SLÁN 2007

Survey of Lifestyle, Attitudes and Nutrition in Ireland
Dietary Habits of the Irish Population



DEPARTMENT OF HEALTH AND CHILDREN, 2008

Department of Health & Children
AN ROINN SLÁINTE AGUS LEANAÍ

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This report should be cited as follows:

Harrington, J., Perry, I., Lutomski, J., Morgan, K., McGee, H., Shelley, E., Watson, D. and Barry, M. (2008) *SLÁN 2007: Survey of Lifestyle, Attitudes and Nutrition in Ireland. Dietary Habits of the Irish Population,* Department of Health and Children. Dublin: The Stationery Office.

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Published by The Stationery Office, Dublin

The SLÁN 2007 Nutrition sub-report is available to download as a PDF from www.slan07.ie

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ACKNOWLEDGEMENTS

SLÁN 2007 has been possible because of assistance from many individuals and organisations. Our first thanks go to the survey participants – over 10,000 people across the country who gave time and information to us to make possible a national profile. We also thank the interviewers, field support staff and data entry staff from the Economic and Social Research Institute Survey Unit and the interviewers from Amárach Consulting, who collected and processed this information in an increasingly challenging environment for recruiting participants to surveys.

For this nutrition sub-report, special thanks go to Professor Cecily Kelleher and colleagues, Ms. Celine Murrin and Mr. Juzer Lotya at the School of Public Health and Population Science, University College, Dublin, who provided advice and the computer programme to analyse the Food Frequency Questionnaire. Professor Albert Flynn at the Department of Food and Nutritional Sciences, University College, Cork, is also gratefully acknowledged for his commentary on the report.

The survey was enabled with the support of a number of occupational health organisations which conducted the physical examination sub-study. Nurses and other staff from the following companies are gratefully acknowledged: the Well at Work, Dundrum, Dublin (Ms. Áine Donovan, Ms. Ann Barry, Ms. Eileen O'Hara and Ms. Wendy Buckley); Employment Health Advisors, Blackrock, Cork (Mr. Pat Rowland, Ms. Sandra Cummins and Dr. John Gallagher); Mid-West Occupational Health, Charlotte Quay, Limerick (Ms. Theresa Dowling, Ms. Audrey McMahon and Dr. Pat Lee); D'Alton House Medical Centre, Salthill, Co. Galway (Ms. Áine Hanley and Dr. Deirdre Sugrue); and the Keogh Practice, Waterford (Ms. Miriam Foley, Ms. Miriam Macklin and Dr. Fergus McNamara). Particular thanks to Ms. Áine Donovan of the Well at Work, Dublin, and Dr. John Gallagher of Employment Health Advisors, Cork, for their coordinating assistance to achieve national coverage for the physical examination sub-study.

In relation to this specific report, many people helped with survey planning. Ms. Janis Morrissey of the Irish Heart Foundation and Ms. Vera McCarthy provided training for nurses and survey interviewers on physical assessment. Ms. Mary Ledwith and Ms. Stephanie O'Connor of Biosys (RCSI) provided advice on laboratory issues and ongoing storage of physical samples. Advice on other aspects of study planning was gratefully received from Professor Alice Stanton of the RCSI (physical examination assessments) and Dr. Tony Fitzgerald of University College, Cork (statistical analyses).

Finally, as a research team, we thank the Department of Health and Children for the opportunity to conduct this survey. Input from the Management and Advisory Groups was much appreciated during the project, in particular the coordinating roles of Ms. Ursula O'Dwyer, the staff in the Health Promotion Policy Unit of the Department and Dr. Karen Harrington. We hope that the combined efforts of those named and acknowledged in delivering SLÁN 2007 will inform and benefit policy and practice in the pursuit of good health in the coming years in this country.

