

References

- ¹ Guggenheim, B, editor (1984) *Cariology Today*, S Karger, Basel
- ² Guggenheim, B (1970) *Int Dent J* **20**, 657–678
- ³ Gibbons, R J and Nygaard, M (1968) *Arch Oral Biol* **13**, 1249–1262
- ⁴ Geddes, D A M (1975) *Caries Res* **9**, 98–109
- ⁵ Featherstone, J D B and Rodgers, B E (1981) *Caries Res* **15**, 377–385
- ⁶ Hamada, S and Slade, H D (1980) *Microbiol Rev* **44**, 331–384
- ⁷ Orland, F J (1959) *Ann N Y Acad Sci* **78**, 285–289
- ⁸ Gau, N (1987) in *Methods in Clinical Chemistry* (edited by Pesce, A and Kaplan, L W), pp 78–82, C V Mosby Co, St Louis, MO
- ⁹ Baginski, E S, Marie, S S and Alcock, N W (1982) in *Selected Methods of Clinical Chemistry* (edited by Faulkner, W R and Meites, S), Vol 9, pp 125–129, American Association for Clinical Chemistry, Washington, DC
- ¹⁰ Serrano, R, Kanner, B T and Racker, E (1976) *J Biol Chem* **251**, 2453–2461
- ¹¹ Nelson, N (1944) *J Biol Chem* **153**, 375–380
- ¹² Featherstone, J D B, Duncan, J F and Cutress, T W (1979) *Arch Oral Biol* **24**, 101–112

Determination of Iodine Numbers of Edible Oils

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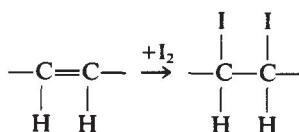
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Introduction

This experiment has been introduced recently in the first semester curriculum of undergraduate medical students of our newly established medical college. The theoretical lectures on lipids include a study of saturated and unsaturated fatty acids, the importance of polyunsaturated fatty acids (PUFA) in human nutrition, and the concept of *iodine number* to illustrate the PUFA contents of common edible oils and fats. The laboratory experiments on lipids earlier included the iodine absorption test, to compare semi-quantitatively the degree of unsaturation in fatty acids present in common edible oils.¹ We have modified this test to make a quantitative determination of the iodine numbers of oils. We have an intake of 50 students per year who, for practical exercises, are divided into two batches of 25 students each. The experiment is performed by each student individually.

Iodine Number

The iodine number equals the number of mg of iodine required to saturate the fatty acids present in 100 mg of the oil or fat. Oils rich in saturated fatty acids have low iodine numbers, while oils rich in unsaturated fatty acids have high iodine numbers. In the experiment, Hubl's iodine is added gradually to a fixed volume of the oil dissolved in chloroform. As long as double bonds are available, the colour of iodine does not appear in the solution as the iodine is absorbed by the double bonds. When all the double bonds are saturated, the colour of iodine appears in the solution.



The iodine number may be calculated from the volume of the oil taken, specific gravity of the oil and the volume of Hubl's iodine required to impart its colour to the solution of oil.

Materials required are: chloroform; oils eg coconut oil, olive oil, sunflower oil; Hubl's iodine (dissolve separately 26 g iodine and 30 g mercuric chloride in about 250 ml of ethanol each, mix the two, and make to 1 litre with ethanol); burette, pipettes and porcelain dishes.

Experimental procedure

The Hubl's iodine is filled in a 50 ml burette and the initial reading noted. Five ml of chloroform is taken in a dry porcelain dish and 2–3 drops of Hubl's iodine are added. This serves as a control for colour comparison.

Five ml of chloroform is taken in another dry porcelain dish, 0.5 ml of oil (eg coconut oil) is added and dissolved by gentle swirling. Hubl's iodine is added slowly from the burette until the colour of iodine (matching with the control) appears in the solution. The burette reading is noted.

The experiment is repeated with other oils.

The specific gravity of the oils is taken as 0.9 so 0.5 ml of the oil weighs 450 mg. Suppose that x ml of Hubl's iodine is used to saturate 0.5 ml of the oil:

1 ml of Hubl's iodine contains 26 mg of iodine

x ml of Hubl's iodine contains $26x$ mg of iodine

Since 450 mg of the oil takes up $26x$ mg of iodine 1 mg of the oil will take up $26x/450$ mg of iodine and 100 mg of the oil will take up $260x/45$ mg of iodine. Hence the iodine number of the oil is $260x/45$

Results and Discussion

The iodine number is an important characteristic of oils as it indicates the proportion of unsaturated fatty acids present. Hubl's iodine is preferred for this determination as the solvent used in this is ethanol which mixes freely with the chloroform solution of the oil.

The iodine number of coconut oil typically ranges from 7.5–10.5, that of olive oil from 74–94 and of sunflower oil from 125–136.² This difference arises from the differences in fatty acid composition of these oils. Thus about 95% of the fatty acids in coconut oil are saturated. Sunflower oil, about 70% PUFA, has a high iodine number, and olive oil, rich in the mono-unsaturated oleic acid, has a moderately high iodine number. Other edible oils, commonly consumed in a particular area, may be given to the students for this exercise. We have found that, after one practice session, the students can determine the iodine numbers of oils with a fair degree of accuracy. The experiment can be conducted with simple glassware and common chemicals, and serves to complement the theoretical knowledge with practical demonstration of a common yet important property of dietary lipids.

Study questions

- (1) What are the names and structures of the nutritionally important polyunsaturated fatty acids?
- (2) What is the nutritional significance of polyunsaturated fatty acids?
- (3) Which edible oils will you recommend to a patient with hypercholesterolaemia?
- (4) Does hydrogenation affect the nutritional value of vegetable oils?
- (5) Which polyunsaturated fatty acid is required for prostaglandin synthesis?

References

- ¹ Gupta, R C and Bhargava, S (1992) *Practical Biochemistry*, Second edition, CBS Publishers & Distributors, Delhi, India
- ² Antia, F P (1989) *Clinical Dietetics and Nutrition*, Third edition, Oxford University Press, Bombay, India