**INFLUENCE OF COOKING ON THE NUTRITIONAL VALUE OF FOOD.
MINERAL CONTENT OF SOME COOKED FOODS.

By

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Results of estimation of thiamine, riboflavin, nicotinic acid and ascorbic acid content of some cooked foods have been reported by us previously [Pai, 1957 (a) and (b)]. In this paper the results of estimation of the mineral contents (calcium, phosphorus and iron) of the cooked foods are presented.

MATERIALS & METHODS

The details of the methods of preparation of the various items of foods that have been analysed for their vitamin content have been reported elsewhere (Pai, loc. cit 1957 (a)).

Phosphorus, Iron & Calcium estimations. The sample, after its moisture was completely removed, was ignited first on the burner in order to burn away the fat, if any present in it, and then in the muffle furnace at a temperature not exceeding 550°C. From this the ash content of the sample was determined (A.O.A.C. 1950 ; Pai 1954). The ash obtained was then treated for its successive examination for determining the phosphorus, iron and the calcium content present in it as follows :—

Phosphorus: The phosphate containing solution of the ash was subjected to the treatment of acid molybdate solution, whereby phosphomolybdic acid is formed. On the addition of a suitable reducing agent, the phosphomolybdic acid was selectively reduced to yield a deep blue colour e.g. "molybdenum blue", which is apparently a mixture of lower oxides of molybdenum (Hawk *et al*, 1947). According to the modification suggested by Briggs (1922), the colour which was obtained after reduction with hydroquinone was made more stable by using an acid solution.

Iron. For the estimation of iron content, the method of Elvehjem (1930) was adopted. The acid solution of the ash was made alkaline. It was then boiled to change pyrophosphate to orthophosphate. Thiocyanate solution

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was added and the ferric-thiocyanate formed was extracted with amyl alcohol. The orange-red coloured solution obtained was matched, after having prepared the standard and the blank solutions, in a photoelectric colorimeter using 480 filter.

Calcium. As regards the estimation of calcium content in the material, the method followed was that of Kramer-Tisdall (1921), and later on modified by Clark-Collip (1925). Calcium was precipitated from the solution of ash, as calcium oxalate. This precipitate, which was then separated and washed, was dissolved in hot dilute sulphuric acid solution in which it was titrated against a suitable standard potassium permangnate solution. Due allowance for the blank was made after having obtained the titration reading for blank separately.

In the table the values for the minerals content of the food articles are given on the basis of dry weight in order to have a comparable data for each of the items studied in their precooked and cooked forms respectively. The samples were analysed in duplicate and the results given are the average value obtained thereof.

RESULTS AND DISCUSSIONS

It has already been seen that the variable losses of water soluble vitamins, like thiamine, ascorbic acid, riboflavine etc., occurring during cooking, will depend on several factors, such as the number of washings of the articles of food in their precooked state, the nature and duration of heating to which they are subjected during cooking, etc. (Pai, loc. cit. 1957 (a)&(b)).

Minerals. A considerable range of values for the vitamin content as well as for the minerals e.g. phosphorus, iron and calcium as also the total ash content, is possible since factors such as season, soil condition, length of storage and stage of maturity etc., play vital roles in determining the nutritional value of various foods. This is particularly true in case of vegetables. Krehl and Winters(1950)reported from their study on the effect of method of cooking on retention of vitamins and minerals in vegetables, that the greatest losses of both minerals and vitamins occurred as a result of cooking by the method of water to cover and that the greatest overall retention and smallest loss resulted when vegetables were prepared by the waterless way. In the present series, the %age loss of the overall mineral content as well as the individual minerals is not calculated because, as can be seen from the table, there is no definite order as regards their losses in the preparation studied. This may be due to the fact that the utensils used for cooking these preparations were made of iron and this metal naturally would be affecting the iron content of the preparations cooked in such vessels. Such and other factors as further addition of the table-salt to taste and/or the water, the quantity of which varied from item to item, to these foods during cooking could not be

TABLE

Ash, calcium, Phosphorus and iron content of foods (on dry weight basis).

