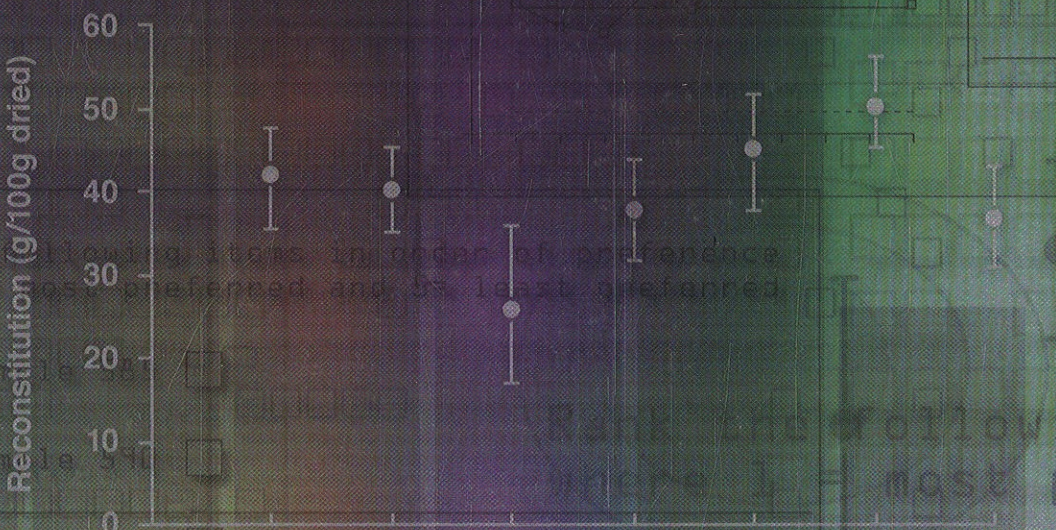
Statistical Methods for Food Science

Introductory procedures for the food practitioner

John A. Bower



WILEY-BLACKWELL

Contents

Preface ix
Acknowledgements xi

Part I Introduction and basics

Chapter 1 **Basics and terminology** **3**
1.1 Introduction 3
1.2 What the book will cover 4
1.3 The importance of statistics 6
1.4 Applications of statistical procedures in food science 6
1.5 Focus and terminology 9
References 12
Software sources and links 12

Chapter 2 **The nature of data and their collection** **14**
2.1 Introduction 14
2.2 The nature of data and their collection 14
2.3 Collection of data and sampling 25
2.4 Populations 35
References 41

Chapter 3 **Descriptive statistics** **43**
3.1 Introduction 43
3.2 Tabular and graphical displays 44
3.3 Descriptive statistic measures 57
3.4 Measurement uncertainty 67
3.5 Determination of population nature and variance homogeneity 83
References 86

Chapter 4 **Analysis of differences – significance testing** **88**
4.1 Introduction 88
4.2 Significance (hypothesis) testing 89
4.3 Assumptions of significance tests 99
4.4 Stages in a significance test 100
4.5 Selection of significance tests 105
4.6 Parametric or non-parametric tests 109
References 109

Chapter 5 **Types of significance test** **111**
5.1 Introduction 111
5.2 General points 111
5.3 Significance tests for nominal data (non-parametric) 112
5.4 Significance tests for ordinal data (non-parametric) 118
5.5 Significance tests for interval and ratio data (parametric) 126
References 135

Chapter 6 **Association, correlation and regression** **137**
6.1 Introduction 137
6.2 Association 138
6.3 Correlation 140
6.4 Regression 144
References 149

Chapter 7 **Experimental design** **150**
7.1 Introduction 150
7.2 Terminology and general procedure 150
7.3 Sources of experimental error and its reduction 154
7.4 Types of design 159
7.5 Analysis methods and issues 168
7.6 Applicability of designs 170
References 171

Part II Applications

Chapter 8 **Sensory and consumer data** **174**
8.1 Introduction 174
8.2 The quality and nature of sensory and consumer data 174
8.3 Experimental design issues 176
8.4 Consumer data (sensory and survey) 176
8.5 Trained panel sensory data 192
8.6 Analysis of relationships 208
References 209

Chapter 9 **Instrumental data** **211**
9.1 Introduction 211
9.2 Quality and nature of instrumental data 211
9.3 Sampling and replication 214
9.4 Experimental design issues 216
9.5 Statistical analysis of instrumental data 218
9.6 Chemical analysis applications 220
9.7 Analysis of relationships 235
References 235

Chapter 10 **Food product formulation** **238**
10.1 Introduction 238
10.2 Design application in food product development 238
10.3 Single ingredient effects 240
10.4 Two or more ingredients 244
10.5 Screening of many ingredients 249
10.6 Formulation by constraints 255
References 260

Chapter 11 **Statistical quality control** **262**
11.1 Introduction 262
11.2 Types of statistical quality control 263
11.3 Sampling procedures 264
11.4 Control charts 265
11.5 Acceptance sampling 279
References 283

Chapter 12 **Multivariate applications** **284**
12.1 Introduction 284
12.2 Multivariate methods and their characteristics 284
12.3 Multivariate modes 285
12.4 Relationship of consumer preference with sensory measures 301
References 302

Index 305