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Janas Harrington and Jennifer Lutomski
UCC Nutrition Sub-group
SLÁN 2007 Nutrition Sub-report

ACRONYMS USED

AR	average requirement
BMI	body mass index
BMR	basal metabolic rate
EI	energy intake
FFQ	Food Frequency Questionnaire
FSAI	Food Safety Authority of Ireland
HSEng	Health Survey for England
IPAQ	International Physical Activity Questionnaire
IUNA	Irish Universities Nutrition Alliance
kcal	kilocalorie
LTI	lowest threshold intake
MCY	milk, cheese and yoghurt shelf of Food Pyramid
Meas	measured
MFPA	meat, fish, poultry and alternatives shelf of Food Pyramid
MUFA	monounsaturated fatty acids
NDNS	National Diet and Nutrition Survey (UK)
NHANES	National Health and Nutrition Examination Survey (USA)
NHIS	National Health Interview Survey (USA)
NNS	National Nutrition Survey (Ireland)
PLB	positive lifestyle behaviours
PUFA	polyunsaturated fatty acids
RDA	recommended dietary allowance
SFA	saturated fatty acids
SHS	Scottish Health Survey
SLÁN	Survey of Lifestyle, Attitudes and Nutrition
SR	self-reported

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

- The third national Survey of Lifestyle, Attitudes and Nutrition (SLÁN) was conducted in 2007, following previous surveys in 1998 and 2002. The 2007 SLÁN survey involved a nationally representative sample of 10,364 respondents (62% response rate), of whom 9,223 (89%) completed a standard Willett Food Frequency Questionnaire adapted for use in the Irish population. The survey included additional anthropometric and other physical examination data from two sub-samples: 967 younger adults aged 18-44 years and 1,207 older adults aged 45 years and over. Data on height, weight and waist circumference were obtained by SLÁN field survey staff from the sub-sample of younger adults. In addition to this data, trained medical staff also measured blood pressure and cholesterol levels among the sub-sample of older adults, as well as collecting blood and urine samples.

- This report on the dietary habits of the Irish population summarises the main findings from the analysis of the height, weight and waist circumference data (both self-reported and measured data) and the Food Frequency Questionnaire. The data are presented by gender, 4 age groups and 3 social class categories, and results are compared with SLÁN 1998 and 2002 where possible. Analysis of the additional physical examination data (blood pressure and cholesterol) is discussed in the Main Report for SLÁN 2007 (Morgan *et al*, 2008).

ANTHROPOMETRIC MEASURES

- Based on Body Mass Index (BMI) scores from self-reported data, more than one-third of respondents (36%) reported themselves as being overweight (BMI 25.0-29.9kg/m^2) and 14% as being obese (BMI >30.0kg/m^2). Men were more likely than women to report being overweight (43% compared to 28%) or obese (16% compared to 13%), while women were more likely than men to report being underweight (3% compared to 1%).

- Based on self-reported measurements, the percentage of men who were overweight has increased since 1998 (1998: 39%; 2002: 38%; 2007: 43%). This pattern was also evident among women (1998: 25%; 2002: 28%; 2007: 29%).

- Obesity levels based on self-reported measurements, although higher than 1998, have not increased since 2002 among men (1998: 12%; 2002: 15%; 2007: 15%) or women (1998: 10%; 2002: 14%; 2007: 12%). However, these trends should be interpreted cautiously due to the limitations of self-reported data.

- Consistent with international research, BMI based on self-reported height and weight measurements provided an *underestimation* of the true prevalence of overweight and obesity. Based on measured data, higher percentages of respondents were overweight and obese, thus highlighting the extent of these conditions among Irish adults. Approximately 2 out of 3 adults were at an unhealthy (either overweight or obese) weight. Almost one out of 4 adults was obese in 2007.

- Comparing measured anthropometric data from the 1999 North/South Ireland Food Consumption Survey (Irish Universities Nutrition Alliance, 2001) to data from SLÁN 2007, there was a substantial increase in obesity over this time period, particularly among Irish

women. The 1999 North/South study estimated that 39% of Irish adults were overweight (46% men and 33% women) and 18% were obese (20% men and 16% women). In SLÁN 2007, over one-third of respondents (38%) were overweight (44% men and 31% women) and almost one-quarter (23%) were obese (22% men and 23% women).

