"VITAMIN D" MILK

A Milk Containing

"Vitamin D" Concentrate

(Prepared from Cod-Liver Oil)

Confidential Data for

Health Authorities, Physicians and Dentists

NATIONAL OIL PRODUCTS COMPANY

Harrison, New Jersey
"VITAMIN D" MILK

Several sources of "Vitamin D" milk are now available. The one under discussion here is produced by the incorporation in the milk, before pasteurization, of an assayed "Vitamin D" concentrate* from cod-liver oil and contains 150 units (Steenbock) of "Vitamin D".

With the acknowledged uncertainties and difficulties attending the administration of cod-liver oil or medicinal preparations of "Vitamin D" it was thought a wise plan to attempt the more or less automatic administration of "Vitamin D" in food products (see J.A.M.A. editorial quoted below).

This step then represents an effort to deal with infantile rickets and the inadequacies of calcium and phosphorus metabolism of growing children by giving in their natural food an amount of "Vitamin D" which will meet the requirements of the growing body. The availability of "Vitamin D" in significant amounts in a palatable food should also be welcome to adults.

"Vitamin D" therapy is generally acknowledged to be rather specific for rickets. The experience of the pediatrician in dealing with individual cases by preventive or curative "Vitamin D" therapy has been supplemented by observations in larger groups. The efficacy of "Vitamin D" in preventing rickets has been amply demonstrated in clinics and health centers where the administration of some form of "Vitamin D" has been carried on under supervision.

The numerical results speak for themselves and make it highly probable that the general addition of "Vitamin D" to the diet of the infant community would deal as successfully with rickets as Vitamin C has dealt with infantile scurvy. A practical demonstration is needed to show that by means of "Vitamin D" milk a sufficiently large proportion of those infants who do not come under nutritional supervision can be prevented from acquiring rickets. This can only be done by offering to the public a well standardized product through the usual channels of milk distribution.

Trials of "Vitamin D" milk in small groups of infants have been very successful** as was to be expected from the known properties of "Vitamin D". The interesting problem is: how successful can a rickets preventing campaign of this kind be made for the large majority of infants who do not come ordinarily under medical care.


** Barnes
Besides this more general aim we also hope that "Vitamin D" milk will be welcomed in private practice and institutional work wherever a palatable source of "Vitamin D" of known potency is desired.

In order to place before health authorities, physicians, and dentists suitable information on the public health function this milk product is designed to serve, its nutritional value, its nature and composition, and the informed opinion of the medical profession concerning it, the accompanying data have been prepared, consisting of the following items:

I. The prevalence of rickets in various parts of the United States.

II. The menace of mild forms of rickets.

III. The need of infants for "Vitamin D" and the value of cod-liver oil in their diet.

IV. The value of "Vitamin D" for people of all ages.

V. The value of "Vitamin D" milk from the standpoint of the American Medical Association.

VI. The value of "Vitamin D" milk from the standpoint of the American Public Health Association.

VII. No danger of hypervitaminosis from "Vitamin D" milk.

VIII. The Zucker process of extracting and concentrating the "Vitamin D" content of cod-liver oil.

IX. The manufacture of "Vitamin D" milk.

X. The control of "Vitamin D" milk.

XI. "Vitamin D" milk is a food product, not a "milk" or a drug or medicine.

XII. Approved form of bottle-cap and hood seals.

XIII. Clinical study of "Vitamin D" milk in the treatment of rickets.

XIV. A typical assay of "Vitamin D" milk.

XV. Supervision of the manufacture of the "Vitamin D" concentrate.
I

THE PREVALENCE OF RICKETS

"Rickets is the most common nutritional disease occurring among children of the temperate zone. Fully three-fourths of the infants in the great cities, such as New York, show rachitic signs of some degree."


"One hundred and seventy-nine or 83 per cent (of a group of children examined in New Haven, Connecticut) showed evidence of mild rickets by Roentgen ray examination before eight months of age; 6 per cent showed it later. The total incidence of rickets in the demonstration group was 86 per cent. Our investigations have shown that a slight degree of rickets is well nigh universal in our clime and in our state of society."


Quoting from a report based on the physical examination of over 12,000 children, who were almost entirely from the rural sections of Michigan, Dr. Lillian R. Smith, of the Michigan Department of Health, states (in private correspondence): "The rachitic group of defects contributed more than one-fourth of all defects found in the children and were present in 51.8 per cent of all children examined."

