

THE RATE OF GROWTH OF FINGER NAILS IN RELATION TO THEIR CYSTINE CONTENT IN ARTHRITICS

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INTRODUCTION

Several investigators, notably Berthold (1), Dufour (2), Sharpey-Schäfer (3), Heller (4) and Voit (5), employing different methods of measurement, have reported that finger nails grow on the average of 1 mm. in ten days, that is, one-tenth of a millimeter (0.100 mm.) per diem. Results obtained by the writer on the growth of finger nails of a large number of apparently normal, healthy individuals agree in general with this rate. As to the factors upon which nail growth depends numerous ones have been suggested. Thus Berthold found that nails grow more rapidly in summer than in winter, in children than in adults, on the right than on the left hand and that the rate of different finger nails differs according to the length of the finger, the most rapid being on the middle then in order the ring, index and little finger and slowest on the thumb.

Moreover, it is well known among clinicians that nails exhibit a hypersensitiveness to disease, especially the acute infectious type as, for example, smallpox, rheumatic, typhoid and scarlet fever. The writer is now engaged in a study of the effect of various diseases and other nutritional disturbances, such as pregnancy, hyperthyroidism and hypothyroidism, on the rate of growth of the nails. Concomitant with this study has arisen the question concerning the relation of the growth of finger nails to their cystine content.

Much interest in recent years has been attached to the physiologico-chemical significance, dietary importance and therapeutic value of cystine. The chemistry of cystine need not be dwelt upon here other than to remark that it is a sulfur compound which forms the basic constituent of keratin, a substance composing such epidermal derivatives as hair, nails, hoofs, horns, feathers, et cetera. As to the physiological significance of cystine, various workers, notably Hopkins and Dixon (6), Lewis (7), Lewis and Root (8), have pointed out that sulfur compounds play an important part in the metabolic processes of cells, especially oxidation and reduction. Accord-

ing to Sullivan and Hess (9) intoxication factors such as bacteria and toxins tend to deplete these regulators of metabolism and thus divert them from their normal reservoirs such as nails. They analyzed the finger nail clippings of 26 normal individuals and 103 arthritics and found that the average cystine content of the nails of the normals was 11.69%, whereas the average for the arthritics was 9.77%. They conclude, therefore, that this decreased cystine content of the nails of arthritics is an index of a toxic factor.

In the light of these and other researches it is now believed by many workers that, notwithstanding the possibility of numerous etiological agents or predisposing causes, the prime factor in arthritis and allied rheumatoid conditions is diminished oxidation resulting from impaired sulfur metabolism—hence the rationale for parenteral sulfur therapy, many favorable results of which have been reported in recent years.

In addition to the reports bearing on the chemotherapeutic action of cystine significant studies have been reported in the last few years concerning the relation between dietary cystine and the growth, texture and cystine content of animal hair and wool. Although the results reported are not unanimous, most of the evidence presented indicates that the growth and histological structure of these epidermal derivatives depend largely on the presence or absence of cystine in the diet.

As a result of these various researches concerning the importance of cystine it seemed logical in connection with the writer's study of the effect of disease on the growth of nails to determine whether or not there is any marked relationship between the growth of the nails and their cystine content. The object of this paper, therefore, is to report the results of a study based on thirty-five arthritic patients who were under observation and treatment at the Arthritic Clinic of the State Street Dispensary, College of Medicine, Ohio State University.

METHODS

The method employed for determining the daily rate of growth of the finger nails was as follows: A mark was made on each nail at the central convex line of the lunula, when present, by means of a sharp, curved scalpel. The daily rate of growth was ascertained by dividing the distance which the mark traversed from the anterior margin of the lunula by the number

of days elapsing from the date of marking to the date of measuring. Thus let us suppose the distance of the mark from the lunula in 30 days was 3.2 mm. The daily rate of growth would be (3.2 mm. divided by 30 days) 0.106 mm. The nails on which a lunula could not be observed were marked at a determined distance, usually five millimeters, proximal to the anterior central border of the nail bed which is visible through the nail. The distance which the nail grew in these cases was calculated by subtracting the distance between the mark and the anterior border of the nail bed from the distance between the latter point and the mark used as a measuring point. Hence if the mark was placed at a point 5 mm. from the anterior border of the nail bed and 30 days later it was 2.8 mm. from the latter the amount of growth would be (5 mm. minus 2.8 mm.) 3.2 mm. The daily rate of growth, calculated the same as above, would be (3.2 mm. divided by 30 days) 0.106 mm.

All measurements were made by means of a Vernier caliper calibrated in millimeters. In order to insure a fine degree of accuracy the two measuring arms of the Vernier were sharpened and the marks on the nails, as well as the adjustments of the measuring arms of the Vernier to these marks, were made under magnification with the use of a binocular loupé.

