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# Comparison of Vitamin A of Liver Biopsy Specimens with Plasma Vitamin A in Man.\*

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The liver, as the chief depot of vitamin A in the body, stores about 95% of it.<sup>1, 2, 3</sup> Therefore, clinical tests for the vitamin A status of the individual are best evaluated by comparing their results with the vitamin A content of the liver.<sup>4</sup> Consequently, in experimental animals, the blood vitamin A level has been compared with the vitamin A content in the liver. As a result of such studies, some<sup>5, 6</sup> considered the blood vitamin A level an index of the liver vitamin A stores and, hence, of the vitamin A saturation of the body. Others<sup>7, 8</sup> failed to find a correlation. In this study, we evaluated the plasma vitamin A level as a measure of the vitamin A saturation in man by comparing it with the vitamin A content of liver biopsies obtained at laparotomy.

Biopsies were taken from 34 patients with various upper abdominal diseases requiring operations. Some of them received supplements of vitamin A a few days before the operation. Blood specimens were drawn before, during, and after the operation. The liver specimens and the plasma were examined chemically (Carr-Price reaction) for vitamin A according to Josephs' method,<sup>9</sup> the liver being first hydrolyzed.<sup>10</sup> Furthermore, the vitamin A distribution of the liver was

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<sup>1</sup> Moore, T., *Biochem. J.*, 1931, **25**, 275.

<sup>2</sup> Baumann, C. A., Rüsing, B. M., and Steenbock, H., *J. Biol. Chem.*, 1934, **107**, 705.

<sup>3</sup> Popper, H., and Greenberg, R., *Arch. Path.*, 1941, **32**, 11.

<sup>4</sup> Nylund, C. E., and With, T. K., *Act. Med. Scand.*, 1941, **20**, 387.

<sup>5</sup> Horton, P. B., Murill, W. A., and Curtis, A. C., *J. Clin. Invest.*, 1941, **20**, 387.

<sup>6</sup> Lewis, J. M., Bodansky, O., and Haig, C., *Am. J. Dis. Child.*, 1942, **62**, 1129.

<sup>7</sup> Leong, P. C., *Biochem. J.*, 1941, **35**, 806.

<sup>8</sup> Brenner, S., Brookes, M. C. H., and Roberts, L. J., *J. Nutrition*, in press.

<sup>9</sup> Josephs, H. W., *Bull. Johns Hopkins Hosp.*, 1939, **65**, 112.

<sup>10</sup> Skurnik, L., and Suhonen, P., *Z. Vitaminforsch.*, 1939, **8**, 316.

examined by fluorescence microscopy.<sup>11, 12</sup> Part of the liver specimen was submitted to routine histologic examination. On most patients, several liver function tests were also performed.

