PROXIMATE ANALYSIS OF A NATIVE BEER *PACHWAI* OF THE ABORIGINAL TRIBES IN BENGAL

By S. NEOGI, M.Sc.

Analyst, Public Health Laboratory, Khulna (Bengal)

Pachwai is a country-made potable spirit, extensively consumed by the miners and the low class people in the Asansol mining settlement. Recently Chopra and Chopra (1933) have pointed out that it is the universal drink of most of the aboriginal tribes, such as the Sontals and Bhils, which inhabit the Chota Nagpur hills, and that its use has spread all over the province of Bengal. Men, women and children of tender age freely indulge in taking it. It is a very cheap beverage. One can get a pint of spirit for the small sum of two pice. On an average a man will consume about 6 to 8 pints during the day.

It is a very crude wort, ugly to look at. To many it would appear at first glance to be a deadly poison, containing innumerable bacteria, fit to be discarded from a hygienic point of view.

The Asansol mining settlement is the abode of cholera epidemics and there was a time when this *pachwai* was suspected to be one of the gateways of the transmission of cholera. On inspecting several grog shops it was found that the vats in which the boiled rice was kept for fermentation with yeast (locally named *bakhar*) was wholly covered up with swarms of flies and other insects. These are only partially separated by mechanical methods. This has tempted me to study it thoroughly from a hygienic point of view. On enquiry it was learnt that about 90 per cent of miners and general low class people of this mining area take the *pachwai*. In this article an attempt has been made towards the study of the proximate principles of this potable spirit, its bacteriological and microscopical examinations and the viability of different pathogenic bacteria in it.

Preparation.—It is prepared in a most crude and simple manner. Generally about 5 seers of rice are boiled with water for 2 to 3 hours, until an almost dry dough of boiled rice is obtained. This is then packed with the addition of necessary yeast (locally named *bakhar*) in an earthenware vat and kept in a damp and warm place with the mouth of the vessel tightly closed by a lid or cover, where fermentation is allowed to continue for 3 days. After 3 days a large amount of boiling water is added and the dilute watery solution of the spirit is separated from the 'lees' or residue, which consists chiefly of unfermented starch and yeast cells, by means of an iron net which serves the purpose of a strainer, and the filtrate as allowed through the network carries along a large amount of gelatinous boiled rice with the dilute watery mixture of the alcohol which constitutes the *pachwai*.

Physical characteristics.—It has a light yellowish tint. It is distinctly acidic, its pH value being slightly lower than 3. It has a peculiar flavour and contains much dissolved gas which causes it to froth. It exhibits ropiness. The yeast is not completely separated; yeast and many Gram-positive bacteria were detected by the hanging-drop method and staining method (detailed examination is proceeding). Microscopical examination of a loopful of *pachwai* revealed the presence of abundant yeast cells and some Gram-positive bacteria.

The yeast cells have the following characteristics :—Endospores, budding, Gram-positive and gas reaction.

Experimental

Samples of grog from different shops within the Asansol mining settlement have been analysed for :—its alcoholic content, fixed acidity, ash, starch, dextrin and cellulose, proteins, volatile acidity, ester, total solid matter, and suspended matter.

The large amount of gas present which causes it to froth during pipetting, measuring and distilling is got rid of before starting the analysis by the 'tossing method', in which process it is quickly poured from one vessel to another and back again several times, the

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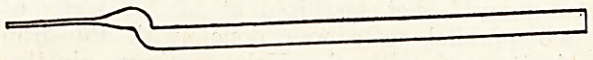
paper. A rubber teat is attached to work the pipette.



Special drop pipette for use in Kahn test.

The calibration was carried out by repeated trials as follows :—

A Wright's pipette with a long tapering end was made. Fifty drops of the antigen emulsion were dropped into a small tube with this pipette and the whole quantity was measured with a measuring pipette. If the quantity was found less than 0.625 c.cm., the tapering end was filed off a little higher to give a bigger drop and then another 50 drops were measured. Thus by a series of trials the correct diameter of the lower end of the pipette was determined which gave 0.625 c.cm. for 50 drops. This diameter was measured with the standard drill and wire gauge and it was found to be no. 54.

