SOME VALUABLE CONSTITUENTS OF OIL CAKES FROM EAST PAKISTAN

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Oil cakes are usually treated as waste products in East Pakistan. Their intrinsic values have never been considered; they are either used as cattle feed or as fertilizer. If proper statistics of the production of oil cakes are made, the estimated loss will run very high. Our attention was drawn to this problem when a local mill owner quoted the quantity of production of cakes in his one firm running upto lacs of maunds per annum.

Two types of oil cakes are available in East Pakistan : (a) machine-pressed and (b) 'ghani'-pressed cakes. Most city mills tend to extract all oils from cakes by mechanical means and hence the food values of their cakes have been found to be small. The ghani-pressed cakes are available both from the cities as well as from the country sides. They do not deteriorate much in colour and quality. Their food values are also significant, as it has been found in this paper. Moreover, they contain more oil and good flavour. As far as the mustard cakes are concerned, the ghani-pressed varieties have been found to contain larger quantities of allyl isothiocyanate (mustard odour principle) and other valuable nutrients. From these points of view, the ghani-pressed cakes of mustard, sesame and coconut have been analyzed for various constituents. The survey of literature indicated lack of such analyses for the East Pakistan types of these cakes.

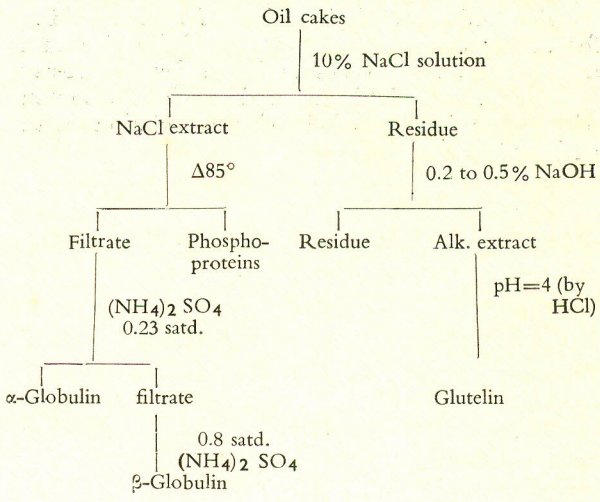
Experimental

Materials.—The seeds of mustard and sesame, as well as ripe coconuts were purchased from the local markets. The seeds and coconut kernel were thoroughly dried and oils in each case were pressed out by ghani, well cleaned ahead. The cakes were dried again and powdered for experiments.

Procedures.—The cakes were initially freed from residual fats by solvent extraction. The defatted cakes were used for different analyses of ash,[1] protein,[2] fibre,[3] starch,[4] free reducing sugar,[5] vitamin E[6] and A,[7] and finally, fractionation of proteins through salt solubilization method.[8] The solubilization method is briefly represented in the chart.

The percentage purity of each fraction was determined by protein contents.[2] The minerals, such as, calcium, magnesium, potassium, sodium,

Chart



iron and phosphorus, were also determined by the standard procedures.[9] The last two minerals have also been determined colorimetrically.[10] The three cakes have been subjected to steam distillation.[11] The processes of leaching with water was carried out by shaking the cakes with water. The water extract on boiling was allowed to precipitate out protein constituents and the filtrate was evaporated to dryness for other water-soluble materials.

The fat, non-saponifiable matter,[12] saponification value,[13] free fatty acid,[13] iodine value,[13] sterols[14] and phospholipids,[15] were determined according to the standard methods. The fat-soluble vitamins[15] (E and A) were also estimated in the fats.

Results and Discussion

The ghani-pressed cakes retain the original flavour, but the machine-pressed ones become somewhat darkened in colour and different in odour. Hence, the nutrients, like minerals (ash), protein, fat, carbohydrates and vitamins (Table 1), may be obtained in better conditions in ghani-pressed cakes. The high percentage of protein in mustard cake has increased its value greatly. Though this cake is not edible, its proteins can be used for various other purposes: glue, plastic and paints. The water extract of mustard cake

contains saponins with some cleansing properties. Each cake has some water-soluble proteins that coagulate on heating as shown in Table 1. The steam distillation did not yield any product, except some traces of odorous principles. Vitamin E in mustard cake is an added asset.

TABLE 1.—NUTRITIVE VALUE OF MUSTARD, SESAME AND COCONUT CAKES.
(g. per 100 g. of the substances).

