SCIENTIFIC STUDY AND DEVELOPMENT OF MEAT-BARIAN - A TRADITIONAL FOOD PRODUCT OF THE INDIAN SUB-CONTINENT

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INTRODUCTION

Traditional foods have been studied systematically for too short a time to make a sufficient number of results available. The gradual replacement of the traditional and laborious practices in the production of bread, biscuits, papers, pickles etc. even in villages by organised production and marketing is noteworthy. Practically every grocery store or mini market shop is doing about half its business these days on food products that did not exist same 10-15 years ago. Religious taboos as well as cultural and ethnic restrictions are being replaced by more liberal and rational attitudes and preferences towards food. Taking advantage of these changes, traditional foods are re-entering the markets with concept of appropriate technology and better hygiene.

Barian is a popular traditional food product common to Indian Subcontinent. It is prepared by wet or dry mixing of ground pulses and condiments with or without meat. Since this product is mostly produced in households or on cottage scale in rural areas, no standard receipes, methods of preparation and standards of hygiene are followed during preparation. These products, therefore, have no uniform quality and are of limited shelf life. The product has a sizeable potential for local, urban and rural consumption, as well as for export. This necessitates the hygienic production of uniform standard quality product on a regular basis. Scientific study of standardisation of the various parameters in the production is, therefore, essential. No systematic survey or research on this product appears to have been reported so far.

"Barian" is a reasonably nutritious product. It is desirable that unfulfilled demand of this relatively cheap, nutritious and traditional product be investigated and improved to exploit as an appropriate technology.

METHODOLOGY

Traditional Method of Making "Barian"

The traditional method of preparing "Barian" is to soak the legumes, usually mash (Phaseolus radiatus), "Mung" (Phaseolus mungo) in water in earthen pots and keeping them in the sun for 2 to 3 hrs. The water so warmed in the sun and presumably the rays soften the skin coats (testa) of the pulses, which are then easily rubbed off, and the grain also swells up as it absorbs water. The swollen and succulent grain are then ground in a stone pot with a wooden log shaped for this purpose. The mass so obtained is called "pithi". This part of the operation is very laborious and time consuming but is presumed to helps in improving the texture and colour of the traditionally-made finished products, as lot of air is incorporated in the "pithi". However, some large scale producers may use machines for the grinding of "dals" and for mixing them with condiments in which case the product may not be as good.

Some manufacturers keep the dough "tight" by coarse grinding of the soaked "dals" (pulses) and others make it slack by grinding it fine. The former may yield a product of darker colour and tougher texture, and the latter type makes a product of light colour and smooth finish.

To the dough/"pithi" prepared by either method, are added thoroughly mixed selected

condiments and salt in appropriate quantities and other ingredients (flavouring agents) which are normally chosen from:

1. Corriander,
2. Chillies
3. Black pepper
4. Dried fenugreek
5. Cumin seeds
6. Garlic powder
7. Turmeric
8. Cinnamon
9. Cloves
10. Cardamum
11. Onion powder
12. Plums
13. Fresh tomatoes or ketchup
14. Dried pomegranate seeds.

Some manufacturers add corn starch called "arraroot" to enhance binding in the dough.

The meat (both beef and mutton) incorporation is of strict economic sonsideration. However, during Eid-ul-Azha (Muslim's big religious festival) when animals like goats, sheep, cows, camels etc. are sacrificed in millions and meat is in abundance "meat barian" may be prepared for domestic use according to the requirement. It is more or less a practice to preserve the extra meat available on such occasions. Meat "Barians" are considered a delicacy and hence are preferred over other types. Commercially meat "Barians" are very rarely available. Manufacturers when quarried disclosed that meat addition shortens shelf-life and raises price.

From the dough prepared (whether plain or containing meat) generally womenfolk cast or shape "barian" by hand. For commercial production both men and women are employed for this job.

Drying

The existing commercial practice is to put the product on sheets of cloth (or old bed sheet) spread on a cot and the product is allowed to dry in the sun till it is almost bone dry. It may take usually 2/3 days in summer, which is peak season of production. During the rainy season (July-September) "barian" producers face the most difficult time. The product cannot be fully dried due to high humidity and when the rain falls on the spread products, the whole lot may go mouldy.

In commercial practice people employ the "sarkanda tray" (Saccharum sara) and still others use portable metallic trolleys comprising many shelves fitted with such "sarkanda tray". These trollies can be pulled in and out of the sunny or rainy areas as and when the need arises.