"In spite of the high degree of solar energy (in California), the deficiency of the ultra-violet portion is so great that there is commonly a mild grade of rickets among young children who are not given cod-liver oil or treatments with artificial light during the summer months."

"It is intimated sometimes that rickets is a disturbance of minor importance, in fact that it is immaterial whether or not it develops, as it is a self-limited disorder and its deformities have a marked tendency to right themselves with advancing childhood. This is an unscientific and dangerous point of view to take of any pathological condition. Experience has taught us we are not yet in a position to gauge the significance of diseases, especially of disorders of nutrition, and that none should be disregarded or neglected. In relation to rickets, the "laissez-faire" policy is a mistake, as, although rickets does not figure directly in our mortality statistics, it plays a role indirectly both in the mortality and in the morbidity of the community. Many of the operative procedures incident to childbirth, which lead to the death or injury of mother or infant, are properly attributed to rachitic deformities of the pelvis. The same holds true for many of the deaths from convulsions in infancy, which are to be regarded as manifestations of tetany — a disorder which is essentially a complication of rickets. Rickets also has to be considered in connection with the pneumonia of infants. It is believed that rickets increases the susceptibility to pneumonia. Many physicians believe that it is the main factor in the exceptionally high incidence of this disease among the negroes and Italians in the large cities. Even though there is some doubt as to whether rickets predisposes to pneumonia, it seems certain that it renders the prognosis much graver and is a factor in the mortality. Finally, we should not lose sight of the fact that as yet we know little of the potentiality, in other words, of the ultimate consequences, of the numerous nutritional disturbances of infancy. There is no means of judging whether a disorder such as rickets, with its lesions of the bones, teeth, muscles, and blood, as well as psychic disturbances, may not result in functional or organic disabilities in adult life."

The following quotations from official government publications emphasize the necessity of giving infants cod-liver oil "Vitamin D":

"Rickets is a disease very common in infancy and early childhood. It is caused by lack of sunlight and of a special substance found in some foods, called "Vitamin D". The food that contains the most "Vitamin D" is cod-liver oil. Milk, although an essential food for infants and children, contains too little "Vitamin D" to protect them from rickets. In the temperate zones, cod-liver oil as well as sunlight is needed to prevent rickets. Even though a baby is born in the spring and receives sunbaths throughout his first summer, he should also be given cod-liver oil. A winter baby cannot get enough outdoor sunshine, so he especially needs cod-liver oil. It should be given to every baby throughout the first two years of life, beginning at two weeks of age."

-- Sunlight for Babies, United States Department of Labor, Children's Bureau, Folder No. 5 (1931)

"Cod-liver oil is not a 'luxury' but an indispensable food for young children. It will not only prevent rickets but will protect the child in other important respects. Cod-liver oil should be included in the diet of all children under 2 years of age, and it may well be given to all young children, especially when malnutrition is present. Under conditions of economic stress, when overcrowding and other bad hygienic conditions may exist, and when diets are limited in the amount of milk, eggs, fruit, and vegetables, there is even greater need for cod-liver oil."

-- Emergency Food Relief and Child Health, United States Department of Labor, Children's Bureau, and United States Department of Agriculture, Bureau of Home Economics (1931)
VALUE OF "VITAMIN D" FOR PEOPLE OF ALL AGES

"Much evidence of an experimental and therapeutic nature is accumulating to support the view that taking a supplemental source of vitamin D raises the resistance to infections of several sorts. . . .

"There is little room for doubt that an additional source of the vitamin, especially during the colder months of the year, affords a safeguard to health. . . .

"If our studies and those of Mrs. Mellanby are as sound as we believe they are, they will afford evidence that in temperate regions people of all ages should take some source of vitamin D."


"In man, the addition of vitamin D to diets previously considered adequate in all respects . . . is an important factor in the prevention of dental caries."


"It has been shown that the addition of cod-liver oil to the diet of children on what is regarded as an adequate diet, decreases the rate of progress of caries."

THE VALUE OF "VITAMIN D" MILK

(American Medical Association)

"... Thanks to an understanding of the origin, prevention, and treatment of the latter disease (scurvy) it has rapidly been eliminated as a serious menace to health and as a prominent factor in the current category of menacing maladies. Unfortunately, this cannot be said with equal assurance in regard to rickets, despite the present-day appreciation of how it can be averted. After several years of vigorous antirachitic propaganda, in which the teachings of the medical profession have been broadcast by all sorts of welfare organizations as well as by advertisers of curative specifics, rickets remains all too prevalent in many communities.