- Central obesity (as defined on the basis of large waist circumference) is associated with increased risk of diabetes and cardiovascular disease, beyond the risk associated with generalised obesity. The waist circumference threshold for men is 94cm (37in) and for women 80cm (31.5in). In SLÁN 2007, the majority of respondents (60%) in the combined sub-samples of younger and older respondents had a mean waist circumference exceeding the relevant gender threshold for central obesity. Women were more likely (70%) to be centrally obese than men (49%).

- Based on measured data, the prevalence of obesity in Ireland in 2007 was broadly similar to that reported from England (2006) and Scotland (2003), and approximately 5% lower than in the USA (2004).

FOOD ENERGY AND MACRONUTRIENTS

- A phenomenon associated with dietary surveys is under- and over-reporting. Cut-off limits based on physiologically plausible levels of habitual energy intake were applied to identify under-, regular and over-reporters. Overall, in SLÁN 2007, 46% of respondents under-reported their energy intake, 42% regular reported and 12% over-reported. Adjustments were not made to account for over- and under-reporting unless otherwise stated.

- Respondents in SLÁN 2007 consumed a mean daily food energy intake of 2,278kcal/day (excluding caloric intake from alcohol), which was similar to consumption in 2002 (2,360kcal/day) and 1998 (2,351kcal/day).

- Without sufficient physical activity to balance caloric intake, excess daily food energy intake will result in weight gain. An under-expenditure of approximately 500kcal/day is equivalent to a weight increase of approximately 0.45kg (about 1lb) per week.

- For overall food energy intake, it is recommended that 55% of energy derives from carbohydrates, 10%-15% from protein and less than 35% from fat. Among all respondents surveyed in SLÁN 2007, mean daily carbohydrate intake contributed to 47% of food energy, which is lower than recommended. Both mean energy contribution from protein (17%) and food energy from fat (36%) exceeded the recommendations. Overall, 13% of respondents had a protein intake contributing between 10%-15% of food energy, while the majority (87%) had a protein intake contributing to greater than 15% of food energy. One-quarter of respondents (24%) had a fat intake contributing between 30%-35% of food energy, while more than half (58%) had a fat intake contributing to more than 35% of food energy.

- The absolute daily intake in grams per day (g/day) of carbohydrates and fat has decreased modestly since 1998, while protein intake had increased. However, between 1998 and 2007, the percentage contribution to food energy from protein has remained stable (1998: 16%; 2007: 17%); similarly for fat (1998: 36%; 2007: 36%) and carbohydrates

(1998: 49%; 2007: 47%). However, these trends should be interpreted with caution since it is highly likely that the percentage contribution, particularly from fat, was underestimated due to under-reporting of energy intake in the Food Frequency Questionnaire.

FIBRE AND MICRONUTRIENTS

- Overall, mean daily fibre intake was 26.8g/day, which is towards the lower limit of the recommended 25-35g/day. While more than one-quarter of respondents (28%) consumed an amount of fibre within the recommended daily range, the majority (52%) consumed less than 25g/day.

- Mean micronutrient intake levels were assessed using current Irish recommended dietary allowances (RDA), average requirements (AR) and lowest threshold intakes (LTI), all of which are based on the dietary recommendations of the EU Scientific Committee for Food. Rather than a single target, these three reference values define individual nutrient requirements based on a population distribution.

- Mean folate intake in 2007 was above the RDA of 300µg/day (men: 354.0µg/day; women: 353.6µg/day). Folate is associated with a decreased risk of neural tube defects and adequate intake is essential for women of child-bearing age. Overall, 18% of women had a folate intake level below the AR of 230µg/day; however, young women were the most likely to have a level below this requirement (age 18-29: 20%; 30-44: 16%; 45-64: 17%; 65+: 19%).

