

depositing lead in the bones but also in attempting to delead at a future date. This may be accomplished by giving a diet low in calcium and relatively high in phosphorus so that the cations removed from the bones are excreted as the insoluble phosphates. The metabolism data of Aub and his associates indicate that, aside from its acidity, H_3PO_4 was the most effective substance in deleading patients suffering from chronic lead poisoning.

More extensive experiments on the effect of dietary calcium and phosphorus in lead and thallium poisoning in rats, induced by oral and subcutaneous administration, are now in progress. The results of these experiments and also of those obtained with phosphate therapy in human cases of plumbism will be reported later.

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Relation of Pressure to Rate and Quality of Milk Secreted.*

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Recent work^{1, 2} has shown that milk secretion takes place in the interim between milkings, and that practically all milk drawn at a milking is present in the udder at the time of milking. It is evident, therefore, that pressure must develop in the duct system as the secretion accumulates. The purpose of this work is to establish the amount of pressure developed by the accumulating secretion; the effect of such pressure upon the rate of secretion; and the maximum pressure against which milk will be secreted.

Neusch,³ Isaachsen,⁴ and Tgetgel⁵ measured the pressure in the udder at milking time and reported wide differences due no doubt to a difference in distention of the gland, and as they measured the

* The data used in this paper are taken mainly from a thesis presented by T. V. Rigor in partial fulfillment for the Ph.D. degree.

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¹ Petersen, W. E., Palmer, L. S., and Eckles, C. H., *Am. J. Physiol.*, 1929, **90**, 573.

² Swett, W. W., *J. Dairy Sci.*, 1927, **10**, 1.

³ Neusch, J., *Über das Sog. Aufziehen der Milch*, 1910, Paul Parey, Berlin.

⁴ Isaachsen, H., *Proc. World's Dairy Congress*, 1923, **2**, 1018.

⁵ Tgetgel, B., *Schweizer Arch. f. Tierheil.*, 1926, **68**, 335, 369.

pressure from the base of the udder there is no way of knowing the variations caused by the hydrostatic pressure due to the column of milk in the udder cisterns. No reference has been found to the maximum pressure developed by not milking.

Two methods were used to measure the pressure: (1) measuring the maximum pressure developed in the udder by means of a manometer and (2) determining the maximum pressure against which milk is secreted by applying air pressure in the duct system.

To measure the pressure developed through accumulation of milk in the udder a manometer was connected to a teat cannula inserted in the teat canal. The pressure was read in centimeters height that the milk would rise from floor of the udder.

While the left gland was milked at regular intervals milk was permitted to accumulate in the right gland for 24, 36, and 120 hour intervals with a 5 day preliminary period before each trial. While the milk was drawn after these intervals the pressure was measured frequently. Two cows were used in the experiment and each trial repeated.

TABLE I.
Milk Pressure and Milk Yield.

Trial	Right Gland Delayed Milking			Left Gland Milked at Normal Intervals		
	Interval	Pressure	Milk	Interval	Pressure	Milk
Cow E 93	hr.	cm.	lb.	hr.	cm.	lb.
1	24	40	5.70	12	—	—
2	24	38	4.90	12	34	2.50
1	36	52	5.70	12	35	2.00
2	36	41	4.50	12	31	2.10
1	120	26	1.80	12	37	2.00
2	120	24	1.60	12	34	2.50
Cow 141						
1	24	50.0	3.80	12	41.0	1.80
2	24	52.2	5.70	12	45.0	2.00
1	36	50.2	3.70	12	44.0	1.80
2	36	49.2	4.70	12	41.7	2.00
1	120	37.0	2.00	12	44.0	1.60
2	120	42.0	1.50	12	45.0	1.50

Table I gives the results of the experiments. The 2 cows while developing the same maximum pressure as a result of accumulating milk in the gland required different time intervals. For cow 141 the maximum pressure of 52.2 cm. was developed at 24 hours while for cow E93 it took 36 hours. In all trials the pressure was greater at 24 hours than at 12 hours. After the maximum pressure is attained there is a fall which at 120 hours is considerably less than at 12 hours. This is due no doubt to a cessation of secretion and reabsorption of the products of secretion.

It is recognized that the method used above is relatively inaccurate due to the variations in hydrostatic pressure and leg pressure on the gland. It was therefore decided to ascertain the minimum air pressure required to stop milk secretion. Air pressure at a constant level was maintained for a period of 6 hours after the cow was milked and the effect upon secretion noted. Pressure was maintained from a tank into one quarter of the udder through a teat cannula. Pressure was used at various levels. Four trials were run, of which the data in Table II are typical. In all 4 trials

TABLE II.
Effect of various levels of air pressure upon the rate of milk secretion compared with normal production.

Quarter Under Pressure		Normal Quarter
Pressure mm. Hg.	Milk Yield lb.	Milk Yield lb.
10	0.9	2.8
20	0.5	2.9
25	0.1	3.0
30	0.0	2.5

the pressure of 25 mm. Hg. resulted in almost complete cessation of secretion. Pressure at 10 mm. Hg. permitted one-fourth normal secretion while at 20 mm. only about one-sixth. In one trial, pressure was maintained at 5 mm. Hg. when one-half the normal secretion was secured.

Summary. Data have been presented to show the pressures built up in the mammary gland due to accumulation of the milk secreted and the effect of such pressures on the rate of secretion. The effect of air pressure on the rate of secretion has also been reported. It is concluded that as pressure develops in the gland the rate of secretion decreases until a pressure equal to 25 mm. Hg. is developed when secretion is stopped and resorption sets in.