	56.6	30.5	42.5	30.0	38.0	50.0	62.0				
Std. Error.	±	-	8.73	17.57	9.28	12.66	11.68	20.35	9.59	17.18	12.68	14.55	15.65	17.69	-	-	-	-				
								Ground-nut balls 75 gms.														
Maximum	-	-	20.0	24.0	48.0	72.0	44.0	52.0	36.0	44.0												
Minimum	-	-	16.0	20.0	16.0	24.0	0.0	8.0	0.0	12.0												
Mean.	-	-	18.0	22.0	32.0	48.0	22.0	30.0	18.0	28.0												
Std. Error.	±	-	-	-	-	-	-	-	-	-												
								Ground-nut balls 100 gms.														
Maximum	-	-	20.0	44.0	44.0	72.0	60.0	80.0	60.0	68.0	55.0	60.0	70.0	75.0								
Minimum	-	-	0.0	4.0	0.0	12.0	0.0	12.0	12.0	24.0	4.0	20.0	0.0	5.0								
Mean.	-	-	10.0	24.0	22.0	42.0	30.0	46.0	36.0	46.0	29.5	40.0	35.0	40.0								
Std. Error.	±	-	-	-	-	-	-	-	-	-	-	-	-	-								

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
									"Khaman" 100 gms.													
Maximum	-	-	20.0	60.0	60.0	80.0	40.0	50.0	55.0	65.0	45.0	55.0	35.0	50.0								
Minimum	-	-	0.0	5.0	0.0	10.0	0.0	10.0	0.0	10.0	10.0	10.0	0.0	10.0								
Mean	-	-	3.3	18.3	14.2	28.3	20.0	29.2	27.5	37.5	26.3	37.5	11.7	23.3								
Std. + Error.	-	-	3.34	8.45	9.68	10.78	6.09	6.06	8.13	8.12	10.24	10.07	11.69	13.36								
									"Sev" 100 gms.													
Maximum	-	-	48.0	68.0	56.0	80.0	52.0	88.0	40.0	70.0	50.0	70.0	44.0	72.0	40.0	50.0						
Minimum	-	-	0.0	4.0	0.0	4.0	0.0	12.0	0.0	4.0	0.0	4.0	20.0	40.0	10.0	30.0						
Mean	-	-	9.6	20.2	21.3	34.8	16.0	38.0	15.2	32.4	21.5	30.0	32.0	56.0	25.0	40.0						
Std. + Error.	-	-	9.6	12.43	9.28	16.62	9.72	14.09	9.32	12.84	6.73	12.29	-	-	-	-						
									"Ganthia" 100 gms.													
Maximum	-	-	20.0	70.0	20.0	60.0	32.0	80.0	40.0	60.0	30.0	70.0	40.0	60.0	50.0	60.0						
Minimum	-	-	0.0	10.0	0.0	3.0	0.0	8.0	0.0	20.0	0.0	20.0	20.0	40.0	0.0	10.0						
Mean.	-	-	5.0	40.0	7.5	29.3	18.0	46.5	15.0	45.0	17.5	40.0	30.0	47.5	22.5	37.5						
Std. + Error.	-	-	5.00	12.25	4.79	14.96	6.63	14.77	9.57	9.57	4.40	10.80	4.08	4.65	10.30	10.28						

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
									"Val" 100 gms.													
Maximum	-	-	40.0	55.0	80.0	100.0	100.0	100.0	100.0	130.0	80.0	100.0										
Minimum	-	-	0.0	5.0	0.0	10.0	20.0	30.0	0.0	10.0	0.0	10.0										
Mean.	-	-	9.3	20.7	35.0	48.6	47.1	58.6	47.1	62.1	30.8	43.3										
Std. Error.	-	-	5.61	6.50	10.29	11.43	10.41	10.75	12.48	15.27	12.43	14.00										
									"Tuver-dal" 100 gms.													
Maximum	-	-	44.0	60.0	56.0	64.0	80.0	88.0	80.0	84.0	80.0	84.0										
Minimum	-	-	0.0	8.0	0.0	8.0	0.0	8.0	0.0	4.0	0.0	5.0										
Mean	-	-	11.2	20.4	26.4	37.6	36.0	45.6	27.2	33.6	25.0	31.2										
Std. Error.	-	-	8.52	10.00	10.99	10.97	13.33	13.11	14.27	13.93	14.66	14.42										
									"Kabuli-grams" 50 gms.													
Maximum	-	-	10.0	30.0	10.0	30.0	8.0	16.0	12.0	24.0	12.0	20.0										
Minimum	-	-	0.0	8.0	0.0	8.0	5.0	15.0	4.0	12.0	8.0	16.0										
Mean	-	-	5.0	19.0	5.0	19.0	6.5	15.5	8.0	18.0	10.0	18.0										
Std. Error.	-	-	-	-	-	-	-	-	-	-	-	-										

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
								"Bhakri (Bajri)" 100 gms.														
Maximum	-	-	12.0	16.0	36.0.	40.0	64.0	68.0	36.0	44.0	40.0	50.0	48.0	52.0	70.0	80.0						
Minimum	-	-	0.0	4.0	8.0	15.0	0.0	4.0	0.0	4.0	10.0	20.0	0.0	5.0	0.0	5.0						
Mean.	-	-	4.8	10.4	21.2	27.0	37.6	44.0	22.4	28.8	20.7	30.0	18.2.	23.0	35.0	42.5						
Std. Error.	-	-	2.33	2.39	6.17	5.53	10.97	11.66	6.53	7.40	9.64	10.00	11.53	11.32	-	-						
								Maize 50 gms.														
Maximum	-	-	8.0	12.0	20.0	28.0	44.0	56.0	40.0	48.0	64.0	76.0	44.0	52.0	35.0	40.0						
Minimum	-	-	0.0	4.0	0.0	4.0	0.0	4.0	0.0	8.0	0.0	5.0	10.0	15.0	5.0	10.0						
Mean	-	-	1.6	5.6	8.2	15.2	22.4	29.6	24.0	31.2	19.6	26.8	27.0	33.5	20.0	25.0						
Std. Error.	-	-	1.60	1.60	4.15	4.62	9.52	10.76	6.57	6.50	11.73	12.87	-	-	-	-						
								"Mug" 100 gms.														
Maximum	-	-	5[illegible].0	60.0	60.0.	80.0	75.0	90.0	85.0	100.0	85.0	100.0	80.0	100.0	70.0	85.0						
Minimum	-	-	0.0	10.0	30.0	40.0	45.0	60.0	10.0	20.0	0.0	10.0	0.0	10.0	40.0	50.0						
Mean.	-	-	15.0	24.7	40.0	52.1	60.0	71.4	50.7	62.9	50.0	61.7	40.0	53.0	56.7	70.0						
Std. Error.	-	-	9.57	10.52	5.24	6.16	3.93	5.80	9.60	9.89	12.59	12.03	15.81	17.14	8.60	10.40						

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
									"Chapti" 100 gms.													
Maximum	-	-	32.0	48.0	56.0	68.0	48.0	70.0	65.0	75.0	60.0	76.0	68.0	80.0	48.0	52.0						
Minimum	-	-	0.0	4.0	0.0	7.0	30.0	40.0	8.0	16.0	0.0	10.0	32.0	36.0	36.0	44.0						
Mean.	-	-	10.0	18.0	31.0	40.3	36.0	55.5	40.0	51.5	29.8	42.8	46.7	56.0	42.0	48.0						
Std. + Error -	-	-	7.39	10.13	11.46	12.81	4.24	6.83	12.73	14.41	15.27	18.00	10.79	12.86	-	-						
									"Gulab-jambu" - 100 gms.													
Maximum	-	-	40.0	50.0	40.0	68.0	64.0	104.0	64.0	92.0	64.0	92.0	76.0	96.0	52.0	66.0	36.0	48.0	44.0	56.0		
Minimum	-	-	0.0	6.0	8.0	44.0	0.0	40.0	16.0	28.0	12.0	24.0	36.0	44.0	48.0	64.0	24.0	40.0	8.0	16.0		
Mean	-	-	15.0	33.5	26.0	55.0	28.0	63.5	33.0	65.0	44.0	64.0	49.0	66.0	47.3	64.7	31.3	43.3	23.0	36.0		
Std. + Error.-	-	-	9.57	10.18	7.39	5.00	13.66	14.06	6.76	13.41	11.88	16.08	9,43	12.54	4.37	1.20	3.74	1.72	-	-		
									"Rasogolla" 100 gms.													
Maximum	-	-	4.0	15.0	32.0	40.0	48.0	56.0	52.0	60.0	48.0	56.0										
Minimum	-	-	0.0	4.0	0.0	10.0	0.0	8.0	0.0	4.0	0.0	5.0										
Mean.	-	-	00.8	11.4	12.0	23.6	19.4	30.2	18.4	28.4	16.0	23.7										
Std. + Error. -	-	-	0.80	1.94	5.93	5.05	8.43	8.90	9.51	9.90	-	-										

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
								"Chevda" 50 gms.														
Minimum	-	-	24.0	40.0	24.0	44.0	40.0	60.0	50.0	70.0	52.0	70.0	60.0	70.0	13.0	20.0						
Minimum	-	-	0.0	8.0	0.0	4.0	0.0	8.0	0.0	8.0	24.0	32.0	24.0	32.0	0.0	8.0						
Mean.	-	-	8.0	20.8	9.4	23.2	20.0	40.8	26.8	42.0	37.5	49.5	35.0	44.5	6.5	14.0						
Std. + Error.-	-	-	5.06	5.85	4.60	7.89	7.38	12. 11.88	8.79	11.10	7.77	10.16	8.39	18.29	-	-						
								"Dhosa" (simple) 50 gms.														
Maximum	-	-	60.0	80.0	70.0	100.0	50.0	90.0	48.0	86.0	64.0	78.0	40.0	64.0	24.0	40.0						
Minimum	-	-	10.0	30.0	20.0	40.0	30.0	50.0	20.0	35.0	32.0	48.0	28.0	40.0	16.0	20.0,						
Mean.	-	-	30.0	50.0	38.5	73.5	40.0	77.5	32.5	62.3	42.5	60.5	32.5	49.0	20.0	30.0						
Std. + Error.-	-	-	10.80	10.80	11.91	12.41	5.77	9.47	5.87	10.06	7.21	6.71	2.54	5.26	-	-						
								"Idli" 100 Kams.														
Maximum	-	-	32.0	63.0	50.0	80.0	60.0	96.0	64.0	96.0	70.0	100.0	80.0	96.0								
Minimum	-	-	0.0	8.0	0.0	8.0	0.0	8.0	0.0	4.0	0.0	7.0	28.0	32.0								
Mean	-	-	11.0	38.0	26.8	54.0	40.8	69.8	30.0	43.2	30.8	44.6	45.3	54.7								
Std. + Error.	-	-	7.55	12.49	9.14	13.30	10.00	15.96	10.84	15.44	13.04	13.34	17.37	20.59								

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
								"Khichdi" 100 gms with 100 cc. milk.														
Maximum	-	-	32.0	52.0	52.0	68.0	70.0	84.0	76.0	88.0	88.0	92.0	80.0	88.0								
Minimum	-	-	8.0	8.0	0.0	12.0	20.0	32.0	0.0	12.0	0.0	12.0	0.0	6.0								
Mean	-	-	11.0	23.0	27.3	39.0	41.0	55.0	42.0	54.0	39.2	46.7	26.7	33.3								
Std. Error.	+ -	-	7.55	10.37	10.75	11.70	11.12	10.87	15.87	16.69	18.65	18.39	28.64	20.53								
								"Khajur" 100 gms.														
Maximum	-	-	30.0	45.0	30.0	40.0	50.0	60.0	55.0	60.0	60.0	80.0										
Minimum	-	-	0.0	10.0	0.0	10.0	0.0	10.0	0.0	10.0	10.0	20.0										
Mean.	-	-	8.6	22.9	13.1	25.0	25.0	36.3	33.1	43.8	40.0	53.3										
Std. Error.	+ -	-	4.57	6.19	4.53	4.72	6.27	6.48	7.73	7.72	15.17	17.64										
								Bread 100 gms.														
Maximum	-	-	40.0	60.0	40.0	60.0	56.0	68.0	52.0	64.0	32.0	70.0	80.0	90.0	55.0	65.0						
Minimum	-	-	0.0	10.0	20.0	30.0	30.0	44.0	4.0	8.0	0.0	4.0	30.0	40.0	0.0	8.0						
Mean.	-	-	22.0	31.7	27.3	44.0	37.3	55.2	32.7	46.0	34.3	45.3	50.0	60.7	27.5	36.5						
Std. Error.	+ -	-	8.25	9.06	3.17	5.87	4.10	3.69	5.49	8.93	8.30	9.88	15.27	14.30	-	-						

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
									"Shira" 100 gms.													
Maximum	-	-	52.0	64.0	64.0	72.0	72.0	80.0	88.0	96.0	88.0	96.0	56.0	68.0	80.0	92.0						
Minimum	-	-	0.0	4.0	0.0	8.0	2.0	12.0	0.0	8.0	0.0	4.0	4.0	12.0	35.0	40.0						
Mean.	-	-	10.3	20.9	25.3	33.7	35.4	46.0	42.9	53.1	42.3	48.9	35.0	46.0.	48.8	56.0						
Std. Error.	+ -	-	7.50	7.79	9.53	9.99	10.40	9.81	10.96	11.48	12.43	12.75	7.08	7.92	10.37	12.11						
									"Puri" 100 gms.													
Maximum	-	-	28.0	36.0	64.0	80.0	88.0	96.0	84.0	96.0	64.0	96.0	75.0	90.0								
Minimum	-	-	0.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	10.0	20.0								
Mean	-	-	16.7	22.7	35.3	45.3	34.7	44.0	34.3	43.5	24.8	32.0	42.5	55.0								
Std. Error.	+ -	-	4.02	4.76	8.99	10.57	12.35	12.52	13.84	14.93	16.68	18.25	-	-								
									Boiled "Sev" 100 gms.													
Maximum	--	-	35.0	40.0	36.0	44.8	56.0	64.0	64.0	72.0	80.0	60.0	50.0	55.0								
Minimum	-	-	0.0	4.0	0.0	8.0	0.0	4.0	0.0	4.0	10.0	15.0	10.0	15.0								
Mean.	-	-	11.8	16.5	16.7	23.5	18.0	22.0	18.0	24.0	23.3	41.7	30.0	35.0								
Std. Error.	+ -	-	5.53	5.47	4.75	4.96	8.18	10.18	10.00	10.48	12.03	13.43	-	-								

(33) Full feast dish (Veg.)- This comprised of boiled rice, 'tuver dal', 'masur' (lentil - lens esculenta) 'dal', 'bhajia', 'basudi', 'gulab-jambu', 'puri' and potatoes - 'bhaji'. This was served to the subjects ad lib. and at leisure and along with water to drink also.

(34) Histamine injection - Histamine was injected subcutaneously in a dosage of 0.01 mg. per kilogram of body weight.

A study of the gastric response, digestion and evacuation time of the preparations of rice, wheat and other cereals, pulses, potatoes, etc. as listed above was made in 10 normal, healthy subjects on similar lines as in the case of the study of the gastric response, digestion, and evacuation time of milk and its preparations, which has already been described in the previous pages. The results of analysis of the gastric examination in case of the individual subjects are given in the tables at the end in the appendix, while the average results for the individual articles of food, are shown in the different tables given below. In table No.6, the average of the highest total acidity,

(Vide table No.6)

evacuation time etc. are shown for each of the article of food given to the subjects. The graphs are also drawn which are shown in figure Nos.17 and 18, indicating the average of the highest total acidity in c.c N/10 acid per cent against each item of the article of food. In table No.7 are shown the results of analysis for the free acidity and

(Vide table No.7)

the total acidity for the individual articles. In that table are given the average readings, with the maximum, minimum and the standard error. The curves showing the average total acidity for each of the articles of food (average found in the various subjects, which is given in table No.7)against the time in hours are drawn which have been shown in figure Nos. 19, 20,21 and 22. Lastly the various curves

Table No.6

Table showing the average of the highest total acidity etc.

