

## Book reviews

National Research Council. *Nutrient Requirements of Non-human Primates*, 2nd revised edition. Washington, DC: The National Academies Press 2003. pp. 286 + xviii, £34.95 (Paperback). ISBN 0 309 06989 0

This volume is the first revision of *Nutrient Requirements of Nonhuman Primates* since the publication of the first edition in 1978. In the intervening 25 years, considerably more information has of course become available about the natural diets and nutritional needs of many primate species. It is becoming ever clearer that data from wild populations are essential in developing species-specific diets, and one major new feature of this edition is a preliminary chapter on feeding ecology and digestive strategies, and their implications for feeding captive primates. This provides a brief but useful overview of methods of studying feeding ecology, and some basic information on the natural diet, behaviour and body weight of selected primate species, subdivided according to their predominant diet.

Although at first sight the latter appears useful, our increasing knowledge of wild diets has drawn attention to the large variations within families and even within genera, and unfortunately this volume pays insufficient attention to these. For example, at least in the section on the Callitrichidae (marmosets and tamarins), the ranges provided for dietary composition are so large that it is virtually impossible to interpret them meaningfully, and it is not clear what they encompass: averages for each species in the group, seasonal or geographical variations, or (most likely) a combination of factors. For *Saguinus* species (which are all lumped together), for instance, the range of insect foraging times is 30–77%, fruits 13–74%, and exudates and nectar about 0–35%. These huge variations suggest large interspecific differences, and the problems suffered by some species in captivity emphasise the possibility of different dietary needs within this genus. There are also some outright errors. For one group of *Callithrix* species, body weight ranges do not overlap for males and females: females are given as 190–320 g, males 357–450 g. This is extraordinary as marmoset species have minimal, and usually no, sexual dimorphism in body weight. The value of the rest of the information in the tables in this chapter is therefore rather questionable, and anyone interested in the natural diet of a particular species should return to the original sources.

Subsequent chapters deal with the major nutrient types: energy, carbohydrate and fibre, protein, fats and fatty acids, minerals, vitamins and water. These are generally thorough treatments and provide a good starting point for further study, although it might have been helpful to a reader searching for specific sorts of information if each chapter had followed a similar format (for example, definitions,

units of measurement, methods of determining levels of each nutrient in foodstuffs, and then discussion of requirements and the effects of insufficiency or excess). This is a relatively minor criticism, however.

The next chapter discusses pathophysiological and life-stage considerations, including developmental considerations, body composition and obesity, all of obvious relevance to human health. There is a useful review of milk composition and artificial formulas and an extensive section on the effects of dietary restriction on ageing, currently a topical issue.

A chapter on dietary formulation, intake and husbandry then considers methods of producing artificial complete diets, factors affecting intake of these preparations, and the use of supplements, including treats, natural fruits and browse. Analytical methods are also discussed, including the use of computer software, although strangely I could find no mention of the *Zootrition* package that is now used widely to analyse and formulate diets. Important points are made regarding the feeding of browse, such as the possibility of poisoning and the fact that some plants used may contain high levels of indigestible lignin. However, I feel that the editors are perhaps over-cautious; both behaviour and health may benefit tremendously from a more naturalistic diet, and few good animal managers would develop a feeding programme for folivorous species that did not include browse. It also concerns me that both here and in the introduction to the book, the editors state their belief that nutritionally complete dietary formulations are best for the health and welfare of most captive primates, using other foods only for enrichment. While this may meet the concerns of those managing laboratory animals in which natural behaviour is not a particular issue (leaving aside the ethics of this), for zoo animals, those maintained in order to study natural behaviour in captivity, and increasingly for laboratory primates, this is often not adequate. Opportunities must be given for species-appropriate foraging and feeding skills to be developed.

This problem is further emphasised when we reach the crux of the book, the chapter on nutrient requirements. Here, information from previous chapters on thirty-two different nutrient types is brought together in two tables, producing a summary of requirements for nine species or groups of species: macaques, baboons, squirrel monkeys, capuchins, howler monkeys, callitrichids, colobines, lemurs and chimpanzees. Values for man are provided for comparison. The huge gaps in the recommendations are immediately obvious. For some groups, only two requirement levels are listed; excluding man and macaques, the mean value is less than five out of thirty-two. Requirements for minerals are virtually absent, and even most vitamins are lacking any information for the majority of taxa. Furthermore, in their introduction, the editors acknowledge the difficulties inherent in attempting to

define nutritional requirements: apart from a basic lack of information, it is not possible to assign a single requirement level for a given nutrient for a given species, as levels vary depending on the endpoint selected, the phase of the life cycle, and so on. In other words, for most species we have no idea whether 'nutritionally complete' artificial foods or any other diet are in fact supplying their requirements.