- Mean calcium intake has increased among men, but was broadly similar for women, between 1998 (men: 956.0mg/day; women: 913.2mg/day) and 2007 (men: 1,041.2mg/day; women: 903.6mg/day) and was above the RDA of 800mg/day. However, 24% of women had calcium intake levels below the AR of 615mg/day, suggesting that a proportion of the Irish female population may have inadequate calcium intake. Nonetheless, mean vitamin D intake was within the lower limit of the RDA of 0-10µg/day (men: 3.8µg/day; women: 3.5µg/day).

- Overall, mean iron intake was similar for both men and women between 1998 (men: 13.3mg/day; women: 12.8mg/day) and 2007 (men: 13.5mg/day; women: 13.1mg/day). On average, women consumed less than the RDA of 14mg/day across the three years of the SLÁN surveys (1998, 2002 and 2007). Overall, 42% of women had iron levels below the AR of 10.8mg/day, suggesting a risk of iron deficiency among a proportion of Irish women.

- Estimated mean salt intake remained the same among men and women between 1998 (men: 8.7g/day; women: 8.0g/day) and 2007 (men: 8.7g/day; women: 8.0g/day). Overall, in 2007, 71% of all respondents exceeded the recommended 6g/day of salt (74% men and 69% women). One-third of salt intake (34%) from food was derived from cereals, breads and potatoes. These estimates exclude discretionary salt added during cooking and at the table, and therefore underestimate the total salt intake by 15%-20%. Thus, the estimated mean salt intake in this study's population exceeds the population target of 6g/day for adults as set by the Food Safety Authority of Ireland. However, it should be noted that the target is set at a level well in excess of physiological requirements.

FOOD PYRAMID

- A major concern in the Irish diet is the overconsumption of foods high in fats and sugar, such as oils, butter, cakes and biscuits. On average, SLÁN 2007 respondents consumed 7.3 daily servings of these types of food, which, according to the Food Pyramid, should be 'used sparingly' (i.e. less than 3 daily servings).

- On average, respondents consumed 4.9 daily servings of cereals, breads and potatoes, which is less than the 6 or more recommended daily servings.

- Overall, 65% of respondents consumed at least 5 or more servings of fruit and vegetables per day, with many respondents consuming more than the current recommended target – on average, 7.1 daily servings of fruit and vegetables.

- The average number of milk, cheese and yoghurt servings consumed per day was 2.4 servings, lower than the recommended 3 daily servings. While one-fifth (19%) of respondents consumed more than 3 daily servings, the majority (61%) consumed less than 3 servings of dairy produce per day.

- On average, respondents consumed 2.7 daily servings of meat, fish, poultry and alternatives, which exceeds the recommended 2 daily servings. Overall, 41% of respondents consumed more than 2 daily servings, while one-fifth (20%) consumed less than 2 servings.

- Respondents who consumed sparingly of foods high in fats and sugar were the most likely to meet the Food Pyramid recommendation of 2 daily servings of meat, fish, poultry and alternatives. Similarly, respondents consuming the recommended 6 or more daily servings of cereals, breads and potatoes were the most likely to also consume at least 5 or more daily servings of fruit and vegetables.

- Less than 1% of respondents complied with consuming all the recommended number of daily servings from each of the 5 shelves of the Food Pyramid, while 10% did not comply with any of the shelves. Almost three-quarters (73%) met the requirement for only 1 or 2 shelves of the Food Pyramid.

OTHER DIETARY HABITS

- Overall, 10% of respondents did not eat a breakfast on the day prior to completing the survey, 4% did not eat a main meal and 6% did not eat a light meal. Most respondents ate their breakfast (80%) and their main meal (83%) at home. However, while the majority of respondents (60%) consumed their light meal at home, nearly one-quarter (23%) purchased their light meal from a food outlet, such as a canteen or restaurant.

- Most respondents (96%) were 'always' or 'usually' able to afford food. Respondents aged 18-29 and those in social classes 5-6 were the least likely to 'always' be able to afford food.

- Compared to respondents who could 'always' afford to buy food, those respondents who reported that they could 'sometimes'/'rarely'/'never' afford food were more likely to consume, on a daily basis, 6 or more servings of cereals, breads and potatoes; more than the 2 recommended servings of meat, fish, poultry and alternatives; and more than the 3 recommended servings of milk, cheese and yoghurt. Furthermore, they were almost twice as likely not to meet any of the shelf recommendations of the Food Pyramid (17% compared to 9% respectively).