Sr. No.	Article of food 100 c. unless otherwise stated	No. of obser-s	Average of the highest total acidity in cc N/10 acid 3	Peptone appear-ed, in time (in minutes)	Proteins dis-appear-ed	Evacuation Hrs.	Evacuation Mts.	Reducing Sugar in cr: tical	Reducing Sugar dis-appear-ed Hrs.	Reducing Sugar dis-appear-ed Mt
1	2	3	4	5	6	7	8			9
1	Boiled rice	8	61.6	15 to 70	Proteins present in all samples	2-40	-		-	-
2	'Dosha' (50 gm)	4	54.0	15 to 45		3-15	-		-	-
3	'Chapda' (50 gm)	5	57.0	15	"	3-45	-		-	-
4	'Dhosa' (simple), (50 gm)	4	83.0	"	"	3-30	-		-	-
5	'Idli'	5	86.0	"	"	3-34	-		-	-
6	'Khichdi' with milk (100 gm in 100 cc of milk)	4	53.0	"	"	3-35	Present		Within 3-15	
7	'Bajra'	3	56.0	"	"	2-0	Fluctuate present		Within 1-45	
8	Bread	6	64.3	"	"	3-50	Present		Within 3-45	
9	'Shira'	7	62.0	"	"	3.0	Nil		"	
10	'Puri'	6	61.0	"	"	2-25	Present		Within 3-15	
11	Boiled 'sev'	6	54.0	"	"	3-15	-		-	-
12	'Tomato'	4	64.5	-	"	3-04	Present		Within 3-45	
13	'Gulab-jambu'	4	74.5	30	"	4-04	-		-	-
14	'Rasogolla'	5	56.0	15	"	3-10	Present		Within 1-10	
15	'Khichi' ('Bajri')	5	52.0	"	"	3-0	"		Within 3-15	
16	Paina (50 gm)	5	48.0	"	"	3-15	-		-	-
17	'Dal'	7	72.0	"	"	3-49	Nil		Within 3-45	
18	'Val'	7	57.0	"	"	3-15	-		-	-
19	'Toor dal'	5	49.9	"	"	3-20	Nil		Within 1-45	
20	'Kabuli gram' (50 gm)	2	30.0	"	"	3-30	-		-	-

Table No.6 Contd.

1	2	3	4	5	6	7	8	9
21	'Kheman'	6	50.8	15	Proteins present in all sample -s	2-25	Present	With in 2-15
22	'Sev'	5	53.0	"	"	2-52	Nil	"
23	'Ganthia'	4	60.0	"	"	3-15	Nil	Withi -n 2-30
24	'Khaja'	3	64.8	30	"	3-15	"	"
25	Sweetballs	5	50.0	-	-	3-05	-	-
26	'Jalebi'	2	80.0	15	Proteins present in in all samples	2-30	Present	With in 2-15
27	'Khaja' (50 gm)	6	72.0	"	"	3-22	-	-
28	Ground-nut balls (75 gm)	2	43.0	"	"	Over 2-45	Nil	With- in 1-45
29	Ground-nut balls (100 gm)	2	58.0	"	"	Over 3-30	"	With- in 2-30
30	Potatoes 'bhaji'	5	38.0	"	"	2-15	"	With- in 1-30
31	'Puran' preparation	4	30.0	"	"	2-13	Present	With -in 1-30
32	Full-meal (veg.) (ad lib.)	7	42.0	"	"	Over 4-45	"	With- in 2-0
33	Full Dinner (veg.) (ad lib.)	4	58.0	"	"	Over 4-30	"	"
34	Histamine inj.	4	87.0	-	-	-	-	-

Table No. 7.

Table showing the acidity in cc N/10 acid % after the various preparations of rice, wheat and other cereals, pulses, potatoes etc.

	Fasting.		I		II		III		IV		V		VI		VII		VIII		IX		X	
	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.
1,	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Boiled Rice 100 gms.																						
Maximum	-	-	60.0	75.0	52.0	68.0	72.0	84.0	68.0	76.0	48.0	60.0	50.0	55.0								
Minimum	-	-	0.0	4.0	0.0	12.0	0.0	8.0	16.0	24.0	0.0	8.0	28.0	36.0								
Mean	-	-	14.9	24.4	20.6	32.6	39.1	50.4	50.1	59.0	24.9	35.8	39.0	45.5								
Std. Error.	-	-	8.25	9.08	7.31	8.07	9.25	9.08	6.33	6.41	7.53	8.01	-	-								
"Ponha" 50 gms.																						
Maximum	-	-	40.0	50.0	32.0	50.0	52.0	68.0	36.0	50.0	36.0	45.0	36.0	45.0	24.0	32.0						
Minimum	-	-	0.0	4.0	0.0	8.0	20.0	28.0	30.0	40.0	16.0	24.0	16.0	24.0	0.0.	8.0						
Mean.	-	-	16.7	28.0	18.0	31.8	30.0	41.8	32.2	47.0	26.8	36.3	19.5	27.3	10.5	18.8						
Std. Error.	-	-	11.99	15.08	7.66	9.47	7.57	8.81	1.73	2.38	5.01	4.10	9.31	9.41	5.12	4.91						

AVERAGE TOTAL ACIDITY IN CC N/20 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 RICE (BOILED)
3 PONHA
4 CHEVDA
5 DHONSA (SIMPLE)
6 IDLI
7 KHICHDI & MILK
8 KHAMAN
9 SEV
10 KHAJUR

AVERAGE TOTAL ACIDITY IN CC N/20 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 BREAD
3 SHIRA
4 PURI
5 BOILED SEV
6 CHAPATI
7 GULAB JAMBU
8 BHAKRI (BAJRI)
9 MAIZE

AVERAGE TOTAL ACIDITY IN CC N/20 ACID PER CENT
TIME IN HOURS
1 ALCOHOL
2 MAVA (100 gms)
3 MUG
4 VAL
5 DALTUVER
6 KABULI GRAMS
7 GANTHIA
8 BHAJIA
9 SWEET BALLS
10 JALEBI

AVERAGE OF THE HIGHEST TOTAL ACIDITY IN N/20 ACID %
ALCOHOL
MUG
VAL
TUVER DAL
KABULI GRAMS
KHAMAN
SEV
GANTHIA
BHAJIA
SWEET BALLS
JALEBI
KHARISING
GROUNDNUT BALLS 75gm
GROUNDNUT BALLS 100-g
POTATOE BHAJI
SURAN PREPARATION
FULL MEAL (veg.)
FULL FEAST (VEG.)
HISTAMINE

case of the article of 'kabuli' gram, where the large size particles were recovered in the gastric samples upto about one hour and a quarter of time after its intake. The reducing sugars were found to be present in some of the articles themselves like 'jalebi' etc. and they were evacuated about 15 minutes earlier than the other constituents like starch, proteins and fats, which on examination were found to be present upto the last gastric sample.

In case of the preparations of nuts, the protein digestion commenced in 15 minutes after their intake. Liquefaction took place within 30 minutes after the intake of the article, ground-nut balls given in whatever portions, but in case of the article, 'khanishing' though given in 50 gms measure, the appearance of large particles in the gastric samples persisted longer i.e. over two hours after its intake. The reducing sugars disappeared about an hour earlier, from the gastric samples obtained after the article, ground-nut balls given in any amount, than the other constituents like, starch, proteins and fats, which, when examined for, were found to be present even upto the time the article evacuated.

The protein digestion after the preparations of tubers was also found to be commencing within 15 minutes after their intake. The articles were liquefied too within 15 to 30 minutes of time in the stomach. Reducing sugars were found to be present only in the preparation of 'suran' but they disappeared from the gastric samples obtained after both the preparations, potatoes - 'bhaji' and 'suran' - preparation, about half an hour earlier, than the other constituents like starch, proteins and fats, which, when examined for, were detected to be present even upto the evacuation time of the articles from the stomach.

In case of the preparation of maize, the protein digestion was found to have commenced also within 15 minutes after its intake. Large

particles could, however, be aspirated upto 2 hours of time.

'Khajur' i.e. dates (Persian) also behaved similarly. The protein -s digestion commenced in 15 minutes after the intake of the article and liquefaction of the article also took place in the same time i.e. 15 minutes. Fructose, was the reducing sugar found to be present in the article itself and this sugar disappeared from the gastric samples within one hour and forty-five minutes while the article itself gave the evacuation time a little longer than this, indicating thereby that the reducing sugars disappeared about a quarter of an hour earlier than the proteins which persisted to be present in the gastric samples till the end of the evacuation time of the article from the stomach.

Lastly with regard to the full meals, proteins were converted into peptones within 15 minutes after taking the meals. The particles were larger in the earlier samples but they were gradually liquefied later on. Liquid samples were aspirated after 1½ hours. Proteins were found to be present in the last clear samples indicating thereby that the digestion of proteins was not completed in the stomach but continued further in the intestines.

Positive tests for reducing sugars were obtained in the articles themselves as well as in the samples withdrawn from the beginning to about two hours after meals in an average. This indicates that these carbohydrates namely the reducing sugars leave the stomach earlier than the proteins, starch or the fats which were detected to be present in the last clear samples. The reason perhaps of these carbohydrates leaving earlier may be that they are unable to combine with acid which is allowed to remain in free state and to hasten their pyloric evacuation.

Evacuation time:

All rice preparations evacuated from the stomach in 2-30 hours to

3-30 hours of time after taking them. 'Sabudana-kanji', boiled rice and 'idli' left the stomach in about 2-30 hours in an average; 'chevda' and 'khichdi' with milk took 2-45 hours averagely to leave the stomach while 'ponha', 'doodhpak', and 'dhosa'(simple) took the longest time, it being about 3-30 hours in an average, for getting themselves evacuated from the stomach.

Amongst the preparations of wheat, 'shira' and 'chapati' took about 3.00 hours in an average to leave the stomach; 'rasagolla', boiled 'sev' and 'puri' left in about 2-30 hours averagely from the stomach; bread took 2-50 hours; while 'gulab-jambu' was the most delayed preparation amongst all. It left in 4-04 hours. This delay perhaps may be explained on the basis of the fact that the article contained 'khoya', which preparation itself was delayed in being evacuated from the stomach.

The evacuation time of the preparations of pulses ranged between 2-15 and 3-15 hours. 'Khaman', 'jalebi', 'val', 'tuver dal' and 'kabuli' grams took in an average about 2-20 hours; 'mug' and 'sev' left the stomach in about 2-50 hours averagely while 'ganthia', 'khajin' and 'sweet balls' were the preparations which took the longest time, more than 3.00 hours, for being evacuated from the stomach.

In case of the preparations of nuts, ground-nut balls when given in quantity of 75 gms. left the stomach in a time which was over 3-15 hours, while when given in quantity of 100 gms, it was over 3-30 hours. And 'kharising' took 3-22 hours to leave from the stomach.

The evacuation time of the preparations of tubers was averagely 2 hours and a quarter, in both the cases, namely potatoes - 'bhaji' and the 'suran' preparation.

Khize took 2-45 hours to leave ~~fa~~ the stomach while dates (Forsiam) left the stomach in 2-00 hours only.

The evacuation time of the full meals was more than 4½ hours, in both the cases. The full meal took more than 4-45 hours to clear the stomach in an average while the full feast dish took averagely more than 4-30 hours for getting evacuated from the stomach.

The variations in evacuation time of different articles seen as above in case of the preparations of rice, cereals etc. may be explain-ed on many grounds. The evacuation time for the total meal differed from the evacuation time required by its components when given separately. There are various theories put forthes to explain the pyloric behaviour towards evacuation of the various articles, which is said to be governed by acid control, consistency and size of food particles, chemical nature of the food etc. Out of these, chemical nature of the food and the size of particles seem to be the two more important factors. It seems that each food has its characteristic response for an individual. Environmental factors, like pleasure or anger, etc. at the time of meals may swing this time of clearance. These environmental factors, however, were standardized in our series of experiments and hence were without much effect on the variation in the evacuation time of various foods.

There were individual differences from subject to subject as regard-s gastric response, evacuation time etc. in accordance with the statement made above that each food has its characteristic response for an individual. Acid curves for some of the subjects have been drawn which have been shown in the figures the numbers of which are indicated in brackets put before the initials of the subjects given in the list below. Regarding the physical examination of gastric contents for the presence of bile, mucus etc., there were individual differences observed

from subject to subject. But nothing of much or particular significance has been observed in this respect.

The following are the initials of the subjects and the numbers of the figures in which their respective acid curves are drawn:-

(23) S.T.V., (24) P.G.J., (25) P.G.J., (26) D.S.H.,(27)D.S.H., (28) D.R.D., (29) D.R.D., (30) D.R.D., (31) T.C.A. ,(32) T.C.A., (33) V.V.K., (34) V.V.K., (35) P.C.B., (36) D.K.C.

Summary and conclusions:

(1) Gastric response, digestion and evacuation time of 33 various preparations of rice, wheat and other cereals, pulses, potatoes, etc. have been studied in 19 normal, healthy subjects, chosen after their fractional gastric analysis examination with alcohol meal was found to be normal. The total number of observations made in these subjects with the various articles of the above preparations is 162.

(2) The acidity produced by the preparations of rice which were given mostly in 100 gm quantity was within normal limits in all cases, 'idli' and 'dhosa'(simple) having produced a response almost on the border of hyperacidity. Lactic acid which was detected to be present in the articles, 'idli' and 'dhosa'(simple), might have caused its own presence in the gastric samples and also the difference of about 30 cc N/10 acid per cent, between the free acid and the total acidity readings. The acid response of 'chevda' and 'poha', though fairly high, could not be compared because they were given in 50 gm measure as larger amount could not be accepted by the subjects at one time without water to drink.

(3) The preparations of wheat, which were given mostly in 100 gms in measure, gave an acid response which was within normal limits, the average highest total acidity being of the order of about 60 cc N/10 acid

per cent. 'Gulab-jambu', however, gave a little higher acid response, the average of the highest total acidity being 74.6 cc N/10 acid per cent. This may be possibly due to the 'mava' content, as one of its constituents, which, as has already been studied, is an article by itself provoking a high acid response.

(4) The average of the highest total acidity obtained in case of the preparations of pulses was of the order of about 60 cc N/10 acid per cent, except in case of 'mug' and 'jalebi', where the acid response was on the border of hiperacidity. The preparation of 'gantlia' on testing was found to be containing lactic acid which might possibly be the cause for giving a difference of about 30 cc N/10 acid per cent between the free acid and the total acidity readings of the gastric samples which in their turn showed also the presence of lactic acid.

(5) Amongst the preparations of nuts, 'khurising' though given in 50 gms measure, as a larger amount could not be accepted by the subjects at one time without water to drink, evoked a higher acid response, the average of the highest total acidity being 72.0 cc N/10 acid per cent. The other articles, namely ground-nut balls, given in two portions of 75 gms and 100 gms each, evoked a lower acid response, the average of the highest total acidity being 48.0 cc and 52.0 cc respectively. This was well comparable with that of alcohol meal.

(6) The preparations of tubers, potatoes - 'bhaji' and the 'suran' preparation, both gave an acid response comparable with that obtained after alcohol meal, the average of the highest total acidity being of the order of 38.0 cc N/10 acid per cent in both the cases.

(7) Maize, given in 50 gms quantity, produced a normal acid response, the average of the highest total acidity being 48.0 cc N/10 acid per cent.

(8) 'Khajur' i.e. dates (Persian) produced an acidity comparable with that of an alcohol meal; the average of the highest total acidity was 58.0cc N/10 acid per cent.

(9) In case of the vegetarian full meals, both the full meal and full feast dish, evoked an acidity falling within the range of the acidity of the highest total acidity with full meal was 42.0 cc and that with full feast dish was 52.0 cc N/10 acid per cent. The association of full meals with the low acid response has been thought to be possessing a significant bearing on the treatment of ulcer cases. readings obtained after alcohol meal. The average

(10) The time of appearance of peptones during the digestion of the proteins of the preparations of rice, ranged between 15 and 70 minutes after the intake of the articles. Liquefaction of the articles took place within 15 minutes except in case of 'chevda' and 'pohe' where large particles persisted for more than one hour. In 'sabudana khanji', curds appeared in ½ hour, which persisted for over an hour. Reducing sugars disappeared earlier than other components of the articles, like starch, proteins and fats, which were detected to be present even upto the last samples of the stomach contents and which are evidently to undergo further digestion in the intestines.

(11) The time of appearance of peptones in case of the preparations of wheat ranged between 15 and 30 minutes. Liquefaction of the articles took place in 30 minutes except in case of 'chapati' and 'puri', where large particles were recovered upto 1½ hours. Reducing sugars disappeared in an average of about 2½ hours of time and they were evacuated earlier than the other components from the stomach.