Laboratory Method of Meat Barian

The legumes mash, mung and/or gram freshly purchased from the local market were sieved, washed and soaked for 2 hours at room temperature (upto 25°-30°C). It was dehulled (where required) under running tap water by hand rubbing. The soaking time of 2 hours was selected on the basis of water absorption curves made for each "dal" at room temperature (25°C). The dehulled wet "dals" were spread again at room temperature for 1 hour to effect some reduction in the moisture content which leads to the desired dough consistency.

Meat (Beef) Preparation

Freshly purchased or frozen stored buffalo meat (Beeflo) in the required quantity was trimmed, chopped into 3 to 4 cm cubes and cured with 150 ppm and 100 ppm of potassium nitrate and sodium nitrite respectively for 2 hours.

The chops were then cooked with the cure water for 20 to 30 min. The cured and cooked meat was then spread on false bottom trays until cooled to room temperature.

Grinding and Mixing

The wet legumes and cured cooked meat chops were fed into the meat mincer having a plate of pore size 4 mm and the following condiments were added:

1. Salt	86 g	4. Coriander (crushed)	34 g
2. Red chillies	12 g	5. Black pepper	14 g
3. White cumin	20 g		

A more thorough mixing was affected by manual kneading. Introduction of a suitable machine to improve this step is under study. A mixed uniform dough was obtained.

Casting

Machine casting: A hand operated mincing machine (local size No. 21) was adopted for use to extrude six corner star shaped solid or hollow sticks.

Manual casting: In this case "barians" were made by hand casting to size them round or oval to near uniform weight of about 10 gm. Since hand casting vary from person to person in shape and size, a wide variety of manual cast "barians" were made for comparison with the commercial market.

Drying: Drying was affected by mechanical means, oven and solar drying.

Steel trollies loaded with the wet-cast Barian, are inserted into the tunnel dryer from one end, moving on metallic line from higher temperature (70°C) to lower temperature (55°C) in about eight hours. Finally these are placed in the finisher dryer (50°C) for 8 hours to bring down the terminal moisture around 6-8%.

Packaging and storage

For the selection of the packaging material to the producer, consumer and its continuous availability, it was decided to use polyethylene (PE) and polypropylene (PP) as packaging materials. Less educated or illitrate consumers of the developing countries use visibility criterion of a packet to decide the purchase. Two different densities of PE and PP were used to monitor the packaging and storeability. The technical data of the two packaging type used is as under:

1. Polyethylene thin (PE-1) 0.302 gm/100 cm^2
2. Polyethylene thick(PE-2) 0.457 gm/100 cm^2
3. Polypropylene thin(PP-1) 0.228 gm/100 cm^2
4. Polypropylene thick(PP-2) 0.357 gm/100 cm^2

Various tests were carried out at regular intervals until the termination of storage period of 6 months.

RESULTS AND DISCUSSION

1. Proximate Analysis:

Table-1 describes the proximate analysis of some commercially available varieties of Barian. The samples were procured from about 2-3 different places in about 5 small and big cities of Pakistan. The table gives the comparable protein content of laboratory made meat barian and of commercial ones. The comparison of laboratory made and commercial may not show significant difference in the protein content yet the improvement in quality, as a result of beef incorporation, was obvious from the nutritional studies carried out on rats

2. Meat (Beef) incorporation

Based on our preliminary studies with respect to beef incorporation in Barian and from cost considerations, the use of Beeflo beyond 30% does not appear feasible. Statistically speaking 25% addition of beef was found to be optimum (at 5% level) to indicate the presence of meat without jeopardising the other traditional traits of the product. It was however, noted that addition of 50% meat on fresh weight basis was more likeable. It was presumed that higher levels of beef may attract discrimination towards Barian, which are traditionally associated with flavour of raw pulses and the beefy flavour would then dominate to that of the pulses.

Barian Formulation

Beef-pulses products (Barian) were tested using various concentrations of beef and pulses . Different percentages of beef have also been used with various combinations of pulses. The purpose was to locate appropriate multiple combinations in respect of grinding, forms of beef used (fibre-type, chopped, minced), machine extruded or manually cast.

The net conclusion of these experimentation was that the wet grinding was significantly superior over dry grinding of the pulses. The "Barians" made using dry pulse powder was dark in colour, hard and not of acceptable shape. On the other hand those prepared from wet grinding appeared light in colour and weight, smooth on the surface, crisp and porous from inside. Probable explanation for this phenomenon may be greater incorporation of air in the wet grinding method. Also elevation of temperature during grinding may be bringing about fermentation to some extent. This also makes drying easier and the product fluffy.