POSITIVE LIFESTYLE BEHAVIOURS

- There is evidence that 4 major positive lifestyle behaviours exert a profound impact on health. These are eating 5 or more daily servings of fruit and vegetables; being a non-smoker; being a moderate drinker; and being physically active. There is an estimated 14-year difference in life expectancy between individuals practising none of these behaviours relative to those practising all of these behaviours.

- In SLÁN 2007, 1% of respondents reported doing none of the four positive lifestyle behaviours; 10% reported one positive lifestyle behaviour; 27% reported 2 positive lifestyle behaviours; 39% reported 3 positive lifestyle behaviours; and 23% reported 4 positive lifestyle behaviours. Respondents in social classes 1-2 were more likely (25%) to report 4 positive lifestyle behaviours relative to those in social classes 3-4 (21%) and social classes 5-6 (18%). Respondents who reported 4 positive lifestyle behaviours were more likely to report that their general health was 'excellent' or 'good'.

CONCLUSIONS AND POLICY IMPLICATIONS

- The high prevalence of overweight and obesity in Irish adults poses a major threat to the health and well-being of the population, with significant negative implications for healthcare expenditure over the next decade.

- The high levels of overweight and obesity based on Body Mass Index (BMI) seen in the past decade among Irish men and the rapid increase of overweight and obesity among Irish women are of particular concern. These findings highlight the need to prioritise the recommendations of the 2005 Report of the National Task Force on Obesity.

- Central obesity (as defined on the basis of large waist circumference) is associated with increased risk of diabetes and cardiovascular disease, beyond the risk associated with generalised obesity (high Body Mass Index). The high prevalence of central obesity in Irish men and women highlights the need for greater awareness of this simple marker of adiposity among health professionals and the general public.

- Self-reported data on height and weight underestimate the prevalence of obesity, particularly in women, when compared with measured data. There is a need for regular ongoing population surveys that include measurements of height, weight and waist circumference in order to monitor the evolution of the obesity epidemic in Ireland.

- Analysis of the Food Pyramid in SLÁN 2007 suggests that a significant proportion of the excess calories in the Irish diet are derived from the top shelf of the Food Pyramid, i.e. foods high in fats and sugar. These findings highlight the limitations to date of traditional public health approaches to the promotion of a healthy diet and the need for policy measures to reduce caloric intake and portion sizes of food items from the top shelf. The findings from this report raise fundamental questions regarding future nutritional policy on food labelling and advertising.

- Dietary salt intake, as seen in SLÁN 2007, remains well in excess of physiological requirements. There is an urgent need to augment current work with the food sector to reduce the salt content of bread, cereals and other processed foods.

1. INTRODUCTION

1. INTRODUCTION

The 2007 Survey of Lifestyle, Attitudes and Nutrition (SLÁN 2007) is the third and largest study of its kind in Ireland and the first to include those participating in languages other than English and Irish. Previous surveys were carried out in 1998 (Friel *et al*, 1999) and 2002 (Kelleher *et al*, 2003), and these reports can be viewed on the website www.slan07.ie.

The main SLÁN 2007 survey was conducted through face-to-face interviews. There were two sub-group studies involving (i) measurement of height, weight and waist circumference (sub-group of younger respondents) and (ii) a detailed physical examination (sub-group of older respondents).

The overall aim was to provide nationally representative data on the general health, health behaviours and health service use of adults living in Ireland. The two sub-group studies aimed to provide vital information regarding the health risk profiles of younger and older adults, and at the same time offer the first opportunity to compare measured and self-reported anthropometric data from the general Irish population.