(12) Protein digestion in the stomach after the preparations of pulses commenced soon in about 15 to 30 minutes, during which time the articles were liquefied also. In case of 'kabuli' grams, however, the large pise particles persisted for about 1½ hours. Reducing sugars disappear

-ed about a quarter of an hour earlier than the other components.

(13) Protein digestion after the preparations of nuts, commenced within 15 minutes and the liquefaction took place within 30 minutes except in case of 'kharising' where larger particles were aspirated upto 2 hours. Reducing sugars after the preparation of ground-nut balls were evacuated about an hour earlier than the other components.

(14) Protein digestion after the preparation of tubers was observed to have started within 15 minutes while the liquefaction took place in 15-30 minutes. Reducing sugars cleared about half an hour earlier from the stomach than the other components.

(15) In case of maize, the protein digestion started in 15 minutes. Large particles were aspirated upto 2 hours.

(16) After dates (Persian), the time of appearance of peptones and of the liquefaction of the article was 15 minutes. The reducing sugar, fructose, disappeared from the stomach about a quarter of an hour earlier than the other components.

(17) With regard to the full meals, peptones appeared within 15 minutes. Liquefaction took place in 1½ hours. Reducing sugars disappeared within 2 hours, indicating that they were evacuated earlier than the other components.

(18) Evacuation time for the rice preparations varied between 2-20 and 3-30 hours. The corresponding time for the wheat preparations was 2-20 to 4-04 hours. In case of the preparations of pulses the range was 2-15 to 3-15 hours. The nuts preparations took 2-45 to 3-22 hours, to be evacuated from the stomach. The evacuation time in cases of the preparations of tubers was averagely 2¾ hours. Maize left the stomach

in 2-45 hours and the dates (Persian) took 2-00 hours only to leave the stomach. The evacuation time for the full meal was over 4-45 hours while that for the full feast dish was over 4-30 hours.

Fig No 38

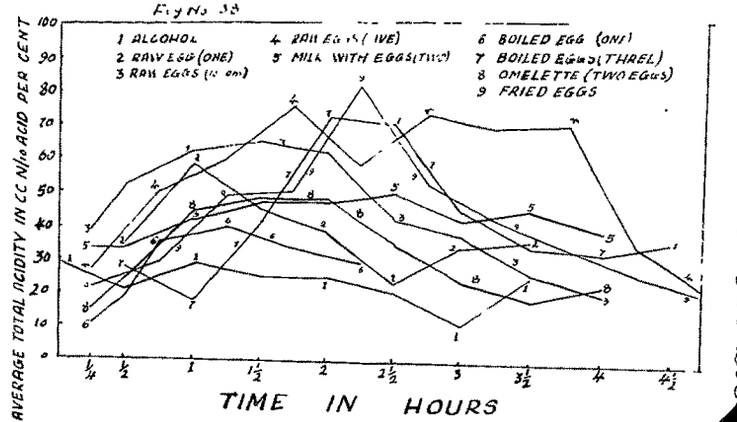


Fig No 39

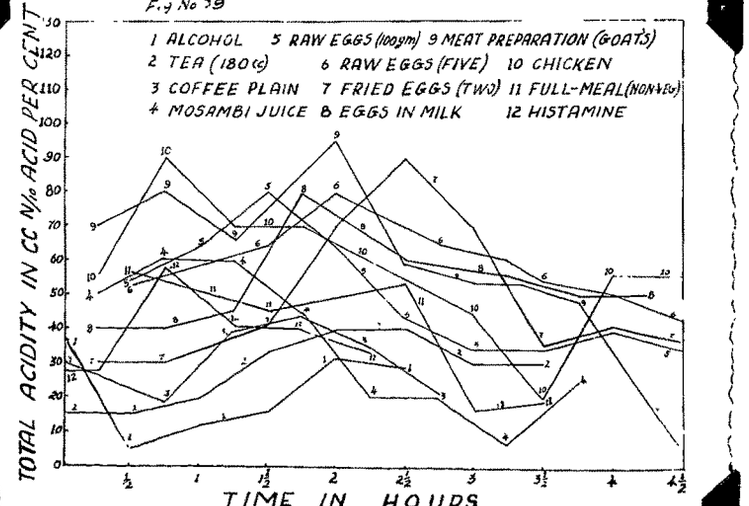


Fig No 40

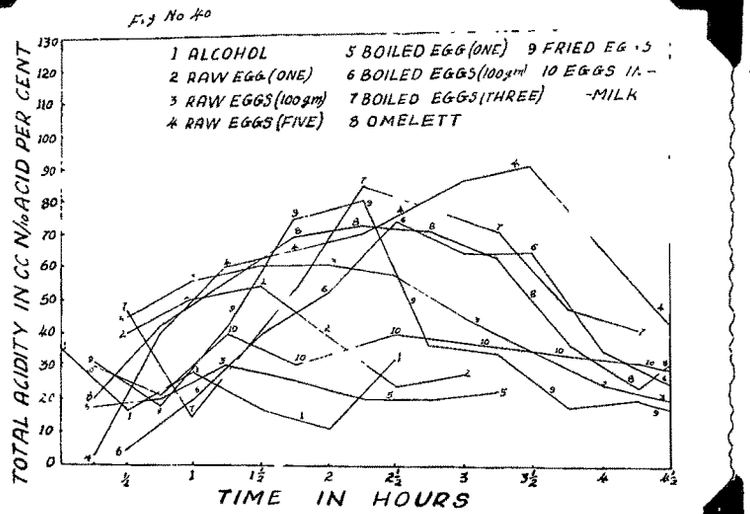
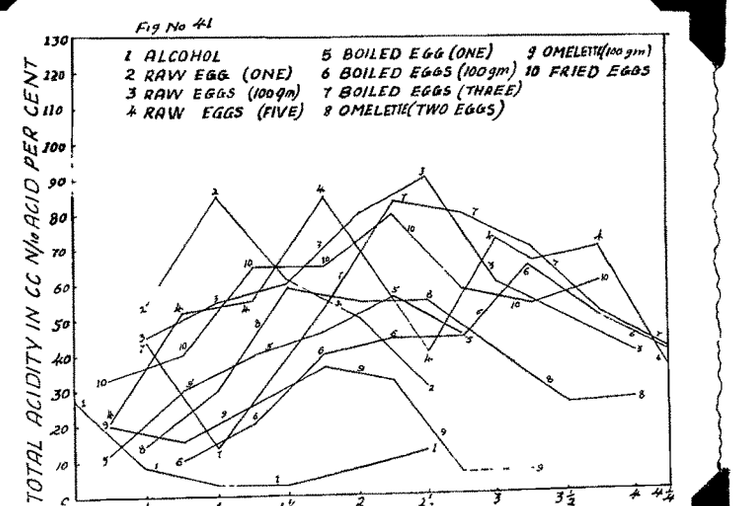


Fig No 41



(4) Eggs and their preparations

Experimental and results:

The following preparations have been studied:-

(1) Egg (raw)...	Nos. 1
(2) Eggs (raw)...	3
(3) Eggs (raw)...	5
(4) Eggs in milk (100 cc)...	3
(5) Egg (hard boiled)...	1
(6) Eggs (hard boiled)..quantity 100 gms.	
(7) Eggs (hard boiled)...	3
(8) Eggs (omelette prepared)...	2
(9) Eggs (fried in ghee)...	3

A study of the gastric response, digestion and evacuation time of eggs and their various preparations as listed above was made in 4 normal healthy subjects, who were habituated to take eggs, on similar lines as in the case of the study of the gastric response, digestion and evacuation time of milk and its preparations, which has already been described in the previous pages. The results of analysis of the gastric examination in case of the individual subjects are given in the tables at the end in the appendix, while the average results for the individual articles of food are shown in the different tables given below. In table No.8, the average of the highest total acidity,

(Vide table No.8)

evacuation time etc. are shown for each of the article of food given the subjects in our series and a comparison is made with similar f/ings of other workers. The graphs are also drawn which are sh/ the figure No.37, indicating the average of the highest total/ in cc N/10 acid per cent against each item of the article of

Table No. 8

Table showing the average of the highest total acidit etc.

Sr. No.	Article of Food with its quantity given.	No. of observations	Average of the highest total acidity in cc N/10 acid %	Peptones appeared in time (in minutes)	Proteins disappeared	Evacuation time Hrs.	Reducing substances within stomach	in duodenum appeared Hrs.
1	Raw egg (one)	4	60.0	15	Proteins present in all samples	2-40	present within 1-0	
2	Raw eggs(three)	4	72.5	"	"	4-25	" within 2-30	
3	Raw eggs(five)	3	85.0	"	"	5-00	" within 2-30	
4	Eggs(three)shaken in 10 cc milk	3	80.0	"	"	5-15	" within 2-30	
5	Boiled egg(one)	3	44.3	"	"	2-55	present within traces in 1-30	
6	Boiled eggs(150 gms)	3	63.0	"	"	3-00	" within 1-30	
7	Boiled eggs(two)	3	75.0	"	"	4-35	" within 1-30	
8	Omelette(two eggs)	5	76.0	"	"	4-15	" within 2-30	
9	Fried eggs(two)	3	83.3	"	"	4-30	" Within 2-30	
10	Alcohol 7% 50 cc	4	28.0	-	"	-	-	-
REF:- Hawk, Rehfuss & Bergeim(loc cit)								
	Egg and egg combination(two eggs used in each preparation)	90	80.0	"	-	2-40	-	-
REF:- Wilson, Dickson & Singleton(loc cit)								
	Egg white (raw) (225 gms)	-	Not examined	-	-	Over 4-30		
	Egg white (raw) (220 gms)							
	Egg (cooked) (190 gms)	-	"	-	-	Slightly over 3-0		

Table No. 9.

Tables showing the acidity in cc N/10 acid after the various articles of eggs and their preparations.

	Fasting.		I		II		III		IV		V		VI		VII		VIII		IX		X	
	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11	12	13	14	15	16	17	18.	19.	20.	21.	22.	23.
Raw egg (one)																						
Maximum	-	-	20.0	55.0	30.0	85.0	55.0	60.0	45.0	55.0	25.0	30.0	35.0	40.0	30.0	35.0						
Minimum	-	-	0.0	5.0	15.0	45.0	20.0	25.0	5.0	10.0	0.0	10.0	25.0	28.0	30.0	35.0						
Mean	-	-	10.0	33.8	25.0	58.8	37.5	46.3	30.0	38.8	16.3	22.5	30.0	34.0	30.0	35.0						
Std. + Error.	-	-	4.08	10.59	3.53	9.79	7.68	7.39	8.89	10.32	9.21	4.33										
Raw eggs (three)																						
Maximum	-	-	25.0	55.0	30.0	65.0	40.0	80.0	50.0	80.0	50.0	90.0	50.0	60.0	30.0	40.0	35.0	40.0	30.0	35.0		
Minimum	-	-	0.0	10.0	0.0	35.0	10.0	45.0	20.0	60.0	20.0	44.0	25.0	30.0	25.0	35.0	10.0	15.0	0.0	5.0		
Mean	-	-	6.3	38.8	10.0	52.5	26.3	61.3	37.5	66.3	31.0	60.5	33.8	42.3	28.3	36.7	21.7	26.7	15.0	20.0		
Std. + Error.	-	-	6.23	9.77	7.07	6.26	6.81	7.00	7.46	4.43	6.66	10.22	5.41	6.96	1.74	1.00	7.21	7.19	7.07	7.07		

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14-	15.	16.	17.	18.	19.	20.	21.	22.	23.
Raw Eggs (five)																						
Maximum	-	-	0.0	55.0	0.0	60.0	30.0	65.0	40.0	85.0	45.0	70.0	40.0	80.0	45.0	85.0	40.0	90.0	25.0	44.0	24.0	32.0
Minimum	-	-	0.0	4.0	0.0	40.0	0.0	55.0	30.0	65.0	15.0	40.0	10.0	60.0	10.0	55.0	25.0	50.0	12.0	24.0	0.0	10.0
Mean.	-	-	0.0	26.3	0.0	50.0	10.0	60.0	35.0	76.7	30.0	58.3	28.7	70.7	31.7	68.3	35.0	70.0	19.0	34.3	12.0	20.7
Std. Error.	-	-	-	15.25	-	4.49	10.00	2.88	2.88	6.41	8.66	9.38	9.50	5.99	11.55	8.94	5.00	11.55	3.79	5.88	6.92	6.28
Eggs (three) shaken in 100 cc milk																						
Maximum	-	-	5.0	40.0	0.0	40.0	0.0	45.0	20.0	80.0	35.0	60.0	35.0	60.0	40.0	50.0	50.0	60.0	40.0	50.0		
Minimum	-	-	0.0	30.0	0.0	20.0	0.0	40.0	0.0	30.0	15.0	40.0	15.0	35.0	20.0	30.0	10.0	25.0	15.0	25.0		
Mean	-	-	1.6	33.3	0.0	33.3	0.0	41.6	8.3	48.3	25.0	48.3	33.3	50.0	33.3	43.3	30.0	45.0	27.5	37.5		
Std. Error.	-	-	-	1.64	3.49	-	6.75	-	1.18	6.03	15.91	5.77	6.14	10.19	8.66	6.75	6.71	11.60	10.45	-	-	
Boiled egg (one)																						
Maximum	-	-	4.0	10.0	24.0	30.0	26.0	40.0	40.0	48.0	45.0	55.0	40.0	45.0								
Minimum	-	-	0.0	6.0	0.0	8.0	14.0	30.0	16.0	26.0	12.0	20.0	15.0	20.0								
Mean	-	-	1.3	12.0	9.3	19.3	21.3	34.7	30.0	40.0	27.0	34.3	25.0	30.0								
Std. Error.	-	-	-	1.35	3.46	7.44	6.40	3.77	2.55	7.21	7.02	9.64	10.59	7.64	7.64							

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
										Boiled eggs 100 gms.												
Maximum	-	-	0.0	10.0	0.0	20.0	0.0	40.0	30.0	52.0	40.0	75.0	40.0	65.0	50.0	65.0	28.0	40.0	30.0	35.0		
Minimum	-	-	0.0	5.0	0.0	15.0	0.0	26.0	10.0	20.0	10.0	20.0	10.0	45.0	40.0	50.0	25.0	35.0	15.0	25.0		
Mean.	-	-	0.0	6.7	0.0	18.3	0.0	35.3	21.3	39.0	25.0	46.7	27.3	58.0	43.3	55.0	26.0	38.3	23.7	30.0		
Std. + Error.-	-	-	-	1.60	-	1.84	-	4.74	5.96	9.71	8.66	15.82	9.01	6.51	3.31	5.00	1.00	2.02	4.39	2.89		
										Boiled eggs (Three)												
Maximum	-	-	0.0	45.0	0.0	30.0	0.0	55.0	35.0	90.0	35.0	80.0	50.0	70.0	40.0.	50.0	30.0	40.0	25.0	37.0		
Minimum	-	-	0.0	10.0	0.0	13.0	0.0	20.0	0.0	40.0	15.0	50.0	10.0	20.0	13.0	18.0	10.0	20.0	22.0	35.0		
Mean	-	-	0.0	28.3	0.0	19.3	0.0	41.7	21.7	71.7	26.7	70.0	30.0	45.0	26.0	34.3	18.3	30.7	23.5	36.0		
Std. + Error.-	-	-	-	2.00	-	5.42	-	10.89	10.89	15.82	5.84	10.00	11.55	14.43	7.81	11.68	6.05	5.72	-	-		
										Omelette (two eggs)												
Maximum	-	-	10.0	20.0	25.0	40.0	24.0	68.0	32.0	72.0	45.0	70.0	40.0	64.0	24.0	36.0	20.0	25.0	28.0	36.0		
Minimum	-	-	0.0	8.0	0.0	10.0.	0.0	10.0	0.0	20.0	0.0	6.0	0.0	5.0	10.0	12.0	0.0	12.0	0.0	8.0		
Mean	-	-	4.0	15.6	10.4	22.2	16.8	44.2	16.4	46.8	23.0	48.2	22.8	35.4	17.0	25.0	11.5	19.0	14.0	22.0		
Std. + Error.-	-	-	1.87	1.48	4.19	5.55	4.28	10.55	5.38	9.24	7.35	10.89	6.85	9.48	4.05	5.00	4.28	3.24	-	-		