The cystine content of the finger nails was determined by Miss Edith M. Miller, Department of Pathology, Ohio State University, who utilized Sullivan's method with a few modifications. The writer wishes to acknowledge his indebtedness to Miss Miller for furnishing the data on the cystine content of the finger nail clippings and to Dr. Geo. E. Watson, director of the Arthritic Clinic, for permission to use the clinical patients for this study.

In Table I are tabulated the results of the present study on the rate of growth of finger nails of arthritic patients in relation to their cystine content.

The rates of growth tabulated here represent the mean daily rate of growth of all the finger nails of each subject and is expressed in thousandths of a millimeter. Thus, for example, in subject G. A. the mean rate of growth of all his finger nails is .110 mms. daily. The cystine content of the nails of each subject is shown in the last column of the table and is expressed in percentage. At the bottom of the table are given the mean age of the group, the mean daily rate of growth and the mean cystine content of the nails of all the subjects.

Although it is not the object of this paper to make a comparative study of the daily rate of growth or cystine content of the finger nails of arthritic patients with normal individuals, it

TABLE I
DAILY RATE OF GROWTH OF FINGER NAILS CORRELATED WITH
CYSTINE CONTENT
(35 subjects)

SUBJECT	AGE	SEX	MEAN GROWTH	CYSTINE %
G. A.	50	M	110	12.0
C. B.	25	M	118	11.6
G. C.	59	M	091	12.2
W. C.	52	M	071	10.5
L. C.	30	M	123	8.7
I. E.	69	F	097	14.5
A. E.	51	F	106	14.2
W. F.	62	M	128	12.5
J. F.	53	M	080	6.8
E. F.	65	M	068	12.5
L. G.	56	F	114	12.5
F. G.	45	M	095	11.5
A. G.	34	F	106	17.6
R. H.	65	F	111	9.2
W. H.	50	M	104	9.7
M. K.	74	M	085	10.1
C. K.	48	M	091	9.7
H. K.	20	F	094	11.5
M. L.	58	F	112	10.2
G. M.	22	M	107	14.1
R. M.	49	M	059	13.0
A. M.	63	F	091	8.3
E. M.	35	F	131	14.6
F. M.	54	M	085	12.3
B. M.	44	M	107	10.6
O. N.	31	M	103	11.3
A. N.	35	F	101	12.0
S. O.	45	M	093	10.2
M. S.	51	F	089	11.1
F. S.	67	F	122	9.1
H. S.	51	F	081	11.4
M. S.	68	F	107	10.8
W. T.	27	M	102	16.5
E. T.	39	M	072	12.6
M. V.	39	M	122	11.3
Mean.....	48.1		099	11.6

can be observed from the results recorded in the table that in the case of the 35 arthritic patients studied the mean daily rate of growth is 0.099 mm. which is essentially similar to normal, being only 0.001 mm. below one-tenth of a millimeter, the accepted normal rate. According to Sullivan and Hess (9)