When 50 drops measure 0.625 c.cm. one drop from such a pipette measures 0.0125 c.cm. provided the pipette is held vertically and the antigen dropped at a uniform rate of 30 drops per minute. Thus one drop, two drops and four drops will give 0.0125, 0.025 and 0.05 c.cm. respectively.

solution being thoroughly agitated throughout the process.

Alcohol is estimated by the direct distillation method. 250 c.cm. of the sample are distilled until about 200 c.cm. of the distillate have been collected and made up to the mark with distilled water. Alcohol is estimated from its specific gravity.

Fifty c.c. of the sample are evaporated on a water-bath and dried at 100°C. for total solid matter and 25 c.cm. are filtered, the residue dried at 100°C. and weighed for suspended matter.

Total acidity is determined after by washing 25 c.cm. of it by means of N/10 alkali using phenolphthalein as outside indicator; it is recorded in terms of crystallized tartaric acid per cent. Twenty-five c.cm. of the spirit are then evaporated in a china basin to a volume of 2 to 3 c.cm., hot water is then added and the whole again evaporated down to 3 c.cm. and the process is repeated once more. The solution is then titrated for volatile acidity.

Starch, dextrin and *cellulose* are estimated by hydrolysis with dilute hydrochloric acid under reflux and the sugar is estimated by Fehling's method.

Ester is estimated by saponification with N/10 alkali. Protein is estimated by Kjeldahl's method.

The figures obtained in connection with analysis of *pachwai* can be compared with those of some typical foreign beers with similar low percentage of alcohol, acidity and proteins.

On enquiry we have learnt on an average a person takes about 2 to 3 litres of *pachwai* during the whole day. Therefore the production of energy or physiological heat units by the proximate principles of *pachwai* in the human organism at rest can be estimated in calories thus :—

In 3 litres average carbohydrates = 30 grammes.

Proteins = 12 grammes.

Production of heat

Metabolism of	Large calories.
Proteins (12 grammes) ..	12×4 = 48.0
Carbohydrates (30 grammes)	30×4.1=123.0
Total	171.0

The food value of 30 grammes of alcohol which is at the same time a stimulant and food adjunct is small. Along with these the important alcoholic solution of yeast is taken which contains the anti-neuritic vitamin B. It is highly probable that the use of yeast along

Table I

Number of samples	Alcohol, per cent	Suspended matter at 100°C., per cent	Total solid at 100°C., per cent	Ash, per cent	Starch, dextrin and cellulose, per cent	Proteins, per cent	Volatile acidity, per cent	Fixed acidity, per cent	Esters, per cent
1	4.2	1.32	2.43	0.14	1.12	0.42	0.28	0.024	0.0062
2	3.9	1.56	2.36	0.11	0.88	0.36	0.21	0.022	0.0076
3	4.1	1.21	2.68	0.12	1.01	0.32	0.20	0.012	0.0064
4	4.4	1.36	2.15	0.13	1.21	0.45	0.21	0.010	0.0068
5	4.6	1.57	2.15	0.11	0.94	0.29	0.28	0.024	0.0052
6	4.2	1.09	1.82	0.09	0.86	0.52	0.26	0.021	0.0048
7	4.6	1.24	1.92	0.12	1.21	0.41	0.23	0.016	0.0032

Table II

Analysis of some typical beers (Moor and Partridge, 1930)

	Sp. gr. at 15.5	Alcohol, per cent by weight	Extract	Ash	Acidity as acetic acid	Proteins
Bitter ale ..	..	5.4	5.4	..	0.1	0.16
Burton, pale ..	..	5.4	5.1	..	0.1	0.21
Burton, pale ..	1.0106	5.3	5.1	0.3	0.2	..
Scotch, pale ..	..	8.5	10.9	..	..	0.74
Bass's pale ..	1.0138	6.2	7.0	..	0.3	0.58
Lager, American	1.0162	2.8	6.0	0.3	0.2	0.45
Lager, Munich ..	1.0110	5.1	5.0	0.2	..	0.83
India, pale ale ..	1.0125	4.3	..	0.25	0.15	..
Irish stout ..	1.0160	4.3	..	0.23	0.17	..
Bock ..	1.0205	4.5	..	0.27	0.12	..
Mild ale ..	1.0101	3.15	..	0.2	0.08	..

with *pachwai* may be one of the predominating factors accounting for the total absence of beriberi or epidemic dropsy in this mining area.