Fried eggs (two)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Maximum	-	-	0.0	35.0	0.0	40.0	50.0	65.0	55.0	65.0	75.0	90.0	60.0	70.0	40.0	55.0	50.0	60.0	20.0	30.0	15.0	25.0
Minimum	-	-	0.0	30.0	0.0	11.0	0.0	40.0	10.0	15.0	30.0	80.0	15.0	35.0	20.0	35.0	5.0	18.0	13.0	22.0	13.0	15.0
Mean.	-	-	0.0	21.6	0.0	28.6	20.0	49.0	26.6	50.0	60.0	83.3	40.0	54.3	30.0	41.6	28.3	37.0	16.5	26.0	14.0	20.0
Std. Error.	-	-	-	1.30	-	6.89	15.29	8.02	14.17	17.56	15.00	3.72	13.22	2.68	5.77	7.91	13.07	12.18	-	-	-	-

Fig No 42

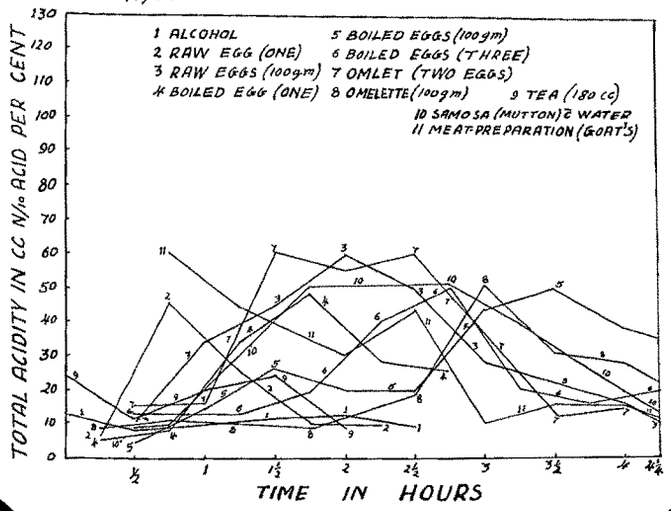


Fig No 44

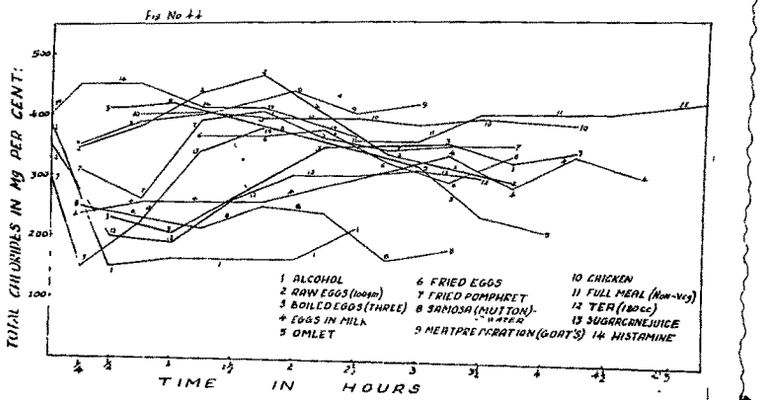
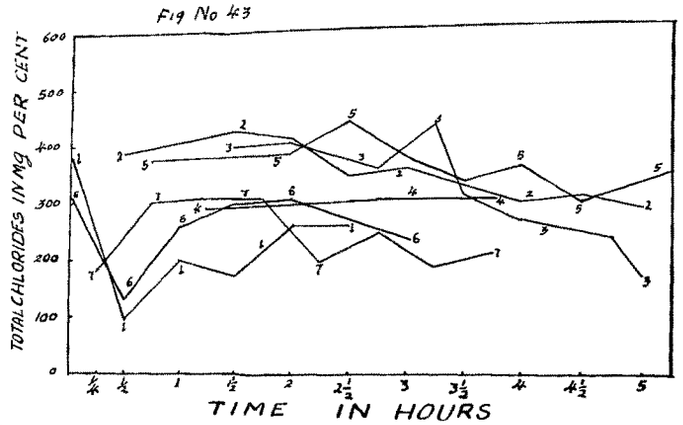


Fig No 43



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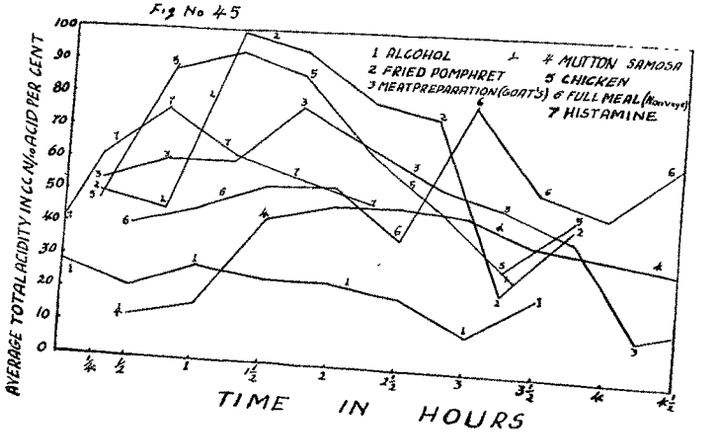


table No.9 are shown the results of analysis for the free acidity and

(Vide table No.9)

the total acidity for the individual articles. In this table are given the average readings, with the maximum, minimum and the standard errors. The curves showing the average total acidity for each of the articles of food (average found in the various subjects, which is given in table No.9) against the time in hours are drawn which have been shown in the figure No.38. Lastly the various curves showing the total acidity for each of the articles of food in the individual subjects are also drawn and they have been shown in the figure Nos.39, 40, 41 and 42. The total number of observations made in 4 subjects for studying the gastric response, digestion and evacuation time of the preparations of eggs listed above is 31.

Discussions:

Gastric response:-

Free and total acidity:--

Table No.8 shows the acid response of four normal young persons to some preparations of eggs. A comparison can be made with the acid response obtained after the alcohol meal examination by the fractional gastric analysis method.

Free and total acidity with any preparation of eggs was higher than that with the alcohol meal. The average of the highest total acidity obtained after the various preparations of eggs ranged between 44.3 cc and 85.0 cc N/10 acid per cent. The alcohol meal examination in these very subjects gave the acid response which was lower than the above range, the average of the highest total acidity in the latter case being 38.0 cc N/10 acid per cent. The average of the highest total acidity when considered for all the preparations of

eggs, is found to be 66.6 cc N/10 acid per cent. Hawk, Robinson and Bergeim (loc cit) had studied egg and egg combinations where two eggs were used in each preparation and had found that the average highest total acidity for these preparations was 80.0 cc N/10 acid per cent. Wilson, Dickson and Singleton had made some studies for egg white and egg cooked preparations, but they had not examined the acidity in the gastric samples. Thus the only data for comparison which are available are those of Hawk et al (loc cit), wherein a higher acid response has been obtained than the acid response produced by the articles from our series of experiments, (see table No.3). Hawk et al (loc cit) had used only two eggs throughout the preparations they had given to their subjects while the quantities and amounts of eggs varied much in the preparations we had given to our subjects, which were thus not constant throughout as was the case with their studies. These values therefore are not comparable with one another as they are obtained under two different conditions.

In our series, the acid response was highest between 1.00 and 2½ hours, in all the preparations, except in case of raw eggs (five), where the highest acid response was obtained after 1½ hours and that remained to be so till 3½ hours. Raw eggs (five) gave the highest acid response, the average of the highest total acidity being 84.0 cc N/10 acid per cent while boiled egg (one) gave the lowest acid response amongst the preparations, its average of the highest total acidity reading being 44.3 cc N/10 acid per cent. An even curve was obtained in case of the eggs (three) shaken in 100 cc of milk, with a range lying between 84.0 cc and 50.0 cc N/10 acid per cent as the average total acidity readings at different intervals of time (see figure No. 3a).

More eggs produced more acid but the amount was not directly proportional to the quantity of eggs or the amounts of proteins

consumed. In the initial stages the difference between the free and the total acidity readings of the gastric samples, obtained after the preparations of eggs, especially, raw eggs in any amount, eggs in milk, fried eggs and boiled eggs when given in quantity of 100 grm and in number of three, was wide, which might be possibly due to the absorption of free hydrochloric acid by the proteins of the eggs preparations. The chemical examination of eggs or their preparations did not reveal acids which could account for the difference.

Digestion:

Coagulated proteins were aspirated from the first samples i.e. the samples taken 15 minutes after the intake of the preparations, to almost until the articles evacuated from the stomach in all the cases of the preparations of eggs given. The particles were larger in earlier samples but liquefied subsequently. With one raw egg, the complete liquefaction of the article was noticed in two hours but with one boiled egg it was after 3½ hours after the intake of the article. The particles were completely liquefied in case of three raw eggs after 3 hours whereas with three boiled eggs, large particles were aspirated even upto the samples which were taken at 3-45 hours after the intake of the articles. With eggs in milk the particles were completely liquefied in the gastric samples which were taken at 3-30 hours and onwards after the intake of the article.

The articles contained no peptones but peptones appeared in the gastric samples taken 15 minutes after the intake of the preparations, indicating thereby that the digestion of proteins commenced soon in the stomach, in all cases of the preparations of eggs. Proteins in all cases were present in all samples of the stomach contents, which shows that all the proteins of even one egg are not transformed into peptones in the stomach. This digestion evidently is carried on

further in the intestines.

A trace of reducing substances was present in the eggs and their preparations tested. The reducing substances disappeared from the gastric samples within an hour in case of raw egg (one), in 1-30 hours in case of boiled egg (one), boiled eggs (100 gms), boiled eggs (three) raw eggs(five), eggs(three) shaken in 100 cc milk and within 2-30 hours in case of raw eggs (three), omelette (two eggs) and fried eggs (two), after the intake of the respective articles. Thus the reducing substances disappeared earlier than the proteins cleared off from the stomach. As has been true in case of the studies with other articles of food, it seems that the reducing sugars leave the stomach earlier than the proteins or the fats. Regarding the dis-appearance of the fats, however, no chemical tests for fats were performed but their presence was detected by the appearance of fat particles, even upto the last clear samples obtained at the time of evacuation of the articles.

In case of omelette dextrins were detected to be present in the article itself and in all the gastric samples till the last samples.

Evacuation time:

One raw egg was evacuated from the stomach in 2-40 hours, three raw eggs in 4-35 hours, while five raw eggs in 5-00 hours, after the intake of the respective articles. The boiled eggs when given in corresponding amounts were found to have been evacuated from the stomach with a little more delay than the raw eggs. Thus one boiled egg took 2-55 hours to leave the stomach, a time which was longer by 6 minutes than the time taken by one raw egg. Three boiled eggs took 4-35 hours to leave from the stomach, here the delay being 10 minutes than the time taken by the raw eggs in the corresponding amounts i.e. three in number. Of course those quantities were not given by weight and

hence it cannot be definitely stated that the two types of the items given, namely the raw eggs and the boiled eggs, were equivalent in quantities. In case of the boiled eggs which were given in 100 gms measure the evacuation time was 5-50 hours. Omelette took 4-15 hours to leave the stomach while the fried eggs, two in number, left the stomach in 4-50 hours after their intake. The preparation of two eggs shaken in milk took the longest time of all the preparations, the evacuation time in the former case being 5-15 hours after the intake of the article.

Hawk et al (loc cit) had also noticed that the raw eggs left the stomach earlier, but the boiled eggs took only 10 minutes longer than the raw ones. They had tested different articles prepared of two eggs in several different subjects and hence a comparative view of varied amounts and preparations in the same persons could not be had. They, however, found that the stomach did not make any difference betwe -en hen's, duck's or other eggs. In our series only hen's eggs were taken. The average evacuation time for all the preparations, namely eggs and eggs combinations of Hawk et al (loc cit) wherein they had used two eggs, in each preparation, has been given by them as 5-40 hours (see table number 8). For the same reason which has been discus -sed in case of the gastric response with the eggs preparations in the previous pages, namely we had used different amounts in the preparation -s of eggs of our series and not a constant amount of two eggs as was so in case of the series of Hawk et al (loc cit), no comparison could be made between the evacuation time obtained in our series and that obtained by Hawk et al (loc cit) in their series.

Wilson, Dickson and Singleton (loc cit), studying the evacuation time fluoroscopically, after giving food to which barium was added, observed that eggs white raw when given in quantities of 225 gms and 230 gms, took over 4-30 hours while egg cooked given in quantity of

190 gms took slightly over 3.00 hours to leave the stomach (see table No.8). Here again the evacuation time obtained by Wilson et al (loc cit) is by fluoroscopic examination and hence it cannot be compared with the evacuation time obtained in our series which is by fractional method of examination.

Total chlorides:

The total chloride content was also estimated along with the acidity determinations of the gastric samples after the preparations of eggs, by the methods which have already been described in part II in the previous pages. The curves showing the total chloride content in mgms per 100 cc of gastric juice against the different intervals of time have been drawn in case of two of the subjects M.M.K. and P.D.A. and have been shown in figure Nos. 43 and 44 respectively. The curves in case of the remaining two subjects have not been shown. The results of the chloride estimations in the gastric samples after these preparations of eggs, in case of the individual subjects have been shown in the tables at the end in the appendix while the average results, with the maximum and minimum for each of these articles, are shown in the table No.10.

(Vide table No.10)

Several factors may operate under normal and abnormal circumstances to modify the state in which hydrochloric acid exists in the stomach. A portion may remain as secreted in the free state, a portion may combine with proteins present in the stomach and a variable portion may exist in inorganic combination. In the event of excessive regurgitation of duodenal contents into the stomach or excessive alkaline secretion of the pyloric glands, a large proportion of the secreted hydrochloric acid may be neutralized, and under such circumstances neither the curve of free hydrochloric acid nor that of total acidity can be regarded as indicating the true state of gastric

Table No.10

Tables showing the total chloride content in mg per 100 cc after the various articles of egg and their preparations.

1.	Fasting	I	II	III	IV	V	VI	VII	VIII	IX	X
					Alcohol 7 & 50 cc						
Maximum	390.0	150.0	200.0	180.0	260.0	260.0					
Minimum	380.0	100.0	170.0	170.0	170.0	220.0					
Mean	385.0	125.0	185.0	175.0	215.0	240.0					
					Raw eggs (100 gms)						
Maximum	-	390.0	410.0	430.0	460.0	350.0	360.0	330.0	300.0	310.0	290.0
Minimum	-	350.0	380.0	430.0	410.0	350.0	340.0	290.0	300.0	310.0	290.0
Mean	-	370.0	395.0	430.0	435.0	350.0	350.0	310.0	300.0	310.0	290.0
					Omelette (two eggs)						
Maximum	-	410.0	420.0	-	480.0	370.0	325.0	240.0	220.0		
Minimum	-	320.0	340.0	-	480.0	350.0	290.0	220.0	175.0		
Mean	-	365.0	380.0	-	480.0	360.0	307.5	230.0	197.5		

	Fasting	I	II	III	IV	V	VI	VII	VIII	IX	X
					Eggs (Three) shaken in 100 cc milk.						
Maximum	-	240.0	260.0	290.0	300.0	310.0	330.0	310.0	-	-	
Minimum	-	240.0	269.0	260.0	260.0	300.0	310.0	285.0	-	-	
Mean	-	240.0	260.0	275.0	280.0	305.0	320.0	297.5	-	-	
					Fried eggs (two)						
Maximum	-	-	370.0	380.0	390.0	440.0	380.0	330.0	360.0	300.0	350.0
Minimum	-	-	370.0	370.0	370.0	380.0	330.0	300.0	330.0	300.0	350.0
Mean	-	-	370.0	375.0	380.0	410.0	355.0	315.0	345.0	300.0	350.0

secretory activity. Bolton and Goodhart (1933) have emphasized the fact that the curve of total chloride is more nearly representative of the true state of gastric secretory activity since it includes, in addition to free hydrochloric acid and hydrochloric acid combined with protein, salts of hydrochloric acid which are neutral in reaction. It has frequently been observed that the total chloride curve may continue to rise for a variable period after the acid curve has begun to fall, indicating that hydrochloric acid is still being secreted but is being neutralized. The determination of total chloride in the gastric content is particularly valuable in the differentiation between true and false achlorhydria; in true achlorhydria no free hydrochloric acid appears in the gastric contents during the digestive cycle and the curve of total chloride is correspondingly low; in false achlorhydria a normal amount of hydrochloric acid may be secreted but is not present in the free state in the gastric contents because of excessive neutralization, and under such circumstances the curve of total chloride may be essentially normal.