"This situation is frankly disappointing. Few specifics have received more widespread commendation than has cod-liver oil, to mention only a single antirachitic agent. Enough evidence is available, from the clinical as well as the experimental field, to give assurance that rickets can be averted. Either this information has not yet been sufficiently impressed on the public or else the available means of prophylaxis are not being used adequately. . . ."

"Obviously it ought to be of advantage if antirachitic properties could be imparted, without attending deterioration, in a suitable degree to a few foods that enjoy widespread use, particularly in the dietary of childhood. This would avert the uncertainties of sporadic intake of vitamin D at periods of crucial importance. Probably the two most universally consumed foods are bread and milk. That is why interest has begun to be centered in these products as a means of antirachitic prophylaxis. Milk is of particular interest because of its unrivaled content of calcium and phosphorus -- the adjuvants of a properly planned antirachitic regimen. . . ."

VI

THE VALUE OF "VITAMIN D" MILK

(American Public Health Association)

"The prevention of rickets is a very live question in spite of the fact that with direct irradiation, ultra-violet rays, cod-liver oil or its concentrates, Haliver oil, viosterol, activated milk, etc., we have more specifics for it than for any other single disease. It is, however, extremely prevalent, even in quarters where it would be least suspected.

"There is a growing feeling that some form of antirachitic milk is the best preventative as well as curative, since it has the marked advantage of a high content of calcium and phosphorus..."

"There are a number of ways of increasing the antirachitic potency of milk. One which seems to be favored by Hess above others is the feeding of activated yeast to milch cows..."

"Another paper gave the results of experiments which have been going on at Columbia University for several years; namely, the purification and improvement of a concentrate from cod-liver oil which contains the antirachitic element. This concentrate, in the proportion of 1 part to 12,000 of milk, will give practically 150 units of vitamin D per quart, equivalent to 3 teaspoons of cod-liver oil... Only 15 experiments on rachitic infants have been carried out by this method so far, but the results were entirely favorable and comparable to those obtained by a dosage of 3 teaspoons per day of cod-liver oil. The author (Zucker) believes that this offers perhaps the best and safest method, since the concentrates are carefully assayed, and there is no possibility of accidental overdosage..."

"... through the labors of these experts, we have learned of a practical method for the prevention of the widespread disease, rickets."


"The time will probably come when health authorities will stress the desirability of having all market milk irradiated or otherwise reinforced with vitamin D. Augmenting the vitamin D content is significant for the promotion of public health and physical welfare."

NO DANGER OF HYPERVITAMINOSIS FROM "VITAMIN D" MILK

"The newspapers have recently given wide publicity to the poisonous character of large doses of vitamin D... This, as is well known to the medical profession, is a false alarm... Experiment has shown that a million units are toxic, but the facts brought out by experiment show that this amount would have to be taken daily to cause injury."


"The so-called toxic effect of vitamin D was obtained only with enormous amounts of the vitamin."

-- A. W. Ham, Archives of Pathology, Vol. 14 (1932), page 613.

"Very few instances of toxic effects due to irradiated ergosterol have been described in human beings, which is not surprising in view of the enormous doses required to produce these effects in animals. Large doses of irradiated ergosterol have, indeed, been given to infants without the appearance of toxic symptoms. Hess, Poncher, et al. (1930) in a prophylactic investigation, observed no toxic symptoms after daily administration of 20-52 times the prophylactic dose of irradiated ergosterol (viosterol) for long periods and of 250 times for short periods. The children were lively, the appetite was increased; constipation was the rule. Bamberger (1929) records loss in weight, vomiting, anorexis... in 10 of 11 tuberculous children receiving large doses of 'vigantol' (0.2 - 0.25 mg. irradiated ergosterol per kg. body-weight). No such effects were observed with cod-liver oil concentrate given in amounts equivalent in antirachitic potency; it would therefore appear that the toxic effect of 'vigantol' was not due to its vitamin D content."