A listing of nutrient levels in a wide variety of foodstuffs follows and the final chapter considers the use of food in environmental enrichment. It makes the important point that wild foods, such as fruits, are not necessarily nutritionally equivalent to cultivated plants, and discusses the importance of ensuring that a varied diet is also nutritionally balanced.

Overall, then, this book is a good initial introduction to primate nutrition and diet formulation for those working with primates in captivity or with an interest in nutrition in general. However, those working with particular species, or indeed on any aspect of the study of nutrition, will need to delve much further into the original literature, particularly as some of the summary data should be treated with caution. This will be made easier by the fairly extensive reference lists provided for each chapter.

However, despite the huge amount of information reviewed here, the list of nutritional requirements is so limited as to be of minimal value to those working with most species in captivity. Unfortunately much of the work needed to formulate diets for captive primates will remain largely a matter of trial and error. All in all, the impression left by the book is of how little we know, not how much. This volume is a very useful source book, but it does not, indeed, it cannot, live up to its title.

Eluned C. Price

2 La Grange

La Rue de Cambrai

Trinity

Jersey Channel Islands

JE3 5AL

eldom@jerseymail.co.uk

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S. Ashcroft and C. Pereira. *Practical Statistics for the Biological Sciences*. Palgrave, Suffolk: Macmillan 2003. pp. 148 + Appendices, Glossary and Index. £18.99, ISBN 0 333 96044 0

The teaching and learning of statistics and mathematics is a thorny problem for academics and students alike across all subject areas, not least the health and life sciences. *Practical Statistics for the Biological Sciences* represents one of the latest additions to the wide variety of 'how to do' statistics books currently available. The main advantage of this publication over other similar texts lies primarily in its straightforward approach to handling and interpreting

data. The authors argue for example, that although many biological scientists will have some knowledge of statistical analysis, this knowledge is often quite superficial and consequently many students need assistance with applying statistical tests in a 'real' research setting. It is this gap in the practical application of statistical tests that the book hopes to fill.

Overall, the book is visually appealing, logical and easy to follow. It opens with a general introduction to basic statistical concepts, introducing relevant terms and ideas accompanied by a clear explanation of their meaning. The first chapter also includes a very easy-to-use flowchart, which allows the reader to identify the appropriate test for use in different research situations. The authors then go on to present a series of chapters that deal with specific statistical concepts and tests including descriptive statistics, Student's *t* test, Mann-Whitney U test, ANOVA, correlation and  $\chi^2$ . Within each chapter, there is a description of the featured test and when it may be used appropriately. The statistical formula for the test is presented and a worked example is included.

The book is accompanied by a CD-ROM containing a new statistical package *PractiStat*, which can be used to conduct any of the tests included in the text. The CD-ROM also includes sample data for use in conjunction with tutorial examples presented in each chapter.

Overall, *Practical Statistics* would appear to be a useful book that adequately covers a comprehensive range of basic statistical terms and technique. It is clearly written and presented and as such should prove to be a useful and popular text for students across a wide range of undergraduate and basic postgraduate programmes. However, my principle reservation concerning this, and similar books, lies in the wider issue of the development of students skills in statistics and data analysis. While the current book provides a clear description of the process of how to analyse data, for many students the key problem is the question of why do it. Thus, while the current textbook clearly describes how to enter data, use menu bars appropriately, and identify key pieces of information from the results section, it is unlikely to solve more fundamental issues concerning the rationale for employing statistical tests: a key problem for many students.

Having said this, I would recommend this text, particularly for use in undergraduate research courses, but would also consider presenting it alongside a more theoretical text that dealt more thoroughly with the issue of why rather than how.

Mary Hanley

Centre for Healthcare Education  
University College Northampton

Northants

UK

mary.hanley@northampton.ac.uk

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