As can be seen from the curves in the figure Nos.43 and 44 as also from the table No.10, the total chlorides were higher with the eggs preparation except the eggs in milk and the boiled eggs, than with alcohol meal. In case of the alcohol meal, the fasting stomach contents gave the highest chloride readings amongst the readings obtained in other samples of the same fractional examination. The chloride readings in the fasting stomach contents were observed to be 585.0 mg per 100 cc. This falls within the normal range as given by Canterow and Brunner (loc cit) where they state that the total chloride content of the fasting juice of normal subjects range from 160.0 to 550.0 mg per 100 cc or 45.0 to 155.0 milli equivalents per liter. They also state that the total chlorides vary within narrower limits than the free acidity. Omelette (two eggs) gave the highest readings

while the eggs in milk gave the lowest readings for the total chlorides content. For raw eggs (100 gm), the average highest reading for the total chlorides content was 435.0 mg per 100 cc while for the same article but given in numbers of five, the highest reading was 440 mg per 100 cc; for boiled eggs given in numbers of three, the highest total chloride content was 360.0 mg per 100 cc, for eggs (two) fried in ghee the average highest reading was 410.0 mg per 100 cc while for omelette (two eggs) the corresponding reading was 430.0 mg per 100 cc. Lastly for eggs (three) shaken in milk (100cc) the average highest total chloride content was 350.0 mg per 100 cc.

The highest chloride readings were obtained between 1-00 and 3-00 hours after the intake of the articles in all the cases of the preparations of eggs except in the case of raw eggs where the highest reading was obtained at 3-15 hours after its intake. This was not so, however, in case of the alcohol meal where the highest reading was obtained with the fasting stomach contents while the total chloride content readings were lower in the subsequent samples. In general the chlorides graphs in case of the preparations of eggs resembled the acid curves.

Conclusions:

It will not be out of place if the comparative data obtained in the study, of gastric response, digestion and evacuation time, made in case of the preparations of milk and its products, preparations of cereals etc. and the preparations of eggs, is analysed from the point of view of offering some concluding remarks.

Regarding the common practice of taking pulses and legumes by the Indians in their diets and those forming the chief sources of protein intake in their diets, Patwardhan in his latest book on Nutrition in India (1952), has remarked as follows:-

"Pulses and legumes form important articles of diet in India. Those Indians who have religious objections to using flesh foods derive a fair amount of protein from pulses and legumes. Others who have no such scruples and yet are denied the frequent use of animal foods through poverty also have recourse to these foodstuffs. Thus it seems that by experience the Indians, like other inhabitants of the tropical regions, have found a comparatively cheap source of protein to supplement their cereal rich diets. Although it is true that in the tropics and subtropical regions outside India leguminous foodstuffs are usually consumed, it is a moot question if pulses particularly are as commonly used elsewhere as they are in India".

Experience obtained after the study of gastric response, digestion and evacuation time of such articles of food commonly taken by the people in India in their diets and which have been described so far in the previous pages, throw a good light on the behaviour of the stomach under different circumstances.

Gastric response, as has already been said to be, to different foods is more or less characteristic for an individual. When the article is repeated the individual gives almost identical gastric response.

Protein foods evoke more acid, though the acid readings are not directly proportional to the amount of proteins consumed. The starch -es tone down the acid response to proteins. For the same quantity of protein, for example, present in cheese or in eggs, the acid secretion obtained was noted to be more than that secreted in case of pulses, having as much protein content. With any of the vegetarian articles, from the table No.6, given in 100 gms portions, the acid level does not cross that upper arbitrary limit of 80 cc N/10 acid per cent, with the exception, of course, of 'idli' and 'dhosa'(simple),

which have, no doubt, given an acid response above that limit but which, as has been explained, might be due to the lactic acid content present in the articles themselves due to the fermentation process during their preparation. Whereas with similar protein content in milk preparations, the response is rather hyperchlorhydric. All foods, even fatty, evoke some acid. The best neutralizing foods are milk (boiled) without sugar or milk (boiled) with sugar. Ice-cream prepared from pure milk is another item worth recommending in dietary of hyperchlorhydrias. The condiments do evoke more acid but not to the extent as one is apt to believe since chevda containing chilli powder and pungent condiments did not give a much higher acid response than the article 'ponha' from which 'chevada' is prepared and which does not contain condiments. Irritation and acidity are related but not identical.

Digestion of proteins commences very soon in the stomach and peptones are invariably recovered within 15 minutes in most of the cases. It is strange, however, that proteins in as small amount as 2-3 gms when taken along with starches etc. are not completely converted into peptones and their further digestion in the intestines is necessary. Stomach, though an important organ for digestion of proteins, has indeed very feeble effect.

Regarding the evacuation time of articles, it seems to be governed not by one factor. Acidity and its degree does not seem to be the sole factor related with the evacuation time. It seems to be related also with the size of the particles. Foods taken coarse and dry leave the stomach later. Thus 'ponha' cleared the stomach about one hour later than the time taken by the same amount of rice (boiled) which was made soft. Though 'ponhas' given were in 50 gms while rice in 100 gms the original weight of rice before cooking would have been

equivalent.

The so-called strain put on the stomach by fried preparations is without much scientific foundation. 'Bhajia', 'puri', 'sev', 'ganthia' and such other fried vegetarian articles did not stay too long as would have been expected to stay according to the common beliefs, at any rate not longer than some of the milk preparations, nor was the acid response too high. However, if the particles are hard in form, they would need to be softened before they are sent forward and involve more strain on a diseased stomach. The evacuation time does not seem to be related to the fat, starch or any other content. Irritants, like condiments, perhaps help to send the article, containing them, quicker from this organ. 'Chevda', for example, when given in 50 gms measure, had given an average evacuation time of 2-45 hours, in five subjects i.e. about half an hour earlier than that in case of 'pohe'. The latter which was also given in the same amount and from which the former is prepared had given an average evacuation time of 3-15 hours in 4 subjects (see table No.6). This much was regarding the comparative data and the concluding remarks thereon.

In case of the study of the gastric response etc. with the preparations of eggs also, the environmental factors were standardized, as was the case with the study of the other preparations which have been described before, because environmental factors like pleasure or anger etc. at the time of meals, are believed to be responsible to some extent in swinging the time of clearance of articles from the stomach. And hence such factors, because of their standardization in our series, can be said to be without much effect on the variation in the evacuation time of the preparations of eggs, obtained in our experiments.

There were individual differences from subject to subject as regards gastric response, evacuation time etc. after the preparations

of eggs. Acid curves for the four subjects have been drawn which have been shown in the figures, the numbers of which are indicated in brackets put before the initials of the subjects given in the list below. Regarding the physical examination of gastric contents for the presence of bile, mucus etc. there were individual differences observed from subject to subject. But nothing of much or particular significance has been observed in this respect.

The following are the initials of the subjects and the number of the figures in which their respective acid curves are drawn:-

(39) M.M.K. (40) S.M.V. (41) P.D.A. (42) A.S.G.

Summary:

(1) Gastric response, digestion and evacuation time of 9 preparations of eggs, have been studied in four normal healthy subjects, selected after their fractional gastric analysis examination with alcohol meal was found to be normal. The total number of observations made in those subjects with the various articles of the said preparations is 31.

(2) Free and total acidity with any preparation of eggs studied was higher than that with the alcohol meal. The average of the highest total acidity obtained after the various preparations of eggs ranged between 44.3 and 35.0 cc N/10 acid per cent, while that after alcohol meal being 23.0 cc N/10 acid per cent in the same subjects. The average of the highest total acidity when considered for all the preparations of eggs is found to be 33.6 cc N/10 acid per cent.

(3) Raw eggs (five) gave the highest acid response, the average of the highest total acidity being 35.0 cc N/10 acid per cent, while boiled eggs (one)gave the lowest acid response amongst the eggs preparations studied, its average of the highest total acidity reading being 44.3 cc N/10 acid per cent. An even curve was obtained in case of the

eggs (three) shaken in 100 cc milk.

(4) The acid response was highest between 1-00 and 2-30 hours in all the preparations, except in case of raw eggs (five) where the acid response was the highest after 1½ hours and remained to be so till 3½ hours.

(5) More eggs produced more acid but the amount was not directly proportional to the quantity of eggs or the amounts of proteins consumed.

(6) Coagulated proteins were expirated from the first samples to almost until the time the articles evacuated from the stomach, in all the cases of the preparations of eggs given. The particles were larger in earlier samples but liquefied subsequently.

(7) The articles contained no peptones but peptones appeared in the gastric samples taken 15 minutes after the intake of the preparations, indicating thereby that the digestion of proteins commenced soon in the stomach, in all cases of the preparations of eggs.

(8) Proteins were present in all samples of the gastric contents, in case of all the eggs preparations studied. This evidently shows that all the proteins of even one egg are not transformed into peptons in the stomach. Their further digestion remains to be carried out in the intestines.

(9) A trace of reducing substances was present in the eggs and the their preparations tested. The reducing substances disappeared earlier than the proteins cleared off from the stomach. Thus, as was found to be so in case of the study with other articles, the reducing sugars leave the stomach earlier than the proteins or the fats.

(10) The evacuation time, as determined by the fractional method, was found to be varying with various preparations of eggs. One raw

egg evacuated in 2-49 hours, three in 4-25 hours and five in 5-00 hours. One boiled egg took 3-55 hours to leave the stomach, boiled eggs (100 gms) took 3-50 hours while three boiled eggs took 4-35 hours. In case of omelette the evacuation time was 4-15 hours, with two fried eggs, it was 4-50 hours while the three eggs shaken in 100 cc milk left the stomach in 5-15 hours.

(11) Total chlorides were estimated in the gastric samples obtained after these preparations of eggs. The total chlorides were higher with the eggs preparation, except the eggs in milk and the boiled eggs, than with alcohol meal. The chloride graphs obtained in case of the preparations of eggs studied, resembled the acid curves.

(12) The results of the eggs preparations obtained in our series have been compared with those of other workers.

(5) Some other non-vegetarian preparations

Experimental and results:

The following preparations were studied:-

(1) Fried pomphret - the fresh fish, pomphret, which was cut into small pieces was fried in ghee in good amount after adding onions, condiments and salt to taste, and was served in 100 gms measure. The weight was of flesh and without the bones.

(2) Meat preparation (goat's) - freshly obtained goat's meat was cut into small pieces and was cooked till soft in a little water after being fried first in a little quantity of ghee. The condiments, onions, a little salt and spices were added during cooking. This was served in 100 gms quantity. Here again the weight was of flesh and without the bones.

(3) Mutton samosa- meat prepared as above but in dry form, which is enclosed in Bengal gram flour dough in a shape of a ball and fried in ghee. This was served in 100 gms measure and with water to drink.

(4) Chicken - this preparation was made in the similar way as above in case of the meat preparation (goat's) and the flesh without bones weighing 100 gms was served.

(5) Full meal (non-vegetarian) - this comprised of potato-'bhaji' and vegetables, 'puri', curds, mutton - 'pulav' (see note below), meat preparation (goat's), tomatoes, carrot, slices of lemon and 'gulab-jambu' as the final sweet dish or the so-called dessert. (Note:- Mutton-'pulav' - rice (boiled) is taken to which meat preparation (goat's) is added, and then to this are added some boiled eggs, condiments, 'mava' and onions and are all mixed together and the whole thing is cooked for a while in steam).

The full-meal (non-veg.) was taken by the subjects to their satisfaction. It was served ad lib and at leisure and along with water to drink also.

A study of gastric response, digestion and evacuation time after these five types of non-vegetarian articles was made, in four normal healthy subjects, who were used to take occasionally such non-vegetarian dishes, on similar lines of the corresponding study after other preparations which have been already discussed in the previous pages. The results of analysis of the gastric examination in case of the individual subjects are given in the tables at the end in the appendix. In the table No.11 given below, the average of the highest total

(Vide table No.11)

acidity, evacuation time, etc. are shown for each of the article of food given to the subjects in our series and a comparison is made with similar findings of other workers.

The graphs are also drawn, which are shown in figure No.37, indicating the average of the highest total acidity in cc N/10 acid per cent against each item of the article of food given. In table No.12 are shown the results of analysis for the free acidity and the total acidity for the individual articles.

(Vide table No.13)

In the table No.13 are given the average readings, with the maximum, minimum and the standard error. The curves showing the average total acidity for each of the articles of food (average found in the various subjects, which is given in the table No.12) against the time in hours are drawn which have been shown in the figure No.45. Lastly the various curves showing the total acidity for each of the articles of food in the individual subjects are also drawn and they have been shown in the figures whose numbers are put in brackets against which the initials of the subjects to whom the curves belong are given;

Table No.11

Table showing the average of the highest total acidity etc.

Sr. No.	Article of food in 100 gms unless otherwise stated	No. of obsns.	Average of the highest total acidity in cc N/10 acid	Peptones appeared (minutes)	Proteins disappeared	Evacuation time hrs. mts.	Reducing substances in articles hrs. mts.	Reducing substances disappeared hrs. mts.
1	Fried pamphret	1	95.0	15	Proteins present in all samples	4-00	Nil	Within 2-30
2	Meat preparation (goat's)	4	82.5	"	"	4-23	Present Within in three	-in 2-00
3	Mutton curree	3	52.0	30	"	4-30	Present	With -in 3-00
4	Chicken	3	103.0	15	"	4-04	-	Within 3-00
5	Dall curd (non-veg.) (ad lib)	3	76.0	30	"	5-25	Present	With -in 4-30
6	Alcohol 7% 50 cc	4	20.0	-	-	-	-	-
Ref: Hawk, Rohfuss and Bergeim (loc cit)								
	Fish 1	75	130.0	-	-	3-50	-	-
	Chicken 1	30	125.0	-	-	5-15	-	-
Ref: Wilson, Dickson and Singleton (loc cit)								
	Meat (140 gms) - Ground, lean, baked.	-	not examined	-	-	over 4-30	-	-
	Cod-fish boiled (100 gm)	-	"	-	-	slightly over 4-30	-	-

Table No. 12.

Tables showing the acidity in cc N/10 acid % after the articles of some other non-vegetarian preparations.

	Fasting.		I		II		III		IV		V		VI		VII		VIII		IX		X	
	F.	P.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Fried Pomphret 100 gms.																						
Mean.	-	-	25.0	50.0	25.0	45.0	50.0	100.0	70.0	95.0	70.0	80.0	65.0	75.0	20.0	25.0	40.0	45.0				
(Note:- Here there was only one subject for this article)																						
Meat preparation (goat's) 100 gms.																						
Maximum	-	-	50.0	70.0	50.0	80.0	50.0	70.0	75.0	95.0	60.0	100.0	65.0	80.0	50.0	75.0	50.0	60.0	20.0	30%	10.0 20.0	
Minimum	-	-	20.0	30.0	20.0	40.0	30.0	45.0	45.0	50.0	35.0	45.0	5.0	10.0	10.0	15.0	0.0	10.0	0.0	5.0	10.0 15.0	
Mean.	-	-	38.4	51.7	37.5	60.0	42.5	60.0	61.3	78.8	47.5	66.2	38.8	53.8	33.3	48.3	30.0	40.0	6.7	13.3	10.0 17.5	
Std. Error.	± -	-	9.34	11.50	6.29	8.16	4.93	10.54	6.08	10.54	5.94	11.90	12.40	17.40	12.08	17.28	15.20	15.20	6.64	8.35	- -	