This report presents the detailed diet and nutrition findings from SLÁN 2007, analysed in accordance with current Irish dietary guidelines. Identification of dietary behaviours and dietary patterns in the Irish population at national level is essential to enhance our understanding of the relationships between diet and disease, and to monitor changes over time. As with previous SLÁN surveys, these patterns were assessed using a comprehensive Food Frequency Questionnaire adapted for use in the Irish population. Due to the changing nature of Irish society, additional information relating to meal patterns, snacking and food consumption outside the home were also included in the main survey.

The SLÁN 2007 survey was funded by the Health Promotion Policy Unit of the Department of Health and Children. The survey and analyses were carried out by the SLÁN 2007 Consortium, consisting of the Royal College of Surgeons in Ireland (RCSI), University College, Cork (UCC), the National University of Ireland, Galway (NUIG) and the Economic and Social Research Institute (ESRI).

2. METHODS: SLÁN 2007 NUTRITION SURVEY

2. METHODS: SLÁN 2007 NUTRITION SURVEY

The SLÁN 2007 survey had three distinct components:

- face-to-face interviews with 10,364 adults (including a self-administered semi-quantitative Food Frequency Questionnaire);
- measurement of Body Mass Index (BMI), which is used as a measure of obesity, and waist circumference of a sub-sample of 967 adults aged 18-44 years;
- physical examination of a sub-sample of 1,207 adults aged 45 years and over.

The fieldwork was organised so that the BMI/waist circumference measurement and physical examination were conducted on sub-samples of those who had completed the main survey interview. The information on general health status and lifestyle factors could then be linked to physical measurement data.

POPULATION AND SAMPLING

The population for the survey was defined as adults aged 18 years and over, living in private households in the Republic of Ireland. It included both Irish citizens and non-Irish national residents. Provision was made to have a translated version of the questionnaire available for those wishing to complete the survey in Irish (full-length survey questionnaire) and in the main languages as indicated from the 2006 Census (short-form survey questionnaire).

The sampling frame used for the previous SLÁN surveys in 1998 and 2002 was the Electoral Register. Since this is no longer an option due to data protection legislation, the GeoDirectory was used instead. This is a list of all addresses in the Republic of Ireland, compiled by An Post, which distinguishes between residential and commercial establishments. Unlike the Electoral Register, the GeoDirectory does not include names of individuals; rather, it is a list of addresses. The residential list was used for the SLÁN 2007 survey. Further details on the sampling and weighting of the data are provided in Appendix 1.

Sampling for the BMI/Waist Circumference sub-study (younger adults)

A sub-sample of respondents aged 18-44 years was asked if they would allow their height, weight and waist circumference to be measured by trained interviewers. Selection of respondents for measurement was based on a multistage probability sampling design. A starting cluster was selected at random within each of 12 strata[1] and eligible respondents in these clusters and adjacent clusters were selected for measurement[2]. Of the 1,662 respondents selected to have their height, weight and waist circumference measured, the full set of three measurements was conducted for 58% of respondents (n = 967). Trained interviewers conducted these assessments at the end of the interview study where possible.

[1] The 12 strata were based on HSE regions and on urban/rural location within those regions.
[2] The number of clusters could not be fixed at the outset since both the willingness to be measured and the number of eligible respondents (aged under 45) were unknown.

Sampling for the Physical Examination sub-study (older adults)[3]

All respondents aged 45 and over who took part in the main survey were invited to take part in the physical examination sub-study. Overall, 67% of adults aged 45-64 and 33% of adults aged 65 and over agreed to undergo a physical examination (n = 1,207). This was carried out at a separate time to the main survey interview, usually in an occupational health setting and conducted by trained medical staff. Appointments were scheduled to suit respondents.

FOOD FREQUENCY QUESTIONNAIRE INSTRUMENT

The survey instrument used in the previous two SLÁN surveys was a semi-quantitative Food Frequency Questionnaire (FFQ). This questionnaire with minor amendments was used in SLÁN 2007.[4] The FFQ was an adapted version of the European Prospective Investigation of Cancer (EPIC) study (Riboli, 1997), validated for use in the Irish population (Harrington, 1997). Details of the strengths and limitations of the survey instrument are discussed in Chapter 4 of this report.

