Nutritional Value of Beer *with Reference to the* Low Salt Diet

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The place of the low sodium diet in the treatment of congestive heart failure and of certain renal diseases has been well established, while the use of the low sodium diet in the management of hypertension is still a matter of controversy. A recent demonstration by flame photometry that beer is truly low in sodium has stimulated further studies on the use of beer in diet therapy.

Table I lists the sodium content for beer in 25 breweries in the United States, as determined by flame photometry.[1] The twenty-five samples examined disclose an arithmetical average sodium content of 6.95 mg. per 100 Gm., with a low of 1.52 and a high of 20.35 mg. The samples represent approximately 37½ per cent of the total United States production capacity.

TABLE I

Comparative Sodium Content of Beer in 25 U. S. Breweries

Beer and ale	Brewery code no.	Beer and ale	Brewery code no.
Mg./100 Gm.		*Mg./100 Gm.*	
1.52	23	7.05	4
1.70	16	8.20	6
2.00	18	9.17	20
2.18	19	9.44	3
2.40	2	10.20	11
2.50	21	10.24	7
2.68	17	10.24	10
2.87	22	13.15	14
2.97	1	13.30	15
4.13	5	14.00	25
4.17	9	14.60	12
4.47	8	20.35	24
6.32	13		

Public drinking water supplies containing less than 10 mg. per 100 cc. are generally accepted[2] as suitable for low sodium diets. This is in excess of the figure just shown for the United States average sodium content of beer of 6.95 mg. per 100 Gm. This is compared in Table II with the sodium value of various beverages usually permitted on the low sodium diet.[2]

TABLE II

Sodium Value of Various Beverages

	Sodium
	Mg./100 Gm.
Ginger ale	8
Whole milk	51
Root Beer	8
Carbonated water	18
Lemon-lime soda	7
Cola drinks	1–15

Plan of Study

The sodium content of beer is standard by chemical assay from bottle to bottle, but there is wide variation in the sodium content of many foods used in the "low salt diet." We decided to test the effect of beer in the low salt diet on normal patients, that is, patients without heart or kidney disease, to see if true salt restriction could be obtained. Since the body tends to conserve sodium when the sodium intake is limited, a suitable method of determining whether true salt restriction is being obtained is to measure the 24-hour output of urinary sodium while the patient is on a restricted sodium intake. If true sodium re-

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striction is achieved, the urinary level of sodium excretion should fall rapidly to a low level and remain at a low level as long as salt restriction is maintained.

Methods

Four patients with no evidence of cardiac or renal disease were placed on a 500- or 250-mg. regular hospital "low sodium" diet for a period of five days. The fluid intake was limited to 2000 cc. per day. The daily urinary excretion of sodium was measured. During the second five-day period, one-fourth of the total calories in the low sodium diet were obtained in the form of a standard American beer (2.9 mg. of sodium per 100 Gm.) This is equivalent to 1530 cc. of beer per day. The total fluid intake was similarly maintained at 2000 cc. per day, and again the daily urinary excretion of sodium was measured. After five days on this program, the patients were again returned to the regular 500- or 250-mg. sodium hospital diet, and similar measurements were made as during the first period.

Table III shows the type of diet used in this project. It will be seen that beer may be substituted in the diet without diminution in protein content. The beer used in this project had the following mineral constituents per 12-ounce bottle:

Phosphorus	125.80 mg.
Calcium Oxide	28.56 mg.
Iron	0.08 mg.
Copper	0.07 mg.
Manganese	0.03 mg.

The nutritional breakdown of the regular hospital 250- and 500-mg. sodium diet compared with the diet containing beer is listed in Table III. It will be seen that the inclusion of beer in the low sodium diet brings the calcium, phosphorus, and iron content over the minimum recommendations of the National Research Council (Table IV).

Beer may also be a valuable part of such a diet because of its vitamin content, particularly riboflavin, pyridoxine, and niacin. Beer has a relatively low caloric content of approximately 160 cal. per 12-oz. bottle.