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
Mutton-samosa 100 gms.																				
Maximum	-	-	10.0	15.0	10.0	25.0	32.0	50.0	50.0	65.0	40.0	60.0	50.0	70.0	50.0	60.0	35.0	45.0	15.0	20.0
Minimum	-	-	0.0	10.0	0.0	10.0	32.0	36.0	20.0	30.0	25.0	35.0	15.0	20.0	13.0	18.0	15.0	20.0	15.0	20.0
Mean	-	-	3.3	13.3	3.3	15.0	32.0	43.0	35.0	48.3	35.0	48.3	35.0	46.6	31.0	39.3	25.0	32.5	15.0	20.0
Std. Error.	+ -	-	3.34	1.78	3.34	5.00	-	-	8.66	10.33	5.00	7.37	10.40	14.47	12.01	12.18	-	-	-	--
Chicken 100 gms.																				
Maximum	-	-	40.0	55.0	80.0	100.0	80.0	110.0	80.0	110.0	55.0	75.0	45.0	55.0	30.0	37.0	50.0	55.0	50.0	55.0
Minimum	-	-	30.0	40.0	53.3	78.0	40.0	70.0	40.0	70.0	40.0	55.0	30.0	45.0	10.0	20.0	30.0	35.0	50.0	55.0
Mean	-	-	35.0	47.5	71.0	89.3	70.0	93.3	56.7	86.6	50.0	65.0	38.3	48.3	23.3	30.7	40.0	45.0	50.0	55.0
Std. Error.	+ -	-	5.00	5.53	9.00	9.13	15.20	12.10	12.10	12.20	5.00	5.72	4.54	3.56	6.72	5.27	-	-	-	-
Full-meal(non-veg.) ad lib.																				
Maximum	-	-	30.0	55.0	25.0	45.0	30.0	55.0	65.0	90.0	50.0	60.0	60.0	95.0	50.0	60.0	40.0	50.0	50.0	80.0	20.0	25.0
Minimum	-	-	10.0	20.0	10.0	45.0	30.0	50.0	0.0	15.0	0.0	20.0	40.0	60.0	40.0	50.0	30.0	45.0	40.0	50.0	20.0	25.0
Mean	-	-	13.3	40.0	18.3	45.0	30.0	51.7	32.5	52.5	25.0	38.4	50.0	77.5	45.0	55.0	35.0	47.5	45.0	65.0	20.0	25.0
Std. Error.	+ -	-	5.30	10.40	4.53	-	-	1.00	-	-	2.90	11.7	-	-	-	--	-	-	-	-	-	-

Fig No 46

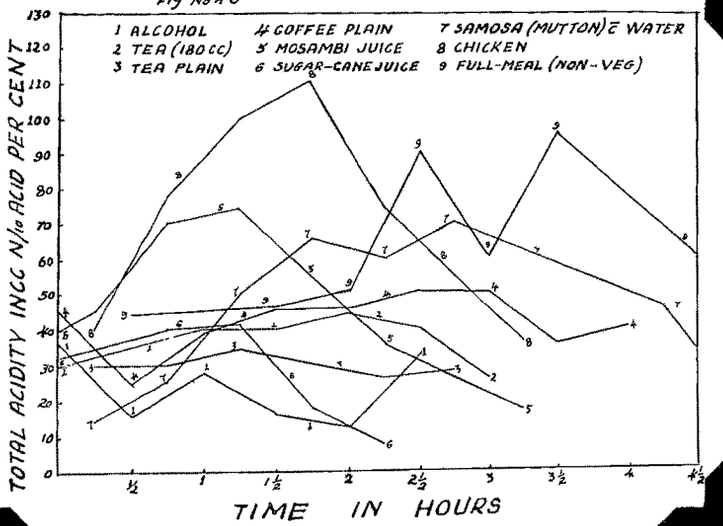


Fig No 47

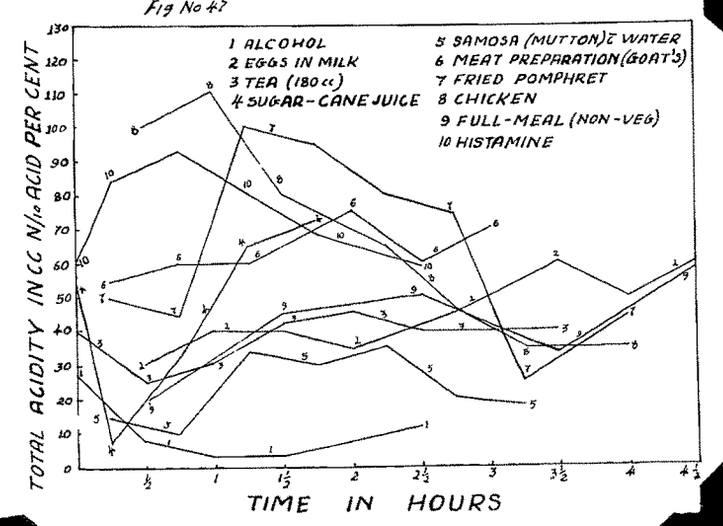
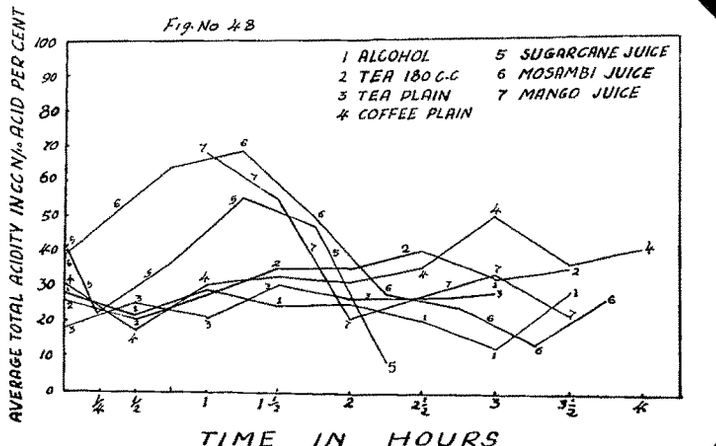


Fig. No 48



they are:-

(46) S.H.V. & (47) P.D.A.

In case of the two remaining subjects, their curves are already shown along with the curves for eggs and their preparations and the figure numbers for these curves are:- (39) M.M.M. & (42) A.S.T. The total number of observations made in four subjects for studying the gastric response, digestion and evacuation time of these non-vegetarian articles of food is 14.

Discussions:

Gastric response:-

Free and total acidity:--

Table No.11 shows the acid response of four normal healthy subjects to some of the non-vegetarian articles of food. In the same table the acid response obtained after alcohol meal by the method of fractional gastric analysis examination, in the same subject -s, has been shown for comparison.

Free and total acidity with any of the articles given was higher than that with the alcohol meal. The non-vegetarian articles gave an acid response which crossed that upper arbitrary limit of normal range, i.e. 80 cc N/10 acid per cent in all cases except the preparation of carnosa (mutton) which was given with water and the full meal (non-veg.). The preparation of fried pomphret gave a high acid response, the average of the highest total acidity being 95.0 cc N/10 acid per cent. In case of meat preparation (goat's) the average of the highest total acidity was 82.5 cc N/10 acid per cent, while the chicken preparation gave the highest acid response of the three preparations mentioned so far, the average of the highest total acidity in case of chicken being 103.0 cc N/10 acid per cent. Mutton soup gave the lowest acid response of all the preparations of the non-

vegetarian type given, the average of the highest total acidity being 52.0 cc N/10 acid per cent. This low acid response may perhaps be due to two factors. Firstly as the mutton samosa was given along with water to drink, the water given might have caused a dilution of the gastric juice resulting naturally in a low acid content of the gastric juice. Secondly samosa (mutton) contains also carbohydrates like starches present in the Bengal gram flour which was used in the preparation of the samosa. Pulses and their preparations have been found to give not a high acid response as has already been described before. Thus the high acid response which might have been obtained with the proteins in the meat preparation present in the samosa if it were given alone without the Bengal gram flour being added to it, seems to have been toned down by the starches and other carbohydrates admixed with the proteins of the meat.

The acid response obtained after the full meal (non-veg.) fell within the range of the normal limits; it touched the upper border limit of the normal range given by the alcohol meal. The average of the highest total acidity of the full meal (non-veg.) was 76.0 cc N/10 acid per cent. When this acidity is compared with that of the vegetarian types of full meals given, it is no doubt much higher. But when the acid response given by the proteins of the meat (goat's) or chicken or the eggs is considered the acidity of the full meal (non-veg.) is lower. And as it was true in case of the full meals of the vegetarian type that the high acid response obtained by the proteins of the individual articles when given alone, was toned down by the carbohydrates and the fats when they were given in conjunction with the proteins just as in the form of the full meal comprising of these individual articles and naturally resulting in a combination of proteins, fats and carbohydrates together, similarly it may be true so in case of the non-vegetarian type of full meal also. In case of

the latter, however, the acid response obtained by the proteins of the meat (goat's) or chicken or the eggs would have been very much higher than what has been obtained with the full-meal (non-veg.), if they were given alone; this high response naturally seems to have been toned down by the carbohydrates and fats admixed with the proteins of the individual non-vegetarian articles, just as in the form of the full-meal comprising of the various constituents and evidently resulting in a combination of proteins, fats and carbohydrates together.

Hawk, Rohfuss and Bergeim (loc cit) had made similar studies in their series. Out of the preparations they had given to their subject-s, the articles comparable with those of our series, in regard to the non-vegetarian type, chicken which was given by them in number of one and its response, as also fish (one) and its response have been taken for comparison, which data is included in the table No.11. They had obtained a response which was higher than that in our series. The average highest total acidity in case of chicken in their series was 125.0 cc N/10 acid per cent, while that in case of our series was 105.0 cc N/10 acid per cent. Of course the quantities given in the two cases were different. Hawk et al (loc cit) had given one chicken while in our series the quantity given was 100 gms only and hence these two types of data obtained under different conditions are not comparable with one another. The same was true in case of fish also from their series. Wilson, Dickson and Singleton (loc cit) had studied some non-vegetarian preparations but they had not examined the acidity in the gastric samples.

The highest acid response was obtained between 1.00 and 2.30 hours after the intake of the articles of food in case of all the non-vegetarian preparations excepting, however, the full meal (non-veg.) where the highest acid response was obtained after 2-30 hours and its

decline took place after 4-30 hours.

Digestion:

The digestion of proteins commenced soon in the stomach and it was observed to take place in 15-30 minutes after the intake of the articles in all cases. Large particles were recovered in the early samples of the stomach contents in all the cases of the non-vegetarian articles excepting the preparation of fried pomphret. These large particles, however, were found to liquefy in the subsequent samples of the stomach contents. The time required for complete liquefaction of the particles in case of all the preparations given ranged from ½ hour to 2¾ hours after the intake of the articles. The complete liquefaction was observed to take place, in case of the preparation of fried pomphret, after 0-30 hour. With meat preparation (goat's) and mutton samosa the liquefaction took place in the gastric samples taken at 2-30 hours and onwards after the intake of the article; whereas with chicken it was in the samples taken at 2-15 hours and onwards after its intake. With full meal (non-veg.), the time of complete liquefaction was 2-45 hours after its intake.

Proteins were detected to be present in all the gastric samples i.e. from the first sample to the last clear sample which was obtained at the evacuation time of the article from the stomach, in all cases of the preparations given. Thus it is evident that all the proteins of the article are not transformed into peptones in the stomach. Their further digestion takes place in the intestines. Similar was the observation made in regard to starch also. By means of physical examination fats were detected to be present even in the last clear samples of the stomach contents.

As regards the reducing substances, it will be seen from the table No.11, that some of the articles themselves contained the reducing substances in small amounts, and that their time of disappearance from the gastric samples varied from 2.00 to 4.30 hours. In case of the preparation of fried pomphret the reducing substances disappeared within 2-30 hours after its intake, with meat preparation (gosht's) in 3-00 hours, with mutton samosa within 3-00 hours and with chicken within 2-30 hours. The time of disappearance of the reducing substances from the gastric samples was the longest with full-meal (non-veg.), it being 4-30 hours after the intake of the article. Thus it seems that the reducing sugars disappeared from the stomach earlier than the proteins or the fats or the starch.

Evacuation time:

The evacuation time after the non-vegetarian articles of food varied from 4-00 hours to 5-30 hours after the intake of the articles. With fried pomphret the evacuation time was 4-00 hours, after meat preparation (gosht's) it was 4-22 hours, mutton samosa gave the evacuation time as 4-30 hours, while in case of chicken it was 4-04 hours. Full meal (non-veg.) was not evacuated from the stomach till 5-30 hours after its intake.

Mark et al (loc cit) had found in their studies the evacuation time after chicken (one) to be only 3-15 hours. This is much shorter than that obtained in our series. The data cannot be, however, compared with one another since they are obtained under different conditions as stated previously with regard to the gastric response also. The second data taken for comparison as given in the table No.11 is that of Wilson et al (loc cit). They found that the evacuation time obtained with codfish boiled given in 100 gms quantity was slightly more 4-30 hours while with meat ground bean boiled given in 140 gms quantity

it was over 4-30 hours. The evacuation time, however, determined by them was by the method of fluoroscopical examination and not by the fractional method of examination, which has been used in our series, and hence these values also are not comparable with one another.

Total chlorides:

As in the case of the eggs and their preparations, the total chlorides estimations were also done in the gastric samples obtained after the non-vegetarian articles of food given. The curves showing the total chloride content in mgms per 100 cc of gastric juice against the different intervals of time have been drawn in case of the subject, P.D.A., and have been shown in figure No.44 along with the curves for eggs preparations. The results of the chloride estimations which have been done only in case of one subject, P.D.A., in all the preparations except mutton samosa, have been given in the appendix at the end. In case of mutton samosa two subjects were studied.

As can be seen from the graphs in the figure No.44 and from the tables in the appendix, the total chlorides were higher with the non-vegetarian articles of food studied, with the exception of mutton samosa, than with the alcohol meal. In case of fried pomfret the highest total chlorides were 400.0 mg %, with meat preparation it was 440.0 mg %, with samosa (mutton) the average highest reading for total chlorides was 270.0 mg %, with chicken the highest total chlorides were 400.0 mg %, whereas after full meal (non-veg.) the corresponding reading was 450.0 mg %. The curve obtained after full meal showed a tendency to rise at the time of the evacuation of the article, at which time the highest reading was obtained. In case of the remaining articles the highest readings were obtained between 1.00 and 2.30 hours after the intake of the articles. In this respect thus the chlorides

curves resembled the acid curves, since in case of these very same articles the acid response was highest between 1-00 and 2-30 hours. This was not so in case of the full meal (non-veg.), however; its acid response was highest after 2-30 hours and the decline took place after 4-30 hours; while the increasing chlorides were obtained from 3-30 hours onwards and they continued to rise till the end.

Regarding the physical examination of gastric contents for the presence of bile, mucus, etc. there were individual differences observed from subject to subject. But nothing of much or particular significance has been observed in this respect.

Summary and conclusions:

(1) Gastric response, digestion and evacuation time of five preparations of non-vegetarian type of articles have been studied in four normal healthy subjects who were selected after their fractional gastric analysis examination with alcohol meal was found to be normal. The total number of observations made in these subjects with the said articles was 14.

(2) The free and total acidity with any of the articles given was higher than that with the alcohol meal. The non-vegetarian articles gave an acid response which crossed that upper arbitrary limit of normal range i.e. 80 cc N/10 acid per cent in all cases except the preparation of samosa (mutton) which was given with water to drink and the full meal (non-veg.). Fried pomphret gave the average of the highest total acidity as 95.0 cc N/10 acid per cent, with meat preparation (goat's) it was 82.5 cc; with chicken, 103.0 cc; mutton samosa gave 52.0 cc, whereas full meal (non-veg.)gave 76.0 cc N/10 acid per cent.

(3) Starches and other carbohydrates present in the Bengal gram flour which was used in the samosa preparation seemed to have toned down the

high acid response which would have been obtained with meat preparation if given alone, of which the osmose was prepared. This was true in case of the full-meal (non-veg.) also, where the acid response of the meat proteins was toned down by other constituents present like starches, fats, etc.

(4) The highest acid response was obtained between 1-00 and 3-30 hours after the intake of the articles of food in case of all the non-vegetarian preparations excepting, however, the full meal (non-veg.) where the highest acid response was obtained after 2-30 hours and its decline took place after 4-30 hours.

(5) The digestion of proteins commenced soon in the stomach and it was observed to take place in 15-30 minutes after the intake of the articles in all cases. Large particles were recovered in the early samples after the articles excepting in the case of fried pomfret, which particles subsequently liquefied. The time of liquefaction in these articles varied between ½ and 2½ hours; with fried pomfret it was the shortest, while with full meal it was the longest.

(6) Reducing substances were present, in some of the articles themselves, in small amounts. The reducing sugars disappeared from the gastric samples in varying time in these various preparations, the time ranging between 2-00 and 4-30 hours. Proteins, starches and fats were detected to be present even in the last clear samples taken at the time of evacuation of the article. Thus it seemed that the reducing sugars disappeared from the stomach earlier than the proteins or the fats or the starch.

(7) The evacuation time after the non-vegetarian articles of food varied from 4-00 hours to 5-25 hours after the intake of the articles.

(8) Total chlorides were estimated in the gastric samples obtained after these preparations of the non-vegetarian type of articles. The total chlorides were higher with these articles of food studied, with

the exception of mutton samosa, than with the alcohol meal. The total chlorides when taken their highest reading ranged between 270 mg % and 450 mg %. The curve of total chlorides obtained after full meal showed a tendency to rise at the time of the evacuation of the article. In case of the remaining articles the highest readings for the total chlorides were obtained between 1-00 and 2-30 hours after the intake of the articles.