Analysis	Mustard cake	Sesame cake	Coconut cake
Moisture ..	12.0	7.3	10.3
Ash ..	10.3	11.6	7.1
Total protein ..	40.1	34.1	15.3
Fat ..	13.4	12.6	23.6
Fibre ..	8.9	20.6	13.0
Starch (acid hydrolysis)	14.6	10.2	28.5
Free reducing sugar	1.2	1.0	1.1
Vitamin E ..	Considerable	Traces	nil
Vitamin A ..	nil	nil	nil
Odour ..	Pungent	Strong sesame-like	Appetizing
Colour ..	Greyish yellow	Greyish black	Almost white
Water-leached protein constituents	10.02	3.45	3.67
Water-soluble .. (Sugar, inorg. etc.)	12.6	25.5	23.59

The solubilization of proteins through salts has been shown in Table 2. This suggests the importance of the proteins present in cakes. The phosphoproteins and globulin fractions in cakes may have far-reaching biological values. It may be noted that they can be isolated in pure conditions through proper methods of reprecipitation and dialysis.[8] These specific proteins may be used as food additives or in pharmacological preparations.

TABLE 3.—CHARACTERISTICS OF RESIDUAL FATS IN CAKES.

Analysis	Fats from Mustard cake	Fats from Sesame cake	Fats from Coconut cake
Total fats ..	13.40	12.60	23.60
Non-saponifiable matter ..	4.80	5.10	2.20
Saponification value ..	173.60	186.80	248.60
Free fatty acids ..	0.76	1.26	0.23
Iodine value ..	97.0	106.0	14.0
Sterols ..	1.35	2.60	1.18
Phospholipids ..	nil	nil	nil
Odour ..	Pungent	Tolerable sesame-like	Nice coconut-like
Odour tolerance (acceptability as food)	+ + +	+ +	+ + +
Colour ..	Deep yellow	Light yellow	Almost colourless
Vitamin E ..	Considerable	Traces	nil
Vitamin A ..	nil	nil	nil

TABLE 2.—PERCENTAGE OF DIFFERENT FRACTIONS OF PROTEIN ISOLATED FROM DIFFERENT CAKES BY SALT SOLUBILIZATION METHOD.

Protein fractions	Mustard cake		Sesame cake		Coconut cake	
	Protein fractions %	Purity of protein fractions %	Protein fractions %	Purity of protein fractions %	Protein fractions %	Purity of protein fractions %
α-Globulin	4.20	88.55	5.40	93.25	0.59	—
β-Globulin	3.24	87.15	3.60	97.31	0.51	—
Glutelin	6.10	81.72	8.76	68.44	2.51	—
Phosphoprotein	12.30	60.72	20.00	65.94	2.10	—

TABLE 4.—INORGANIC ELEMENTS IN DIFFERENT CAKES.

Elements	Amount present in 100 g. of ash formed from			Amount present per 100 g. of air dried oil cake		
	Mustard oil cake	Sesame oil cake	Coconut oil cake	Mustard	Sesame	Coconut
Calcium	9.213	10.112	4.579	0.767	0.871	0.2322
Magnesium	6.275	5.055	4.600	0.521	0.587	0.2326
Potassium	10.940	6.271	27.750	0.914	0.728	1.407
Sodium	0.306	0.490	2.441	0.022	0.057	0.124
Iron	0.038	2.920	0.267	0.0031	0.251	0.003
Phosphorus	6.650	9.266	7.604	0.554	1.076	0.385
K (as oxide)	16.500	7.545	33.500	1.372	0.876	1.699

Table 3 indicates the nature of fats extracted from the respective cakes. They are found to be of similar properties as the main bulk of oil initially processed.The larger quantities of the non-saponifiables may be removed by refining processes.[16] It is surprising that the cakes do not contain any phospholipids which usually accompany cakes. It may be attributed to the climatic or soil conditions of the land.

Table 4 gives the mineral contents of each cake. For the advantage of various workers, the minerals have been calculated on the basis of both ash and original oil cake (dried). Calcium in mustard and sesame cakes deserves particular attention. (Potassium (coconut in particular) and sodium are interesting to coronary patients.) Iron and phosphorus in sesame cake bid for better nutritive values. In general, the mineral contents in all cakes are very appreciable. Sesame cake has uniformly high levels of minerals estimated. From the point of view of odour, the sesame and coconut cakes may be turned into edible food products.

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