The comparison of machine extruded product with the manual cast favoured the latter. Due to the application of high pressure used in the extrusion process, the particles of different ingredients are pushed too close to yield the tough and hard structure in "Barians". These findings were substantiated by comparison of rehydration ratios (Table- 2)of the two cast-types. The manually cast samples consistently yielded higher ratios than their machine-cast counterparts.

Best results of drying were obtained at 60-65^{o}C where it took around 16-18 hours. Increased use of "dal mash" in the blend increased the drying time. The use of "dal mung" and lentils reduced the drying time (Table-6).

Amongst the three shapes of meat, minced, chopped and fibre-type, the latter was more acceptable on the basis of its visual appeal in the fresh "Barians". The machine minced meat was next in order and largest in commercial use. Table- 3 describes the preference testing of of 3 "dals" based on hedonic scale showing that beef-pulses Barian made from "dal mash" and "mung" are superior to "dal gram". "Dal gram Barian", however, obtained good marks in flavour, yet these failed badly in respect of maintaining their shape during and the desired texture after cooking. Dal gram was also not common in use in commercial samples of the product.

Amongst the use of "dal mash" and "mung", the former was favoured which is used in more than about 80-90% of commercially produced "Barian".

The statistical testing was applied using Frideman's test to test the Null hypothesis which showed significant positive difference in favour of "dal mash".

Drying Methods

Potential use of solar energy in comparison with natural gas, both of which are abundantly available in Pakistan, was investigated using selected formulations of "Barian". It was Concluded that the three drying methods have different effects in respect of quality parameters and the results favoured natural gas drying closely followd by solar drying(Table-4).

Other Parameters:

Effect of various drying methods on the amount of important nutrients like available Lysine, vitamins B_1 and B_2 was investigated. Maximum losses in these occured during open sun drying because of the prolonged exposure to uncontrolled wavelengths of sun light(Table-5).

The microbiological testing indicated absence of food-born pathogens initially and throughout the storage period. Since there is no prescribed microbiological standards for this traditional food product a good manufacturing practice (GMP) is the sole guidance. A microbiologically safe storage of upto 6 months of barian in the two cheaper packaging (PE, PP) is possible.

The organoleptic testing of meat barian after storage of 6 months showed no significant difference in respect of colour, flavour, and taste in the two types of packaging. There was also found no significant difference in biological evaluation after storage of 6 months at room temperature. Similarly no significant change was observed in non-enzymic browning and rancidity value.

Table 1

Proximate analysis of 'Barian' samples

Chemical Constituents (%)	Lahore City						Other Cities/Towns						Laboratory Made			
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4
Moisture	11.7	11.8	9.4	10.3	11.7	10.6	11.2	9.3	5.5	4.6	9.0	8.1	7.6	9.2	9.0	9.0
Starch	55.8	52.7	60.6	61.5	60.6	56.6	58.5	56.0	55.7	59.7	58.8	58.2	55.7	58.4	54.9	51.6
Protein	20.7	24.2	20.9	21.0	20.2	22.2	22.5	23.8	25.2	23.2	23.2	23.1	23.7	22.1	23.1	25.3
Ash	7.75	7.8	5.46	4.95	4.35	6.5	3.25	6.85	8.8	8.43	4.7	6.5	7.65	6.3	9.32	9.53
Fat	2.38	1.9	2.09	1.98	1.58	1.35	1.5	1.63	2.35	2.38	2.5	2.1	2.48	2.2	1.98	2.01
Calcium	0.14	0.12	0.14	0.23	0.33	0.55	0.48	0.30	0.28	0.28	0.34	0.55	0.38	0.37	0.38	0.42
Fibre	2.32	1.54	1.96	1.14	1.33	2.27	2.51	2.30	2.19	2.43	1.53	1.18	2.73	1.55	1.69	2.20
Iron mg/100 gm.	19.0	20.0	10.6	21.0	13.4	11.8	11.0	10.5	49.0	10.0	11.0	20.3	13.0	18.0	17.0	19.6

Table-5
Effect of Different Drying Methods on the Nutritional Components of Beef/Pulses "Barian"

Samples Drying*	Dal	Available lysine (gm/100 gm sample	Vitamin B_1 (mg/100 gm sample	Vitamin B_2 (mg/100 gm sample)
S	Mash	1.12	255	190
S	Mung	1.01	280	193
Sd	Mash	1.21	260	220
Sd	Mung	1.05	290	215
NG	Mash	1.31	275	215
NG	Mung	1.15	295	224

S : open sun ; Sd : Solar dryer ; NG : Forced air natural gas.