THE ZUCKER PROCESS* OF EXTRACTING AND CONCENTRATING

THE "VITAMIN D" CONTENT OF COD-LIVER OIL

Cod-liver oil, which has been assayed for its "Vitamin D" content, is mixed with 50% of its volume of cold 95% ethyl alcohol, which dissolves out of the oil the active antirachitic substance ("Vitamin D") together with the free fatty acids in the oil and a small amount of the oil itself.

The alcoholic solution settles out on top of the oil and is siphoned off and reduced to a small volume by distillation. To the residue is added an equal volume of 40% aqueous sodium hydroxide, which saponifies the fatty acids and also the unchanged cod-liver oil.

To an aqueous solution of these soaps, a concentrated solution of calcium chloride is added. Insoluble calcium soaps are precipitated and carry the active substance along with them.

The calcium soaps are filtered out and treated with acetone, which dissolves out the active substance.

The acetone solution is reduced to small volume by distillation, and an approximately equal volume of ether is added.

The ether solution, which contains the active substance, is washed with dilute sodium hydroxide to remove traces of fatty acids or soaps, and then with dilute hydrochloric acid to remove amines and other organic bases.

After further purification of the ether solution, the ether is distilled off.

The residual material, which includes the active substance, is dissolved in cotton-seed oil. It is undoubtedly a mixture of various components, but as far as can be determined, they are all natural and unaltered constituents of cod-liver oil.

A concentrate can be prepared in this manner that is 15,000 times more potent in "Vitamin D" content than the original oil, but the potency of concentrates prepared for practical purposes ordinarily does not exceed 1000.

IX

THE MANUFACTURE OF "VITAMIN D" MILK

Dairies producing "Vitamin D" milk by this process receive the Zucker concentrate of natural "Vitamin D" derived from cod-liver oil from the National Oil Products Company of Harrison, New Jersey, manufacturers of the concentrate.

The concentrate as supplied to dairies differs little in appearance, color, viscosity, etc., from cotton-seed oil, the menstruum in which the actual cod-liver oil concentrate is dissolved. It possesses no fishy taste or odor. One pound of it contains at least 900,000 "Vitamin D" units as described by the "Council of Pharmacy and Chemistry of the American Medical Association. New & Non-Official Remedies, 1931", page 414.

At the dairy, the concentrate is finely dispersed in milk in the proportions of 1 lb. of concentrate to 6000 quarts of milk. The addition is made prior to pasteurization.

Each quart of "Vitamin D" milk thus made contains 150 Steenbock "Vitamin D" units.

The finished product differs in no way perceptible to the senses from untreated milk.
THE CONTROL OF "VITAMIN D" MILK

Among the restrictions which, in the interest of public health and for the protection of the public, control the operations of sub-licensed dairies are the following:

Each quart of such milk must contain not less than 150 Steenbock "Vitamin D" units.

Tests of "Vitamin D" milk purchased in the open market may be made at any time, and deficiencies in "Vitamin D" content, if any, must be corrected within 24 hours.

No claims can be made publicly regarding the curative, physiological, medicinal or other similar properties of "Vitamin D" milk unless such claims have been approved by the Licensor.

The plan for assaying the "Vitamin D" content of the products of the licensees varies in different localities, but the preferred plan is to have monthly assays made, unknown to the licensee, in the laboratories of the local state agricultural college.
"VITAMIN D" MILK, PREPARED BY THIS PROCESS, IS NEITHER A "MILK"

NOR IS IT A MEDICINE OR DRUG; IT IS A FOOD PRODUCT

Under the laws of many states, "Vitamin D" milk produced by this process is not technically a "milk" but a food product consisting of a designated grade of milk and "Vitamin D", a nutritive substance derived from cod-liver oil. That it is such a compound must, of course, be plainly designated on the label.

Nor is it a medicine or drug, but a food rich in various essential nutritive elements.

That this is the view of the Committee on Foods of the American Medical Association is shown by the acceptance of certain brands of this type of milk by the Committee, and by the following letter:

AMERICAN MEDICAL ASSOCIATION

Committee on Foods

March 14, 1933

Dr. Bion R. East,
Technical Consultant,
National Oil Products Co.,
Harrison, N. J.

Dear Dr. East:

. . . . . The Committee looks upon vitamin D milk (fortified with your company's vitamin D concentrate) as a milk with enhanced nutritional values which is in the interest of better nutrition and the health of the public.