(9) The results have been compared with those of other workers.

(6) Drinks and some fruit juices

Experimental and results:

The following are the drinks and some fruit juices that have been studied:-

(1) Tea: To boiling water the tea leaves were added and after adding sugar and milk, the drink was served in a cupful amount i.e. 180 cc.

(2) Tea(plain): To boiling water tea leaves were added and the drink was served in a cupful amount, without adding milk or sugar.

(3) Coffee(plain): To boiling water the coffee powder was added and the drink was served in a cupful amount, without adding milk or sugar.

(4) Sugar-cane juice: Fresh juice of sugar-cane was given in quantity of 100 cc.

(5) 'Mosambi' juice i.e. orange juice: Fresh juice of orange was given in quantity of 100 cc.

(6) Mango juice: Fresh juice of mangoes was given in quantity of 100 cc.

A study of gastric response, digestion and evacuation time after the drinks and the fruit-juices listed above was made, in normal healthy subjects on similar lines of the corresponding study after other preparations which have already been discussed in the previous pages. The results of analysis of the gastric examination in case of the individual subjects are given in the tables at the end in the appendix. In the table No.13 given below, the average of the highest total acidity, evacuation time etc. are shown for each of the article of the drinks and the fruit-juices given to the subjects.

(Vide table No.13)

The graphs are also drawn, which are shown in figure No.37,

Table No.13

Table showing the average of the highest total acidity,etc.

Sr. No.	Name of the article of drinks and fruit-juices with its quantity given	No. of obsn.	Average of the high-est total acidity in cc N/10 acid	Peptone reaction (in min.)	Protein digestion appeared in time	Evacuation time Hrs.Mts.	Reducing substances in article	Reducing substances disappeared Hrs.Mt
1	Tea (180 cc)	4	38.8	15	Proteins present in all samples	3-33	Present	Within 2-00
2	Tea(plain)(180 cc)	2	30.0	"	"	3-15	"	Within 0-45
3	Coffee(plain) (180 cc)	3	36.7	"	"	3-00	Nil	Within 2-00
4	Sugar-cane juice (100 cc)	3	57.0	"	"	2-00	Present	Within 1-30
5	'Mosambi' i.e. Orange juice (100 cc)	2	67.5	"	"	3-30	"	Within 3-00
6	* Mango-juice (100 cc)	5	66.0	30	"	over 2-00	-	-
7	Histamine inj.	2	76.0	-	-	-	-	-
8	Alcohol 7% 50 cc	4	28.0	-	-	-	-	-

* Note:- For this article which was studied in the beginning of the commencement of the research problem i.e. at the time of the studies on milk and its preparations, because that was the season when ripe mangoes are available in plenty from which the sweet juice was squeezed out, the subjects were from another batch and naturally were different from those four subjects who were given the drinks and the other fruit-juices.

indicating the average of the highest total acidity in cc N/10 acid per cent against each item of the article of the drinks and the juices given. In table No.14 are shown the results of analysis for the free acidity and the total acidity for the individual articles.

(Vide table No.14)

In the table No.14 are given the average readings, with the maximum, minimum and the standard error. The curves showing the average total acidity for each of the articles of the drinks and the juices given (average found in the various subjects, which is given in the table No.14) against the time in hours are drawn which have been shown in the figure No.48. Lastly the various curves showing the total acidity for each of the articles of the drinks and the juices given, in the individual subjects are also drawn and they have already been shown along with the curves for other preparations in the figures whose numbers are put in brackets against which the initials of the subjects to whom the curves belong are given:

(38) M.M.M. (46) S.M.V. (47) P.D.A. & (48) A.S.S.

The total number of observations made in the subjects for studying the gastric response, digestion and evacuation time of these articles of the drinks and the juices is 18.

Discussions:

Gastric response:-

Free and total acidity:--

The acid response with the drinks, tea, tea(plain)and coffee (plain) for all three, was comparable with that obtained after alcohol meal. The average of the highest total acidity ranged between 30.0 and 38.8 cc of N/10 acid per cent. The plain tea gave the lowest acid response of all the three drinks, the average of the highest total acidity with tea(plain)being 30.0 cc N/10 acid per cent; with coffee

Table No. 14

Tables showing the acidity in cc N/10 acid % after the various articles of drinks & some fruit-juices.

	Fasting.		I		II		III		IV		V		VI		VII		VIII	
	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.	F.	T.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11	12	13	14	15	16	17	18
Tea 180 cc																		
Maximum	30.0	40.0	20.0	35.0	25.0	40.0	30.0	42.0	35.0	45.0	30.0	40.0	30.0	40.0	35.0	40.0		
Minimum	5.0	15.0	0.0	10.0	10.0	20.0	15.0	25.0	0.0	10.0	30.0	40.0	15.0	25.0	20.0	30.0		
Mean.	16.2	27.5	6.3	21.3	17.5	27.5	23.8	35.5	25.0	35.0	30.0	40.0	21.7	31.7	27.5	35.0		
Std. Error. ±	5.20	5.19	4.70	5.47	3.19	4.78	4.07	3.98	6.12	8.41	-	-	-	-	-	-		
Tea (plain) 180 cc.																		
Maximum	5.0	17.0	25.0	30.0	25.0	30.0	30.0	35.0	25.0	30.0	20.0	25.0	22.0	27.0				
Minimum	5.0	17.0	10.0	20.0	8.0	13.0	20.0	25.0	15.0	20.0	20.0.	25.0	22.0	27.0				
Mean.	5.0	17.0	17.5	25.0	16.5	21.5	25.0	30.0	20.0	25.0	20.0	25.0	22.0	27.0				

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
Coffee (plain) 180 cc.																		
Maximum	35.0	45.0	20.0	25.0	30.0	40.0	40.0	45.0	35.0	45.0	40.0	50.0	40.0	50.0	25.0	35.0	35.0	40.0
Minimum	10.0	15.0	0.0	8.0	5.0	10.0	5.0	10.0	10.0	15.0	15.0	20.0	40.0	50.0	25.0	35.0	35.0	40.0
Mean	20.0	30.0	11.0	17.0	21.7	30.0	28.3	33.3	23.3	31.7	27.5	35.0	40.0	50.0	25.0	35.0	35.0	40.0
Std. Error. + -	7.64	8.66	5.86	4.91	8.34	3.16	11.70	6.94	-	-	-	-	-	-	-	-	-	-
Sugar-cane juice 100 cc.																		
Maximum	42.0	55.0	25.0	35.0	32.0	40.0	55.0	65.0	65.0	72.0	0.0	7.0						
Minimum	25.0	33.0	25.0	8.0	27.0	32.0	35.0	42.0	13.0	18.0	0.0	7.0						
Mean.	33.5	44.0	25.0	22.2	29.5	36.0	45.0	53.5	39.0	45.0	0.0	7.0						
Orange-juice 100 cc.																		
Maximum	25.0	40.0	20.0	50.0	40.0	70.0	60.0	75.0	35.0	55.0	20.0	35.0	17.0	27.0	13.0	18.0	17.0	25.0
Minimum	25.0	40.0	15.0	45.0	30.0	60.0	35.0	60.0	30.0	45.0	13.0	20.0.	15.0	20.0	0.0	8.0	17.0	25.0
Mean.	25.0	40.0	17.5	47.5	35.0	65.0	47.5	67.5	32.5	50.0	16.5	27.5	16.0	23.5	6.5	13.0	17.0	25.0

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
							Mango-juice 100 cc.											
Maximum	-	-	72.0	104.0	56.0	76.0	24.0	34.0	24.0	36.0	40.0	48.0	8.0	20.0				
Minimum	-	-	2.0	4.0	12.0	20.0	0.0	8.0	0.0	8.0	10.0	20.0	8.0	20.0				
Mean.	-	-	42.4	67.2	35.2	51.6	12.8	21.2	16.0	26.0	24.6	33.3	8.0	20.0				
Std. Error.	±	-	-	9.69	9.88	10.00	10.10	5.43	5.64	5.41	6.21	8.76	8.17	-	-			
							Histamine inj.											
Maximum	51.0	60.0	80.0	84.0.	84.0	92.0	72.0	80.0	60.0	68.0	55.0	60.0						
Minimum	20.0	28.0	32.0	36.0	52.0	60.0	35.0	40.0	32.0	40.0	30.0	35.0						
Mean	35.5	44.0	56.0	60.0	68.0	76.0	53.5	60.0	46.0	54.0	42.5	47.5						

F = Free T = Total

(plain)it was 36.7 cc whereas after tea taken with milk and sugar the average of the highest total acidity was 38.8 cc N/10 acid per cent. More or less an oven curve which resembled much the curve of alcohol was obtained with tea(plain).

The highest acid response was obtained with these drinks between 1½ and 3 hours after their intake. The plain tea gave the highest reading for the acid response at 1-30 hours after which it declined. With coffee(plain)on the other hand the highest reading was at 3-00 hours and the decline was noted afterwards; whereas the tea taken with milk and sugar gave the highest reading at 2-30 hours followed by subsequent decline.

The plain tea and plain coffee, both of which were given without milk and sugar, left a sensation of some depression on the subjects, who always took tea and coffee with milk and sugar.

The acid response obtained with the fruit juices, namely the orange juice, sugar-cane juice and the mango juice, was higher than that obtained with alcohol meal. The average of the highest total acidity given by these fruit juices ranged between 57.0 and 67.5 cc N/10 acid per cent. The acid response after orange juice and mango juice touched a higher limit i.e. 60 - 70 units. The acidity curves obtained with these two juices were close to one another. The average of the highest total acidity after orange juice was 67.5 cc N/10 acid per cent, which was the highest of all the three juices; with mango juice it was 66.0 cc N/10 acid per cent, thus close to the former, whereas the sugar-cane juice gave the average of the highest total acidity as 57.0 cc N/10 acid per cent, which was the lowest acid response of all the three juices. The high acid response obtained with orange juice may perhaps be due to the fact that the orange juice itself was highly acid - the total acidity estimated being 60 cc N/10 acid

per 100 cc of the juice. The gastric samples obtained after orange juice showed a wide difference between the free and the total acidity readings, especially in case of the early samples. This also possibly might have been caused by the high acid present in the orange juice itself.

The highest acid response obtained after these fruit-juices was between ¾ and 1½ hours after their intake. This was thus earlier than the time required by the drinks like tea etc. given to the subjects, to attain the highest acid response. The acid response with the juices showed a tendency to decline after 1½ hours in all the three cases.

Youngly and Sayer (1948) had studied the effects of orange juice and milk in gastric ulcer cases and they had come to the conclusion that the buffering action of milk was maximum between ½ to 1 hour and that the orange juice had a stimulating effect, so much that the pH fell to the fasting level after an hour. They recommended that because of the stimulating effect of orange juice and other fruit juices these juices should be given with other foods which have neutralising action in peptic ulcer. Their studies, however, were in the diseased stomachs and hence the findings of those studies are not comparable with the results obtained in our series which have been studied in normal stomachs. Nevertheless their studies do show that orange juice and other fruit juices have stimulating effect on the acidity of the gastric secretion.

Digestion:

The protein digestion commenced soon in the stomach and it was observed to take place in 15 minutes after the intake of the drinks in all cases. Proteins were detected to be present even in last clear

samples. Reducing substances were present in the gastric samples taken upto 2-00 hours after the intake of the drinks in all cases except in tea(plain)where the reducing substances were detected to be present in the gastric samples taken upto 45 minutes after its intake. Tests for starch were found positive in all cases even upto the last samples of the stomach contents obtained after the drinks. In case of tea taken with milk and sugar, curds appeared in the gastric samples obtained after the intake of tea and the curds persisted to about 2 hours of time. Reducing substances were evacuated earlier than other components like starch and proteins.

In case of the juices, the digestion of proteins commenced soon in the stomach and the time within which the peptones appeared in the gastric samples obtained after the juices ranged between 15 and 30 minutes after their intake. Proteins were detected to be present even in the last clear samples as also the starch. The reducing sugars were present in the juices themselves in case of orange juice and the sugar-cane juice. The reducing sugars disappeared from the gastric samples taken after these two juices half an hour earlier than the starch and the proteins.

Evacuation time:

The evacuation time for drinks varied between 2-15 and 3-00 hours after their intake. Tea(plain)left the stomach in 2-15 hours, tea given with milk and sugar took 2-53 hours to leave the stomach while the evacuation time taken by coffee(plain)was the longest of all the three drinks, it being 3-00 hours after its intake.

In case of the fruit juices, however, the evacuation time varied between 2-00 and 3-30 hours after their intake. Sugar-cane juice took the shortest time of all the three juices, to leave the stomach, it being 2-00 hours after its intake. Mango-juice took averagely over

2-00 hours to leave the stomach whereas orange juice was evacuated completely from the stomach in a period which was the longest of all the three juices, it being 3-30 hours after its intake.

Total chlorides:

As in the case of eggs and their preparations, the total chlorides estimations were also done in the gastric samples obtained after some of the articles of drinks and fruit juices given. The curves showing the total chlorides content in mgms per 100 cc of gastric juice against the different intervals of time have been drawn after plain coffee and orange juice in case of the subject K.M.K. and have been shown in figure No.43 along with the curves for eggs preparations, while those drawn after tea and sugar-cane juice in case of the subject P.D.K. have been shown in figure No.44 along with the curves for eggs preparations and other non-vegetarian articles of food. The results of the chlorides estimations which have been carried out in these two subjects and in one more subject S.M.V. (whose curves are not drawn) after the drinks and fruit juices which have been given to these subjects, have been given in the tables, in the appendix at the end.

As can be seen from the graphs in the figure Nos.43 and 44 and also from the tables at the end, the highest total chlorides readings obtained in the gastric samples obtained after the drinks and the juices studied were lower than the corresponding readings obtained after the alcohol meal. The highest total chlorides readings in these articles varied between 300.0 and 330.0 mg per 100 cc of the gastric juice. With tea taken along with milk and sugar the highest total chlorides were 330.0 mg %, after plain tea the corresponding reading was 300.0 mg %, coffee(plain)and orange juice gave the highest total chlorides as 310.0 mg % in each, whereas after sugar-cane juice the highest total chlorides were 330.0 mg per 100 cc of the gastric juice.

Regarding the physical examination of gastric contents for the presence of bile, mucus etc. there were individual differences noted from subject to subject but they did not show anything much of particular significance apart from what has been discussed already in connection with the alcohol meal, in the beginning of the part III of the thesis.

Summary and conclusions:

(1) Gastric response, digestion and evacuation time of 6 articles of drinks and fruit juices have been studied in normal healthy subjects who were selected after their fractional gastric analysis examination with alcohol meal was found to be normal. The total number of observations made in these subjects with the said articles is 18.

(2) The acid response with the drinks, tea, tea(plain)and coffee(plain), for all three, was comparable with that obtained after alcohol meal. The average of the highest total acidity obtained with them ranged between 30.0 and 38.3 cc N/10 acid per cent. Tea(plain)gave an acid curve much resembling the acidity curve after alcohol meal. The acid response which was highest was obtained between 1½ and 3 hours after the intake of these drinks.

(3) Plain tea and plain coffee, which were given both without milk and sugar, left a sensation of some depression on the subjects, who always took tea as well as coffee with milk and sugar.

(4) The acid response obtained with the fruit juices, namely, orange juice, sugar-cane juice and the mango juice, was higher than that obtained with alcohol meal. The average of the highest total acidity given by them ranged between 57.0 and 67.5 cc N/10 acid per cent. The acid response after orange juice and mango juice touched a higher limit i.e. 60 - 70 units. The acidity curves obtained with these two juices were close to one another. The orange juice itself contained

high acidity, it being 60 cc N/10 acid per 100 cc of the juice. Highest acid response after the three juices was obtained between ½ and 1½ hours after their intake.

(5) The protein digestion commenced soon in the stomach i.e. within 15 minutes after the intake, in case of the drinks. Proteins and starches were detected even upto the last clear samples of the stomach content-s. Reducing sugars were evacuated from the stomach earlier than other components like proteins and starches. In case of tea taken with milk and sugar, curds appeared in the gastric samples and they persisted to about 2 hours of time.

(6) The time of appearance of peptones in the gastric samples obtained after the juices ranged between 15 and 30 minutes. Proteins as well as the starch were detected to be present even in the last clear samples. The reducing sugars which were present in orange juice and sugar-cane juice themselves, were evacuated from the stomach half an hour earlier than the other components like starch and proteins.