TABLE III

Type of Diet Used in Project

Type of diet	Diet before addition of beer	1150 and 1530 cc. beer alone	Total for diet including beer
Calories	1177–1262	480–640	1650–1900
Protein, Gm.	60–68	3.20–4.30	62–72
Carbohydrate, Gm.	117–124	50–67	167–191
Fat, Gm.	49–63	—	49–63
Alcohol, Gm.	—	40–55	40–55
Fluid, cc.	470–850	1150–1530	2000
Sodium, mg.	220–470	34–45	254–515

TABLE IV

Mineral Breakdown of Regular Low Salt Diet and Low Salt Diet with Beer Included

	Calcium	Phosphorus	Iron
	Gm.	*Gm.*	*mg.*
NRC recommended allowance per day	1.0	1.5	12
Diet including beer	1.75	1.77	13.14
Regular hospital 500 mg. Na diet with milk	0.9	1.4	13.9

Reference to Figure 1 shows that during the first five-day period these patients had a rapid fall in the urinary excretion of sodium. This low total daily excretion of sodium continued

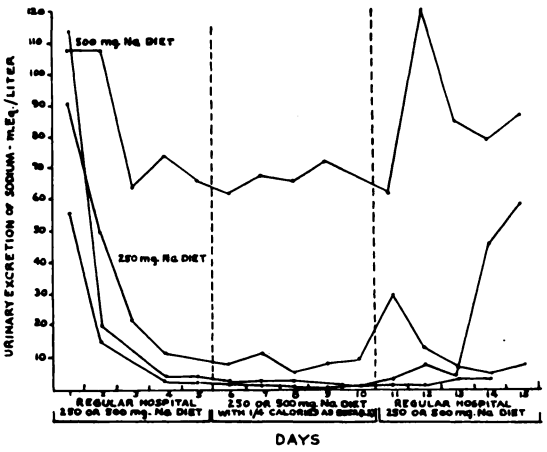

Fig. 1. Daily output of sodium of 4 patients while on the regular hospital low salt diet and the low salt diet with the inclusion of beer. Note low sodium excretion during period of beer included diet. Note irregular and elevated excretion of urinary sodium during last period when patients were again placed on the regular hospital low salt diet, indicating that rigid sodium restriction was not being obtained.

throughout the period in which beer was included in the diet. However, it will be noted that during the last five days when the patients were again placed on the regular hospital low sodium diet there was wide fluctuation in the urinary output of sodium in three cases, indicating that true sodium restriction was not being maintained as well during this period as during the period when the diet included beer. The reason for this is probably that the regular hospital low sodium diet varied considerably in actual sodium content from day to day, due to the variation in the sodium content of the foods used. However, the inclusion of one-quarter of the calories in the form of beer with accurate sodium content from bottle to bottle made possible a more consistent and lower intake of sodium from day to day as indicated by the low and even excretion of sodium in the urine.

Discussion

A search of the modern scientific literature reveals that little attention has been given to the use of beer in therapeutic situations. Some reference has been given to the nutritive value of beer, and other information regarding its nutritional value can be inferred from studies performed on alcohol and alcohol solutions. Daniel[3] concludes from his study of alcohol metabolism and his review of the literature that alcohol spares carbohydrate, fat, and protein because of the fact that it cannot be stored in the body. It is rapidly oxidized in the presence of normal liver function to acetaldehyde and then to acetic acid and acetates. These can be oxidized by all the tissues of the body, providing energy for muscular work and for the maintenance of body temperature. Daniel concludes that as much as 70 per cent of the caloric value of ingested alcohol can be thus utilized.

Newman, Wilson, and Newman[4] have concluded that the ability of the average individual to metabolize alcohol per 24-hour period far exceeds the amount contained in 36 to 48 ounces of beer.