Summary

A perusal of table I will show that this *pachwai* contains only a small percentage of alcohol; in most cases it is below 5 per cent.

By comparing the results of tables I and II it will be seen that the proximate principles of *pachwai* can be aptly compared with those of some typical foreign beers.

Its nutritive values have been established and the production of energy or physiological heat units have been shown to be on an average about 171.0 large calories for 3 litres.

It contains solutions of vitamins belonging to the groups B_1 and B_2 derived from yeasts which promote growth and nutrition and the extensive use of this beverage may be one of the predominating factors of the total absence of beriberi or epidemic dropsy throughout this mining area.

Acknowledgment

I wish to express my thanks to Dr. B. Mukherjee, M.B., D.P.H., Assistant Director of Public Health, Bengal, for his kindly suggesting this work to me and for his keen interest throughout the work.

This work was undertaken while the author was working in the Asansol Mines Board of Health Laboratory, Asansol (Bengal).

[*Note.*—We publish this paper because we feel that the data may be of value to those interested in the subject. We must, however, protest against the last paragraph of the writer's summary, and the suggestion that it contains. It is well known that yeast is used in the preparation of *pachwai* and also that yeast is a potent source of vitamin-B complex, but nowhere in the paper has the writer reported any experimental work that shows the presence of vitamin B in *pachwai*, in large or even in small quantities.

There is little evidence that beriberi is prevalent anywhere in Bengal or Bihar so that its absence from the mining area is not remarkable.

There is little evidence that vitamin-B deficiency plays any part in the ætiology of epidemic dropsy, so that the freedom of the mining area from epidemic dropsy—if in fact it is free—can scarcely be attributed to the high-vitamin-B content of *pachwai*, which the writer assumes—probably rightly—but has not demonstrated, and the reputed indulgence of the inhabitants of this area in this drink.—Editor, *I. M. G.*]

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ÆTIOLOGY OF PRIMARY GLAUCOMA*

By B. G. S. ACHARYA, B.A., M.S., F.R.C.S.E., D.O.
Professor of Ophthalmology, University of Lucknow
and
J. N. JASWAL, M.B., B.S., D.O.M.S. (Eng.), P.M.S.
Research Fellow, University of Lucknow

Primary glaucoma is a common disease in India (two per cent of all eye cases) and its ætiology is still unknown, in spite of the fact that much work has been done all over the world to investigate it. The junior writer of this paper was appointed as a research fellow by the University of Lucknow to investigate the ætiology of this disease, with the guidance of the senior writer.

Methods of investigation employed were suggested by the saying that 'glaucoma is a sick eye in a sick body'. Patients were investigated regarding race, age, profession, diet, use of intoxicants, physique, time of the day of the attack of glaucomatous symptoms, the eye first affected, tonometric and blood-pressure readings, pulse rate, erythrocyte sedimentation rate, liver-efficiency test, blood-urea estimation, urea-concentration test, septic foci, and basal metabolism. In order to have control findings, normal healthy individuals of advanced age were also investigated.

We do not propose to give full details of the methods employed, or to give the tables showing the results of all the findings, so only those findings that might throw further light on the ætiology of glaucoma are discussed briefly.

One of us (B. G. S. A.) has maintained for the past many years that primary glaucoma is mostly due to general metabolic disorders, and from time to time he had the basal metabolism rate done and found that it was invariably higher than in normal individuals of advanced ages. Liver-efficiency tests (bromosulphalein) were done, but in no case in the first twelve was any deficiency noted.

Nitrogen metabolism was considered; in almost every case the blood urea was found slightly but definitely increased. The average value in 84 glaucomatous cases was 42.9 milligrammes per 100 c.cm., as compared with the average 34.5 milligrammes in 28 non-glaucomatous patients of advanced ages. In this connection it is worth while noting that blood urea is comparatively lower in the Indian than in the European.

The urea concentration was 2.43 per cent in 34 glaucomatous patients against 2.56 per cent in normal healthy individuals.

Sixty-eight out of 100 patients were non-vegetarians, but, for practical purposes, all Indians should be considered as vegetarians because they take very little meat, and therefore little value is attached to this last finding. The proportion of Mohammedans to Hindus in

* Rearranged by Editor.