(7) The evacuation time, required by the drinks to clear from the stomach, ranged between 2-15 and 3-00 hours after their intake.

(8) In case of the fruit juices the evacuation time required by them to clear off from the stomach varied between 2-00 and 3-30 hours.

(9) The highest total chlorides readings obtained after some of the articles of drinks and juices studied were lower than the corresponding readings obtained after the alcohol meal. The highest total chloride readings after the articles studied ranged between 300.0 mg and 520.0 mg per 100 cc of the gastric juice.

(7) Histamine meal

On two occasions the fractional analysis examination of the gastric contents with the histamine meal was carried out in 4 normal healthy subjects on the first occasion and in two subjects on the second occasion by the method of Bloomfield and Polland (1929) with a few modifications in the technique. First the resting juice was completely aspirated out from the stomach by means of the usual method of using Levin's tube and the syringe. The stomach was then washed with several syringefuls of warm water, until rinsing fluid was obtained clear. This was desirable as lavage. Blood pressure of the subjects was taken, this was very essential because if the systolic blood pressure was below 110, the dose of histamine was required to be reduced. Histamine was then injected subcutaneously in a dosage of 0.01 mg per kilogram of body weight. This is the dosage recommended by Bloomfield and Polland (loc cit) - 0.1 mg per 10 Kg. of body weight. Lender and Thelagan (1934) have, however, stated that in view of the relatively slight differences found by Englebach and Brown, between the effects of 0.75 and 0.5 mg. (this was the dosage used by Lender et al (loc cit) in their subjects, 0.75 mg. being the usual dose, which was reduced to 0.5 mg if the systolic blood pressure was below 110), any small difference in dosage is probably unimportant. Stomach contents were then withdrawn at the intervals of time. On the first occasion the intervals of time kept was 15 minutes while that on the second occasion was 30 minutes. The stomach contents were examined for acidity, total chlorides content etc. as usual.

The results obtained for the acid response after the histamine meal studied on the first occasion have been given along with the

results of the preparations of cereals etc. in the tables pertaining to those preparations and the curves etc. obtained after the histamine meal have been also drawn along with the curves obtained after those very preparations of cereals etc. in the figures pertaining to them. As regards the results and the curves etc. obtained with the histamine meal studied on the second occasion, they have been given along with the results and the curves etc. of the articles of drinks and juices and have been shown in the corresponding tables and the figures of these articles. The curve for the total chlorides content estimated in case of the subject F.D.A. is drawn and shown in figure No.44 and the results are given at the end.

The average of the highest total acidity obtained on the first occasion of the examination in the gastric samples after the histamine meal was 57.0 cc N/10 acid per cent while that on the second occasion was 76.0 cc N/10 acid per cent. The average of the highest total acidity when calculated for all the six observations made on the two separate occasions after being combined was found to be 83.3 cc N/10 acid per cent and their range for these six observations was found to be from 60.0 cc to 104.0 cc N/10 acid per cent. The total chlorides content was higher than that with alcohol meal, the highest being 450.0 mg per cent.

Lander et al (loc cit) after a study of 100 histamine test meals on normal male students between the ages of 18 and 32 years had found that the mean total acidity in their results was higher than that found by Polland (1933) in his studies for the same age period. The difference was not statistically significant and hence the two values namely, 111.0 cc obtained by Lander et al (loc cit) and 101.1 cc obtained by Polland (loc cit) were combined by Lander et al (loc cit), in order to give an estimate which should form a satisfactory normal standard

for males from 18-50 years. Thus the average mean after combination was given as 107.9 cc N/10 acid per cent.

Cantarow and Trumper (loc cit) have mentioned that histamine is a powerful gastric secretory stimulant, producing a juice of maximal acidity and relatively low pepsin content. The maximum response in normal subjects, excluding those with achlorhydria, may range from 30 - 100 units (30- 160 millimols HCl for 0.1 - 0.6 per cent Sol).

Regarding the time during which the highest acid response was obtained after histamine meal, it can be seen from the figure No.38 wherein the curve for the average total acidity after the histamine meal studied on the first occasion is drawn against time in hours, that the maximum response was obtained at 30 minutes after the injection, while the time for the maximum response to be obtained in the individual subjects varied from 30 minutes to 50 minutes after the injection. The maximum response obtained after the histamine meal studied on the second occasion was at 40 minutes in case of the subject M.M...., as can be seen from the figure No.39, whereas it was at 45 minutes in case of the subject P.D.A., as can be seen from the figure No.47. Thus in these two subjects studied the time for the highest acid response to be obtained varied between 40 and 45 minutes after the injection and for all the six subjects, the variation in the time was from 30 to 50 minutes.

Lander et al (loc cit) have remarked that the acidity and volume increase upto 30 - 40 minutes period and then they decrease but maximum may occur at any time from 10 - 50 minutes. Cantarow and Trumper (loc cit) have stated that with histamine stimulation, the free acidity rises rather promptly, reaching a maximum usually in forty to sixty minutes and then declining.

Thus the results obtained in our series regarding both the acid response as well as the time of the maximum response after histamine meal can be found to be comparable with those of the other authors mentioned above.

Summary and conclusions:

(1) The fractional analysis examination of the gastric contents with the histamine meal was carried out in six normal healthy subjects on two different occasions, in four subjects on one occasion and in two on another occasion, by the method of Bloomfield and Polland (1929), with a few modifications in the technique.

(2) The average of the highest total acidity after the histamine test meal given to six subjects was found to be 33.3 cc N/10 acid per cent, with a range of 20.0 cc to 104.0 cc N/10 acid %.

(3) The maximum response after the histamine test meal was obtained in a period varying from 30 to 50 minutes after the injection was given.

(4) The results obtained in our series regarding both the acid response as well as the time of the maximum response after histamine meal have been compared with the corresponding findings of the other workers.

(5) Regarding the total chlorides content estimated in case of one subject (P.D.A.), the readings were higher than those with the alcohol meal. The chlorides content ranged between 370.0 mg per 100 cc and 450.0 mg per 100 cc, of gastric juice. The highest total chlorides content obtained in the gastric juice after histamine test meal was 450.0 mg per 100 cc, which was naturally higher than the corresponding reading of 390.0 mg per 100 cc obtained with alcohol meal. The total chlorides curve obtained after histamine meal in case of the said subject, more or less resembled his total acidity curve given by the same test meal.

(8) Chemical composition of some cooked and uncooked articles of food

A few samples of some of the articles of food which were given to the subjects during the study of their gastric response etc., were analysed for their chemical composition with respect to their contents of proteins, fats, moisture, ash and carbohydrates (by difference), by the methods which have been described in part II on methods in the previous pages. This chemical analysis was done with a view to find out whether any relation could be obtained between their composition and the gastric secretion. During the discussions on the gastric response etc. of the milk and the milk preparations, which have been described in the previous pages, this point has already been referred to in the statement that high acidity was obtained when the amount of protein in the article was high. Here the values for the protein content were taken from the tables or calculated therefrom, but such values given in the tables are generally of uncooked articles of food. It is but natural that the composition of the cooked articles of food, which were given to the subjects in our study, would have been differed from that of the uncooked articles of food. There is another point also, which emphasises the importance of obtaining such a type of data, namely, studying the composition of uncooked articles of food, and this point has been discussed under "comment", in the following paragraphs. The values of the chemical composition of some of the articles studied have been shown in the table No.15.

(Vide table No.15)

Of course, it must be admitted here that no definite conclusions could be drawn from the data given in the table No.15, because the comparative study of the uncooked portion of the articles of food was not made, except in case of the article eggs, where white and yolk

Table No.15

Table showing the average chemical composition in gms % of some cooked as well as uncooked articles of food

Sr. No.	Article	Moisture	Proteins	Fats	Ash	Carbohydrates (by difference)
1	'Lava'	15.00	10.40	30.60	2.30	35.20
2	Icecream	74.00	6.40	4.34	3.65	11.61
3	Ground nut balls	1.50	18.60	35.00	2.10	42.30
4	'Khichdi'	60.85	6.04	2.96	1.05	29.10
5	Full meal (veg.)	69.60	5.50	3.99	2.15	18.35
6	Full feast dish (veg.)	50.00	6.10	10.20	2.00	31.70
7	White of egg (raw)	71.00	14.10	1.50	1.00	2.40
8	Yellow of egg (raw)	47.80	4.50	30.00	2.60	15.10
9	White of egg (boiled)	77.50	12.10	00.50	2.30	7.60
10	Yellow of egg (boiled)	45.50	5.00	32.40	2.30	16.80
11	Fried eggs	64.00	8.00	15.00	5.10	5.30
12	Eggs in milk	69.10	8.42	12.14	2.00	8.34
13	Fried pomphret	70.35	8.32	9.70	2.30	9.35
14	Meat preparation (yeast's)	56.00	14.10	15.40	2.00	12.50
15	Mutton curries	33.75	20.40	31.74	3.35	30.76
16	Chicken	62.85	13.44	14.00	2.65	7.66

Note:- The above articles were from those which were given to the subjects during the study of their gastric response, digestion and evacuation time.

of raw eggs were studied as also the white and yellow of the boiled eggs, for their chemical composition. The study of the composition of those parts of the eggs in two different states does show a slight difference in their composition.

Lal and Mitra (1952) reported that such type of data which has been published so far was from the South India districts by Devdas (1949); while they had given similar data for Bihari cooked food preparations. In the data given by Lal et al (loc cit) the comparison of the chemical composition of the cooked articles has been made with the calculated values of the raw materials from the tables. It would have been better, however, if the analyses were done as far as possible in half the portions of the samples of the raw materials and then the remaining half of the portions were cooked whose analyses could have been done after cooking.

Comment:

Nutrition has always been placed as a subject in the forefront of the programme of the schemes for the National development and more especially the study of those problems of health and disease which are related to differences, both qualitative as well as quantitative, in the chemical composition of various foods and diets. Great advances have been made in fundamental knowledge in this respect, but full application of the experimental results of human dietetics cannot be made without exact knowledge of the amounts of the different substances which are present in foods and available for the body's use.

Many of the articles of food are subjected to the process of cooking before they are eaten. The processes of cooking also differ from place to place and the duration of cooking may differ for different length of time. Some articles are cooked in large quantity of water and the water is then thrown away. Most vegetables for example are

boiled in large quantity of water before being eaten and the cooking water is usually thrown away. On the other hand some articles are boiled in small quantity of water and the cooking water retained. Some are subjected to a high temperature with high pressure while some to a low temperature. Some are baked and some are fried.

The change in the chemical composition brought about by cooking has been a subject of study of very few observers. Due to the lack of data of experimental results in this respect, the nutritional investigators have been confronted with difficulties especially in their work which has involved practical planning of diets on an accurate basis. The chemical analysis of the raw articles of food may sometimes be misleading as a guide to its nutritional value, because some of the material estimated in the raw article may not be available for nutrition after it has been subjected to the varied changes during the processes of cooking. Thus it is necessary for the dietitians and the physicians to have a knowledge about the nutritive value of cooked food preparations in order that they may be able to prescribe diets to individuals in health and disease.

Concluding remarks:

It is thought to be appropriate to offer finally a few concluding remarks on the basis of the results obtained, which have been discussed so far, and to consider as to how far those results will have bearing in prescribing the articles of food studied in the dietary treatment for the diseased stomachs e.g. in cases of peptic ulcers, etc.

Approximately 10% of the people, as estimated by Hurst, inherit a hypersthenic gastric diathesis, reacting to ordinary stimuli by hyperchlorhydric gastric secretory response. Hyperchlor-hydric

response offers no advantage in digestion but in the absence of mucous secretion is liable to promote, if not form, gastric ulcer in the slow evacuating and duodenal ulcer in the fast evacuating stomach. Associa-ted pyloric spasm prevents the evacuation of highly acid secretion from the stomach as well as its neutralisation by the duodenal contents. This is expressed by a climbing acid curve in such cases.

The treatment in these conditions is aimed at keeping the acids at as low levels as far as possible. This is done by rest, drugs and diet.

Evaluating the position of drugs Davidson (1947) writes:- "For the immediate symptomatic relief, baking soda, chalk and magnesium oxide are more effective than magnesium trisilicate, aluminium hydroxide and are considerably cheaper. In the post ulcer regime - drugs are unnecessary provided there are no symptoms". He further states:- "Alkalies are of doubtful value in the control of hyperacidity and the fundamentals of treatment are diet, mental relaxation and physical rest".

Numerous dietetic methods have been employed in the treatment of hyperchlorydrias with peptic ulcer.

Sippy recommended milk, cream and later on eggs at hourly intervals Leobartz diet is mainly in fluid form but eggs are added thus giving more proteinous than by Sippy method. Hurst modified this method by introducing drugs in between the foods for neutralising the gastric acid. It is claimed that this (Hurst) regime completely neutralises the HCL throughout the waking hours as it employes antacids after and olive oil before a number of meals.

Nicol, however, found that the mean acidity, contrary to all expec-ations, was actually higher after Hurst than Meulengracht's routine of

four courses a day, in patients actually under treatment by the above methods. The latter (Moulengracht's) diet permits a much wider variety of food stuffs - chicken, rabbit and other meats, fruits and vegetables - all foods being carefully pounded or sieved. The Hurst method is monotonous, offers no advantage over Moulengracht's, involves nursing difficulties and causes undue disturbance to the patient to no purpose.

Davidson (1947) commenting on the value of different foods in tempering the acid response in ulcer cases states, "We have found that the giving protein foods, such as pounded fish, chicken or eggs, reduces HCl, much more efficiently and maintains it at a low level for longer periods than do meals of milk and cream".

Studies on normal healthy stomachs described here amply support this. Every food evokes some gastric secretion; the nature of acid response is almost characteristic for each food in each individual. Of course, it must be admitted that our results are obtained in normal stomachs. They need to be repeated in diseased stomachs.

After testing milk and its preparations, it was noticed that milk, boiled and mildly sweetened or unsweetened, produced the lowest acid secretion, icecream did the same but all other preparations e.g. curds, butter-milk, 'mava', 'shrikhand', 'basundi', cheese in the same amounts produced very highly acid secretion. Such articles prepared of milk are not therefore suitable in hyperchlorhydrias.

All protein foods of the non-vegetarian type yield higher acid secretions. The eggs in any amount and any preparation - omelette, egg shaken in milk, boiled, fried etc., provoke more acid secretion than the alcohol meal with which the curves were compared. So do meats and fish preparations also.

Fat and carbohydrate foods cause less acid secretions. Rice and its many preparations, potatoes or even a full vegetarian meal taken ad lib and in good amounts was associated with gastric secretions, with the acid level even and well under control for a long time.

All foods were liquefied almost before they left the stomach. The time taken for rendering them soft and fine varied with the state in which they were consumed.

It is time that our prescription of diet in ulcer cases be revised. A full (vegetarian) meal provided the articles are well boiled, cooked, rendered soft and sieved to give a fine particulate form would be more suitable.

The erotic schedule of milk and eggs produces more incomplete secretory response. It may therefore be suggested that in the people of this part of the world a diet of 4 meals of rice cooked soft, ghee, milk, pulses - soft and emulsified, vegetables cooked soft and sieved would be more agreeable. For early morning, night and similar periods, milk preferably citrated, and slightly sweetened, if required, may be prescribed.

A recent evidence (Lancet, 1949) shows that hyperacidity does not damage gastric mucosa and that on biopsy of gastric mucosa through gastroscope, lesions heal as rapidly in subjects with hyperacidity as in normals.

The success of Hurst regime is, not to a minor content, due to the compulsory rest physical and mental that it emphasises rather than to the/antacids and drugs. Similar rest regime should be ensured, whatever the diet. It is time that we revise our understanding of the etiology of peptic ulcer, especially the stress and strain factors of modern life

Cannon (loc cit) has suggested that social inhibition of hostile action and consequent repressed conflict may give rise to 'positive inductance' - a physiological phenomenon described by Sherington and Pavlov in which inhibition of a reaction is followed by a greater reaction than before. Wolf and Wolff (loc cit) while considering the gastric changes which accompany emotional disturbances as part of a general bodily reaction pattern, have, in the light of the recorded facts, nicely suggested, "Therapeutic efforts, in the management of patients who exhibit the gastritic and ulcer syndrome, should be directed towards preventing or controlling gastric hyperfunction, and the problem resolves itself into one of the care of the man rather than merely his stomach".