Sr. No.	Preparation	Ash in gms. %	Phosphorus in mg.%	Iron mg
1	Dough of 'Chapati' from wheat flour.	1·59	123·5	5
2	Chapati from wheat flour.	1·48	128·4	5
3	Dough of bread (Bakery, white).	0·62	155·0	5
4	Bread (Bakery, white).	0·92	153·0	5
5	Dough of 'Puri' from white wheat flour.	1·66	134·5	6
6	'Puri' from white wheat flour.	1·44	133·0	5
7	Dough of 'Bhakari[2], from 'Jowar' flour, white.	1·36	143·5	9
8	'Bhakari' from 'Jowar' flour, white.	1·42	117·5	8
9	Dough of 'Bhakari from 'Bajara[3] flour.	2·74	211·0	13
10	'Bhakari' from 'Bajara' flour.	2 82	203·0	13
11	Dough unfermented for preparing 'Idli'.	4·32	279·3	7
12	Dough fermented for preparing 'Idli'.	4·83	310·8	8
13	'Idli'.	4·50	307·5	7
14	Dough unfermented for preparing 'Dosa'.	4·15	268·1	8
15	Dough fermented for preparing 'Dosa'.	3·95	247·0	7
16	'Dosa'.	2·45	201·0	7
17	Cauliflower (raw) on dry wt. basis.	1·83	155·6	3
18	Cauliflower made ready with ingredients added, for preparing 'Bhaji' (pre-cooked).	2·83	192·0	4
19	Cauliflower 'Bhaji' (cooked).	2·49	201·0	4
90	Cabbage (Raw) on dry wt. basis.	1·78	140·0	2
21	Cabbage made ready with ingredients added for preparing 'Bhaji' (pre-cooked).	2·20	221·0	4

22	Cabbage 'Bhaji' (cooked).	2·01	230·0	
23	Rice, raw, milled.	0·59	112·0	
24	Rice, after being washed (pre-cooked).	0·67	176·2	
25	Rice (cooked).	0·47	163·0	
26	Tuver, red gram 'dahl'.	3·97	281·2	
27	Dahl tuver made ready with ingredients added for preparing liquid 'Dahl' (pre-cooked).	7·60	252·0	
28	'Dahl-Tuver' (liquid) (cooked).	7·42	236·0	
29	Green gram ('mug') without hus.	3·57	319·0	
30	'Mung'-dahl made ready with ingredients added for preparing 'Dahl' (pre-cooked).	6·90	270·0	
31	Mung dahl liquid (cooked).	7·10	280·0	
32	Khichdi of rice and Tuver dahl made ready with ingredients added (pre-cooked).	1·93	207·0	
33	—do—(cooked).	1·73	193·0	
34	Khichdi of Kodri and tuver dahl made ready with ingredient added (pre-cooked).	1·73	189·0	
35	Khichdi of kodri & tuver dahl made ready with ingredients added (cooked)	1·51	190·0	
36	Raw 'Kodri, on dry weight basis.	0·41	76·0	
37	'Kodri' (pre-cooked).	0·46	105·0	
38	'Kodri' (cooked).	0·37	101·0	
39	Kovai-fruit (tender) (tondle) (pre-cooked).	6·5	195·0	
40	—do—(cooked).	6·5	157·0	
41	Pumkin–'bhaji' (pre-cooked).	8·2	187·0	
42	—do—(cooked).	8·1	160·0	

controlled with the result that the % age loss of the mineral content has not been calculated. One of the most important factors affecting the mineral content of the cooked food is the leaching effect of the cooking water.

SUMMARY AND CONCLUSIONS

1. Results of analysis of forty-two items of articles of food for their total ash and the mineral content, namely phosphorus, iron and calcium, in their precooked and cooked stages are presented.

2. The content of the total ash as well as the minerals, namely phosphorus, iron and calcium, in these food preparations was found to vary much, being influenced by the factors such as the nature of the metal of the utensils used during cooking. Another important factor affecting the mineral content of the cooked foods was leaching effect of the cooking water.

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