of two different groups of animals run at different times are not justifiable. In both experiments, however, the quality of the protein in the beef was significantly higher than that of the nuts. Mitchell and Beadles (*21*) obtained a biological value for beef protein which was 32% higher than that of almonds and 26% higher than that of English walnuts. Almond protein was about 94% as digestible as English walnut protein, and 84% as digestible as beef protein. Allowing for possible varietal differences in the nuts used by these workers, and for the variation in values measured by these two methods of study, the relative differences in the protein qualities of these foods, as measured by the protein efficiency, are quite comparable with those measured by the nitrogen balance method.

As the dehydrated beef used for these experiments had been defatted, the nuts were also defatted. In experiment 1, the fat was pressed out of the almonds by a hand press, leaving about 26 and 31% of the fat in the unblanched and blanched almonds, respectively. A power press was no more effective in removing the fat than was the hand press. In experiment 2, the fat was removed by ether extraction, and can be presumed to have been completely removed. As the protein efficiency of the blanched almonds was practically the same in both experiments, the removal of the fat made no difference in the utilization of the protein for growth. No difference would be expected, however, because the fat level, and thus the caloric value of all diets, was kept at the same level. Obviously, no toxic effect resulted from the use of ether in the extraction process.

The protein efficiency values for the protein in toasted almonds, experiment 1, and the dry- and oil-roasted almonds in experiment 2 were 0.24 ± 0.07, 1.12 ± 0.05, and 1.05 ± 0.19, respectively. The 85% decrease in protein efficiency in the toasted almonds, as compared with a decrease of 30% in those dry-roasted in experiment 2, is probably due in part to the greater intensity of heat used in preparation of the former and also to the fact that they were finely ground before toasting, thus exposing greater surface area to the heat and resulting in a greater degree of browning. Those which were dry-roasted were roasted before grinding, and the resultant meal was not so brown. The difference in the protein efficiency of these two types of roasted nuts is of high statistical significance. The 35% decrease in protein efficiency in the oil-roasted almonds is slightly greater than that found in the dry-roasted nuts. However, the difference in protein efficiency between these two types of roasted nuts is small and of doubtful significance.

The greater damage by heat to the toasted ground nuts is more of academic than of practical interest as this method of roasting will probably only rarely be used. This experiment does point out the dangers of such practices. The extent of the loss in almonds subjected to the dry- and oil-roasting method, comparable with commercial methods of roasting, is of real concern to consumers, especially those who use this type of nuts as the chief source of dietary protein. Mitchell and Beadles (*21*) have found that a slight but significant decrease occurs in the biological value of peanuts roasted by a commercial method. This decrease is considerably less than that found in almonds by the growth method of measuring protein quality if one assumes that the same magnitude of difference would be shown equally by the two methods of measure of protein quality.

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Literature Cited

(1) Asenjo, C. F., Muñiz, A. I., *Food Research* **20,** 47–54 (1955).
(2) Atkin, L., Schultz, A. S., Williams, W. L., Frey, C. N., *Ind. Eng. Chem., Anal. Ed.* **15,** 141–4 (1943).
(3) Booher, L. E., Hartzler, E. R., U. S. Dept. Agr. Tech. Bull. **707,** 1939.
(4) Cheldelin, V. H., Williams, R. J., University of Texas Publication No. **4237,** 1942.
(5) Conner, R. T., Straub, G. J., *Ind. Eng. Chem., Anal. Ed.* **13,** 380–5 (1941).
(6) Dunn, K. R., Goddard, V. R., *Food Research* **13,** 512–17 (1948).
(7) Fournier, S. A., Beuk, J. F., Chornock, F. W., Brown, L. C., Rice, E. E., *Ibid.*, **14,** 413–16 (1949).
(8) Hall, A. P., Morgan, A. F., Wheeler, P., *Ibid.*, **18,** 206–16 (1953).
(9) Hall, A. P., Wheeler, P., Thielen, A., Morgan, A. F., *Ibid.*, **18,** 574–7 (1953).
(10) Hart, C. V., *Ind. Eng. Chem.* **22,** 1128–30 (1930).
(11) Hawley, E. E., Murlin, J. R., Nasset, E. S., Szymanski, T. A., *J. Nutrition* **36,** 153–69 (1948).
(12) Hennessy, D. J., Cerecedo, L. R., *J. Am. Chem. Soc.* **61,** 179–83 (1939).
(13) Higgins, B. B., Holley, K. T., Pickett, T. A., Wheeler, C. D., Georgia Expt. Sta., Bull. **213,** 1941.
(14) Hubbell, R. B., Mendel, L. B., Wakeman, A. J., *J. Nutrition* **14,** 273–85 (1937).
(15) Ives, M., Strong, F. M., *Arch. Biochem.* **9,** 251–8 (1946).
(16) Jacobs, M. B., "Chemical Analysis of Food and Food Products," 2nd ed., pp. 754, 775, and 781, D. Van Nostrand Co., Inc., New York, 1951.
(17) James, D. P., *Brit. J. Nutrition* **6,** 341–56 (1952).
(18) Jentsch, M. S., Morgan, A. F., *Food Research* **14,** 40–53 (1949).
(19) Jukes, T. H., *J. Nutrition* **21,** 193–200 (1941).
(20) Mims, C., Laskowski, M., *J. Biol. Chem.* **160,** 493–503 (1945).
(21) Mitchell, H. H., Beadles, J. R., *J. Nutrition* **14,** 597–607 (1937).
(22) Morgan, A. F., Newbecker, B. M., Bridge, E., *Am. J. Physiol.* **67,** 173–92 (1923).
(23) Pickett, T. A., Georgia Expt. Sta., Circ. **146,** 1944.
(24) Pitman, G., *Ind. Eng. Chem.* **22,** 1129–34 (1930).
(25) Skeggs, H. R., Wright, L. D., *J. Biol. Chem.* **156,** 21–6 (1944).
(26) Snell, E. E., Strong, F. M., *Ind. Eng. Chem., Anal. Ed.* **11,** 346–50 (1939).
(27) Snell, E. E., Wright, L. D., *J. Biol. Chem.* **139,** 675–86 (1941).
(28) Toepfer, E. W., Zook, E. G., Orr, M. L., Richardson, L. R., U. S. Dept. Agr., Agr. Handbook **29,** 1951.
(29) Watt, B. K., Merrill, A. L., U. S. Dept. Agr., Agr. Handbook **8,** 1950.
(30) Wright, L. D., Skeggs, H. R., *Proc. Soc. Exptl. Biol. Med.* **56,** 95–8 (1944).
(31) Zook, E. G., MacArthur, M. J., Toepfer, E. W., U. S. Dept. Agr., Agr. Handbook **97,** 1956.

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Mechanism of Browning of Ascorbic Acid-Citric Acid-Glycine Systems—Correction

On page 137 in our recent article [J. AGR. FOOD CHEM. **6,** 135–9 (1958)], the figure caption should read "Figure 3. Rate of carbon dioxide production"; the caption for the upper figure, page 138, should read "Figure 2. Rate of increase in absorbance"; and the caption for the lower figure, page 138, should read "Figure 4. Carbon dioxide production relative to browning." With these corrections, the figures as cited in the text are correct.

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