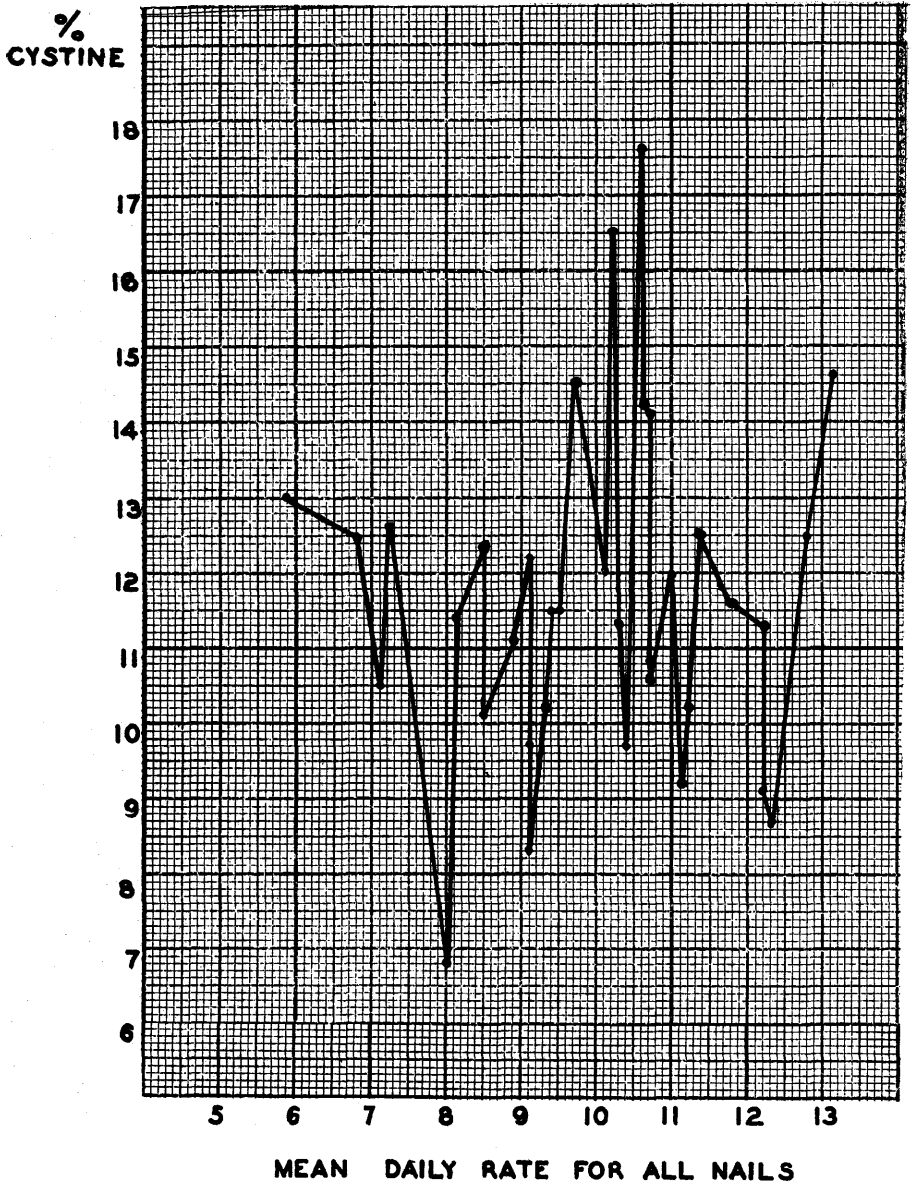


Fig. 1. The mean daily rate of growth of the finger nails in relation to their cystine content.

the average normal cystine content of finger nails is roughly 12% as compared with arthritics in which it is in general lower. As is shown in the table the mean percentage of cystine contained in the finger nails of the 35 patients examined is 11.6% which is only four-tenths percent (0.4%) below the accepted normal.

In regard to the question as to whether or not there is any correlation between the rate of growth of finger nails and their cystine content in arthritics it is logical to conclude from the results shown in Table I and graphically represented in Figure 1 that no such correlation exists. Take for example the cases in which the cystine content of the finger nails ranges from 12% to 12.5%, the rates of finger nail growth vary much more considerably, thus 068 (E. F.), 085 (F. M.), 091 (G. C.), 101 (A. N.), 110 (G. A.), 114 (L. G.), and 128 (W. F.) thousandths of a millimeter. Similarly if we compare the five lowest rates of nail growth, namely, 059 (R. M.), 068 (E. F.), 071 (W. C.), 072 (E. T.) and 081 (H. S.), with their respective cystine content the range of variation of the latter is likewise quite considerable, thus 13, 12.5, 10.5, 12.6 and 11.4 percenta. Neither is the highest mean daily rate of nail growth (131 thousandths of a millimeter) correlated with the highest cystine content (17.6%) or the lowest rate (.059 mm.) with the lowest cystine content (6.8%) or vice versa. Moreover, it is evident that should a correlation exist between these two factors we should expect to have either a gradual ascending or a descending curve, depending of course upon whether a high cystine content corresponds to a high rate of growth, which we should expect, or to a low rate.

SUMMARY AND CONCLUSIONS

1. The problem as to whether the daily rate of growth of finger nails of arthritics is correlated with their cystine content was undertaken in view of other researches concerning (1) the importance of sulfur compounds, such as cystine, to the metabolic processes of cells; (2) the significance and relation of cystine of the nails to toxicity and disease, such as arthritis; (3) the beneficial effects of dietary cystine on the growth of animal hair and wool.

2. The amount of growth of the finger nails of 35 arthritic patients used in this study was determined by measuring the distance which a mark, previously made, grew from the convex

central line of the lunula of the nail or toward the anterior border of the nail bed in a given length of time by means of a Vernier caliper calibrated in millimeters.

3. The daily rate of finger nail growth was calculated by dividing the amount of growth by the number of days of growth. Only the mean daily rate of all the nails of each patient was recorded. Considerable variation in daily rates of finger nail growth existed between patients. The mean finger nail rate of the 35 patients was 0.099 mm. daily, which may be taken as normal, since this figure does not differ significantly from the accepted normal rate, that is 0.100 mm.

4. The cystine content of the nail clippings of these patients likewise varied considerably, the mean percentage being 11.6, which is slightly below the normal (12%).

5. There is no evidence in the present study of any correlation between the daily rate of finger nail growth and the cystine content of the nails in arthritics.

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