Table 6 Drying time and temperatures for Barian made from different dals and with different %ages of beef (cabinet dryer - electrical).

S. No.	Temperature (°C)	Drying time: 25% Beef Mash (hr)	25% Beef Mash + gram (hr)	25% Beef Gram (hr)	50% Beef Mash + (hr)	50% Beef Mash + gram (hr)	Mung (hr)
1.	60	18	14	14	10	13	15
2.	70	13	12	12	10	10	10
3.	80	13	10	10	10	9	8
4.	90	9	9	9	8	9	8
5.	100	6	6	6	7	8	7

1. Each batch studied was about 8 kg wet weight.
2. Varying the rate of air velocity to high, medium and low made insignificant affect on drying rate at any one temperature.

Table 2 Comparison of the rehydration studies of beef-pulses product (Barian) made in the laboratory (wet method) with market samples (rehydration time 2 hrs).

Serial	Combination of pulses (%)	Fresh beef form used (%)	Forming/ casting	Rehydration ratio
1.	Mash (44) + gram (19)	Minced (37)	Machine	1.50
2.	Mash (44) + lentile (19)	"	"	1.51
3.	Mash (63)	"	"	1.50
4.	Mash (44) + gram (19)	"	Manual	1.63
5.	Mash (44) + lentile (19)	"	"	1.73
6.	Mash (63)	"	"	1.71
7.	Market sample No. 1	Nil	"	1.52
8.	Market sample No. 2	Nil	"	1.24
9.	Market sample No. 3	Nil	"	Broken down
10.	Market sample No. 4	Nil	"	1.42
11.	Market sample No. 5	Nil	"	Broken down
12.	Market sample No. 6	Nil	"	1.36

Table-3
Preference Testing of "Barian" Using Three Different "Dals" with 25% Beef

Parameters	Mash 75%	Mung 75%	Gram 75%
Colour	8.5	7.2	5.0
Flavour	7.8	7.4	6.6
Shape/Size	8.0	7.2	4.6
Taste	9.0	7.3	6.2
Texture	8.4	6.5	4.8

1. The values are average of thirty panelists.
2. Rating 0-3 means poor, 4-5 means fair, 6-8 means good, 9-10 means excellent.
3. Almost invariably the "Barian" samples having gram were broken down during cooking. It also happened in case of Dal Mung to some extent.

Table-4 Effect of Three Different Drying Methods on Beef/Pulses Barian (Beef 25% in all cases)

No.	Sample code Drying*	'Dal'	Temperature range during drying	Drying time	Visual inspection
1.	S	Mash	30°C—55°C	3 days or more	Slightly dull color with lot of dust particles
2.	S	Mung	—do—	—do—	
3.	Sd	Mash	40°C--50°C	2 — 2½ days	Slightly darkish glaxy in case of dal Mung
4.	Sd	Mung	—do—	—do—	
5.	NG	Mash	65°C	8—9 hours	Best drying and best color amongst all, Brownish red tinge of dal Mung was likeable.
6.	NG	Mung	—do—	—do—	
7.	Commercial samples (S) (no beef)	Open sun dries	Unknow	3—5 sunny days	A big variety in color, shape, and size

S : Open sun ; Sd : Solar dryer ; NG : Forced air natural gas.

Table 7 Biological evaluation of wheat flour containing different percentage of 'Barian' compared with commercial samples.

No.	Diet (wheat floor containing)	Protein in the diet (%)	Net weight gain (gm)	PER	Food efficiency
	Dal Mash				6.44
1.	10% (lab. sample)	12.63	166.00	1.33	5.23
2.	20% (lab. sample)	15.13	186.00	1.33	4.61
3.	30% (lab. sample)	17.00	210.00	1.29	6.42
	Dal Mung				
4	10% (lab. sample)	12.80	150.00	1.22	5.40
5.	20% (lab. sample)	14.60	170.00	1.27	4.62
6.	30% (lab. sample)	16.40	207.00	1.32	7.42
	Commercial sample				
7.	10% Barian (commercial)	14.50	128.00	0.93	8.28
8.	20% Barian (commercial)	16.50	114.00	0.73	8.07
9.	30% Barian (commercial)	17.50	128.00	0.94	