Some attention has been given to the effect of beer and of solutions of ethyl alcohol on renal function. Bruger, Localio, and Guthrie[5] report their observations on the renal function of various patients to whom alcohol itself was administered. They observed that moderate diuresis was frequently induced, even in patients with marked impairment of renal function. No untoward effects in subjects with normal kidneys were observed, nor were they observed in patients suffering from various stages of glomerulonephritis. A transient rise in the red cell component of the Addis count was observed in patients with "arteriosclerotic nephritis" (nephrosclerosis), and in these patients impairment of renal function studies increased temporarily following the ingestion of alcohol. They were able to state categorically, however, that the ingestion of alcohol (in amounts somewhat greater than would be contained in 36 to 48 ounces of beer) did not produce aggravation of chronic diffuse glomerulonephritis, nor did it retard the expected degree of recovery.

Strouse *et al.*[6] have shown that there are no harmful effects from the use of beer in the diabetic diet.

Summary

The true low sodium content of beer is indicated. Analysis of 25 representative samples of beer reveals an average sodium content of 6.95 mg./100 Gm. This may be compared to drinking water containing 10 mg./100 cc. used in the "low salt" diet.

The study of the urinary excretion of sodium in four patients while on a regular low sodium diet and while on a low sodium diet including beer indicates that more accurate salt restriction is obtained on the diet in which beer is included.

The use of beer in some therapeutic situations is discussed.

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Resumen

Valor nutritivo de la cerveza, con referencia a la dieta pobre en sodio

Se demuestra el contenido verdaderamente bajo en sodio de la cerveza. El análisis de 25 cervezas representivas revela un contenido de sodio de 6,95 miligramos/100 gramos. Esto se puede comparar con el agua, que contiene 10 mg./100 cc., y que se emplea comunmente en la dieta pobre en sodio.

El estudio de la excreción de sodio en las orinas de 4 pacientes durante su adherencia a una dieta pobre en sodio *standard* y luego a una dieta pobre en sodio pero incluyendo la cerveza, indica que una restricción más precisa de sodio se obtiene con la dieta en la cual está incluida la cerveza.

Se discute el uso la cerveza en varias situaciones terapéuticas.

The "Serial Why"

"In thinking about the fundamental nature of any phenomenon, the human mind invariably tends to analyze it from two essentially distinct viewpoints. We want to know its *primary cause* and its *primary constituent element*. . . .

"This innate quest for the Primary is also quite evident during the period of mental awakening in every child. It manifests itself by what might be called the 'serial why,' which leads to the following type of conversational pattern: 'Why is it dark at night?' 'Because the sun sets.' 'Why does the sun set?' 'Because the earth turns away from it,' and so forth, until the hard-pressed adult succeeds in changing the topic.

"Our craving to climb up along such question-ladders does not diminish with maturity; only our hopes of reaching the top rung fade away with age, for we come to realize that it is just as inherent in human nature to be blind for the Primary as it is to look for it. Yet, as soon as man understands that, for him, the ladder of comprehension has no end, he can find comfort in the realization that, consequently, there also is no limit to his possible progress; no matter how advanced his wisdom, he always remains capable of yet another step forward."
—Hans Selye. *Texas Reports on Biology and Medicine* 12: 396–397, 1954.

Finding the Mean in Medicine

"After centuries of wavering between religion and philosophy, magic and mysticism, dogmatism and rationalism, medicine returned again to reliance upon facts proved by experience, to the truths that can be confirmed by objective scientific evidence. For a time it looked as if the laboratory was to become the centre of medical activity at the expense of the clinic, but saner counsels prevailed, and a reaction against undue materialism has brought us back today to something very close to the Hippocratic ideal—studying at the bedside of the patient those factors which can best be observed there, but doing so in the light of that wider knowledge and deeper understanding which has been the invaluable contribution of the basic sciences to medicine. However potent, however marvellous may be the weapons which science can forge in her laboratory to arm the physician in his fight against disease, they must never be allowed to take him away from his post of honour beside the sickbed, for it is there that the medical man will achieve his ultimate triumph, the cure of his patient."
—A. D. Trendall. *The Medical Journal of Australia* 41 (4): 120, 1954.