(Signed) RAYMOND HERTWIG
Secretary,
Committee on Foods
XII

APPROVED BOTTLE-CAP AND HOOD SEALS
June 21, 1932

Dr. Bion R. East,
48 Martin Place,
Detroit, Michigan

Dear Sir:

The study for the National Oil Products Company has been completed. It included fifteen rachitic infants of an average age of 14.5 months. X-ray examinations were made every two weeks subsequent to the beginning of treatment. Treatment consisted of one quart of "Vitamin D" milk, i.e. plain pasteurized milk to which was added Zucker cod liver oil concentrate sufficient to make 150 Steenbock units of Vitamin D per quart. The milk and concentrate were then homogenized and used in the ordinary way in preparing the formula. The infants all took the milk willingly, gained weight, and there were no feeding difficulties. The X-rays showed typical healing at about the rate we have become accustomed to seeing in patients treated with cod liver oil. One patient, M. Carter, had very serious florid rickets and was not judged entirely healed after 41 days of treatment. He was, however, very rapidly recovering at the time of the last X-ray.

Two of the cases, G. Kurzak and H. Crawford, who had mild rickets were X-rayed 10 and 15 days, respectively, before a second X-ray and treatment. They showed no healing during the period and serve as controls showing that sunlight had not yet produced healing. Also, severe cases, showing no evidence of healing came in after the study was well under way and after favorable results were beginning to show in those patients already under treatment. This is helpful because the work was started a little later in the spring than the optimum time for such a study.

In conclusion, fifteen infant patients with active rickets received Zucker concentrate in the amount of 150 Steenbock units of Vitamin D homogenized with milk per day. The milk was well taken and well tolerated by all the patients and healing progressed satisfactorily in all instances. From this evidence it is safe to say the Zucker concentrate will ordinarily cure rickets when given in this dosage and homogenized with milk.

May I express my appreciation for your help with the study. As you know I am to present a resume of results with antirachitic concentrates at the State Medical Society meeting and at the Wayne County Medical Society Noon Day Study Club this fall.

Very truly yours,

(Signed) DON. J. BARNES, M.D.
DEPARTMENT OF PATHOLOGY
COLLEGE OF PHYSICIANS & SURGEONS
COLUMBIA UNIVERSITY
NEW YORK CITY

REPORT

SUBMITTED TO National Oil Products Company
Harrison, New Jersey

DATE 3/29/33

LABORATORY NO. 2059

SAMPLE RECEIVED 3/9/33

MATERIAL Milk

MARKING Pedigree Dairies, Inc.
Pasteurized Milk with 150 Vitamin D units added to each quart.

RESULTS OF EXAMINATION

This milk was tested according to the LINE TEST technique. Since the quart (946 cc.) contains 150 units, then 946/150, or 6.3 cc. should contain 1 unit. Therefore 6.3 cc. mixed into 50 grams of Steenbock diet #2965 was fed over a 10-day test period. The test shows the antirachitic activity of the milk to be at least 150 units per quart.

Photographs of the LINE TEST and controls are attached.

This is a confidential report to serve as evidence of "Vitamin D" potency of the particular sample of material mentioned above. It may be used where such evidence is requested by physicians and health officials but it is not to be used in any advertising.

Theodore I. Zucker
May 4, 1929

National Oil Products Company
Essex & First Streets
Harrison, New Jersey

Gentlemen:

For the information of those who may be interested, we take pleasure in advising you as follows:

Under date of April 27, 1928, the University Patents, Inc., a subsidiary of Columbia University in the City of New York, entered into an Agreement with you whereby you became the sole licensees in the United States, Canada and New Foundland, of the United States patent numbered 1,678,454, granted July 24, 1928, to Dr. Theodore F. Zucker of Columbia University for the process for extracting the antirachitic element commonly known as vitamin D from cod liver oil.

Under our Agreement with you, you are obligated to make such tests upon the products produced by following the above mentioned patent, as we may reasonably require, in order to insure a satisfactory quality of the product, and such biological tests are being constantly made in your laboratories and in your plant, under the personal supervision of the patentee, Dr. Zucker.

As our Agreement contains explicit restrictions with regard to any statements made by you regarding the products of this patent, we feel that, in justice to you, and to your customers, we should make the above statement regarding the safeguards placed around the following of the process and the products produced thereby.

Yours very truly,

UNIVERSITY PATENTS, INC.

By

President