Respondents were asked to complete the FFQ after the main interview. Some respondents completed it while the interviewer waited; others chose to complete it at a later stage and return it either in the FREEPOST envelope provided or to arrange to have an interviewer collect it when completed. The interviewer assisted respondents in completing the FFQ in cases where this was preferred or where respondents were having difficulties filling it in on their own. A large print version was also available for those with difficulty reading small print.

The Food Frequency section of the survey was designed to assess the whole diet and included 150 food items arranged into the main food groups consumed in the Irish diet. Respondents were asked to indicate their average frequency of consumption of each food item over the last year. They could choose from 9 frequency categories, namely: 'never or less than once a month'; '1-3 times per month'; 'once a week'; '2-4 times per week'; '5-6 times per week'; 'once a day'; '2-3 times per day'; '4-5 times per day'; and '6+ times per day'. Approximate amount of food consumed was measured on a 'medium' serving (e.g. a slice) or a common household unit (e.g. a teaspoon) and these were later converted into quantities using standard portion sizes. Typical weights, portion sizes and nutrient intake were based on recommendations established by the Food Standards Agency (2002) in conjunction with McCance and Widdowson's Food Composition Tables (1997).

Additional data on dietary habits

The main interview included a separate section on dietary habits. Questions were asked relating to frequency of consumption of fried food, use of salt, location of meal consumption, meal composition, snacking habits and household food affordability.

The SLÁN 2007 main questionnaire and FFQ can be accessed on the SLÁN website, www.slan07.ie.

[3] Although matched to the main survey on demographic characteristics, it is possible, although undetermined, that results from the sub-sample that underwent a physical examination have provided optimistic estimates of the selected measurements.

[4] Based on discussions with the Department of Health and Children, several additional foods were added to the standard FFQ to be concordant with the changing nature of the Irish diet.

FFQ analysis

The food frequency data was analysed using a specially designed computer program called FFQ_Software, Version 1.0, developed by Juzer Lotya of the National Nutrition Surveillance Centre, School of Public Health and Population Science, University College, Dublin. The program converts the dietary information provided to food quantities and subsequently to food nutrient values, based on data from the Food Standards Agency (2002) and from McCance and Widdowson's Food Composition Tables (1997).

STATISTICAL METHODS

Data were analysed using SPSS™ (Version 15.0). Extreme values were identified and excluded from the analyses using the 'Explore' function in SPSS. SPSS identifies these extreme points as those that 'extend more than three box lengths from the edge of a box plot' (Pallant, 2005). Remaining outliers were removed from the nutrient dataset based on standardised z-scores for energy (kcal/day) of 3.29 (Tabachnick and Fidell, 2001).

For the univariate analysis, measures of central tendency (mean, standard deviation and median) of food and nutrient intakes were computed. For the multivariate analysis, if statistical analyses were conducted, a p-value assessing the significance of the relationship will be presented. If a p-value is not provided, then statistical testing was not conducted unless otherwise noted.

Where parametric assumptions were met, significant differences between population means were evaluated using a two-sided t-test or an analysis of variance (ANOVA). T-tests were conducted for comparisons involving two-point estimates, while ANOVAs were conducted for those involving multiple estimates. If distributions were paranormal, significant differences between population means were evaluated using a Kruskal-Wallis test. For all statistical tests, differences resulting in a test p-value less than or equal to 0.01 were considered statistically significant.

REPORTING OF LEVELS OF DIETARY INTAKE

Dietary surveys, irrespective of the method of data collection, are prone to both under- and over-reporting by respondents. In SLÁN 2007, the percentage of respondents who under-, regular and over-reported their energy intake (EI) was calculated. Standard equations based on gender, self-reported weight and age allow the estimation of basal metabolic rates (BMR) (Schofield *et al*, 1985). Using the ratio of reported energy intake to estimated BMR (EI/BMR), cut-off limits based on physiologically plausible levels of energy intake on a habitual basis developed by Goldberg *et al* (1991) were used to identify those respondents who under-, regular and over-reported. Under-reporters were taken as those with EI/BMR<1.35, regular reporters were in the range of 1.35-2.39 and over-reporters were $\geq$2.4 (Goldberg *et al*, 1991, Black *et al*, 1996).