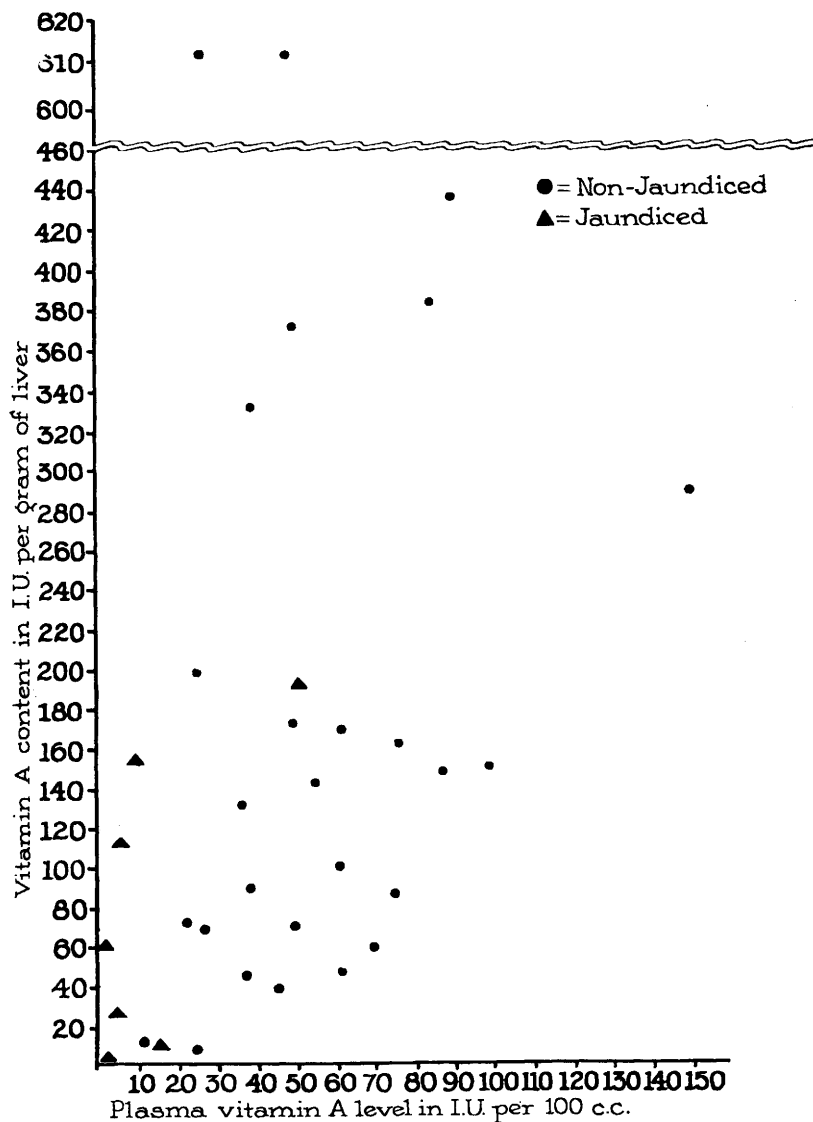


FIG. 1.

Plot of the plasma vitamin A level during operation against the vitamin A content of liver biopsies in man.

<sup>11</sup> Querner, F. von, *Klin. Wchnschr.*, 1935, **14**, 1213.

<sup>12</sup> Popper, H., *Proc. Soc. Exp. Biol. and Med.*, 1940, **43**, 133.

Confirming previous studies<sup>13, 14</sup> great variation in distribution of vitamin A fluorescence (normally localized in Kupffer and liver cells) was found. In liver damage with or without jaundice the vitamin A fluorescence was reduced. The vitamin A fluorescence agreed fairly well with the amount of liver vitamin A determined chemically. In livers with high vitamin A content the Kupffer cells were especially rich in fluorescence.<sup>3</sup>

No parallelism, however, was evident between the plasma vitamin A level during operation and the liver vitamin A content as determined chemically and histologically. (Fig. 1.) In the majority of cases, no change in the plasma vitamin A level during operation was noted. Different vitamin A concentrations coincided with similar blood levels, *e. g.*, a plasma level of 50 I.U./100 cc was found in subjects with liver vitamin A content between 40 and 612 I.U./g. Plasma levels around 10 I.U./100 cc coexisted with liver concentration up to 160 I.U./g. However, the concentration of vitamin A in the liver was never low in subjects with plasma vitamin A above 80 I.U./100 cc. Low plasma levels of jaundiced patients coincided either with low or with average liver vitamin A.

These results suggest that the plasma vitamin A level indicates the vitamin A store in the liver only insofar as a high plasma level excludes a low liver storage. A low plasma level does not necessarily prove low liver storage. Apparently the vitamin A level of the blood fluctuates more readily and is sooner depleted than the vitamin A stores of the liver. Whether difficulties in release of vitamin A from the liver account for these discrepancies between plasma and liver vitamin A is being investigated.

*Summary.* The vitamin A content of biopsy specimens of human livers determined chemically and by fluorescence microscopy was compared with the plasma vitamin A level. No parallelism was found between liver and plasma vitamin A, except that subjects with high blood levels had at least an average liver storage.

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<sup>13</sup> Popper, H., *Arch. Path.*, 1941, **31**, 766.

<sup>14</sup> Meyer, K. A., Popper, H., and Ragins, A. B., *Arch. Surg.*, 1941, **43**, 376.