RESPONSE RATE

In total, 10,364 interviews were conducted, with a response rate of 62%. As detailed in the SLÁN 2007 Main Report (Morgan *et al*, 2008), the age, gender, socio-demographic profile, nationality and ethnicity distribution of respondents were highly comparable to Census 2006 figures. A socio-demographic breakdown of the overall survey sample is given in Appendix 2.

The Food Frequency Questionnaire (FFQ) was completed by 9,223 respondents (89%) following the main interview. Table 1 details the gender, age and social class of the FFQ respondents.

Table 1: Breakdown of SLÁN 2007 FFQ respondents, by gender, age and social class*

	%	N
Gender		
Men	49	4,511
Women	51	4,661
Age group		
18-29	25	2,285
30-44	31	2,839
45-64	29	2,710
65+	15	1,337
Social class		
SC 1-2	32	2,946
SC 3-4	38	3,489
SC 5-6	17	1,523
Unclassified	13	1,214

* Numbers (Ns) do not add up to the total sample that participated in the FFQ (9,223) due to missing and/or invalid data.

In previous SLÁN surveys, the FFQ was completed as part of a postal survey and respondents returned the FFQ in a FREEPOST envelope. In SLÁN 2007, respondents who completed the questionnaire had several options: complete while the interviewer was present or complete at a later time and either return by FREEPOST or arrange for the interviewer to collect it. If the interviewer remained while the questionnaire was filled out, he or she was available to assist where necessary.

The majority of questionnaires (86%) were completed by the respondent while the interviewer was present, 11% were collected by the interviewer at a later date and 3% were returned by post. Overall, 50% of respondents required no assistance completing the FFQ, 15% required some assistance and 35% completed the questionnaire in an interview format. Over half of those requiring assistance were in the 65+ age group. Table 2 shows a breakdown by gender and age of how respondents completed the FFQ.

Table 2: Breakdown of how respondents completed the FFQ, by gender and age*

	No help required (N = 4,341)		Some help required (N = 1,260)		Completed in interview format (N = 3,055)	
	%	N	%	N	%	N
Gender						
Men	49	2,096	15	632	36	1,519
Women	51	2,246	14	628	35	1,536
Age group						
18-29	59	1,300	12	260	29	629
30-44	56	1,525	13	342	31	834
45-64	47	1,195	16	394	37	944
65+	26	321	22	265	52	647

* Numbers (Ns) do not add up to the total sample that participated in the FFQ (9,223) due to missing and/or invalid data.

PRESENTATION OF RESULTS

The results will be presented in the following four chapters, with a brief summary at the end of each:

Chapter 3 Anthropometric measures

- Self-reported BMI for all respondents in 2007.
- Comparison of self-reported height, weight and BMI for 1998, 2002 and 2007.
- Comparison of self-reported and measured height, weight and BMI for sub-samples in 2007.
- Overall distribution of BMI and central obesity from the combined sub-samples, SLÁN 2007.

Chapter 4 Food nutrient intakes

- Comparison of macronutrient, fibre and micronutrient intakes with Irish dietary recommendations for 2007.
- Comparison of nutrient intakes between 1998, 2002 and 2007.
- Comparison of SLÁN 2007 macronutrient intake with other studies.

Chapter 5 Food Pyramid consumption

- Healthy eating guidelines according to the Food Pyramid.
- Breakdown of the food constituents of each shelf of the Food Pyramid and their contribution to the overall daily serving intake.
- Compliance patterns with Food Pyramid.
- Overall compliance with Food Pyramid (multiple shelves).

Chapter 6 Other dietary habits

- Breakfast, light meal and main meal habits.
- Household food affordability.
- Positive lifestyle behaviours.

The **Appendices** contain additional data on:

- Appendix 1: Sampling and weighting.
- Appendix 2: Socio-demographic profile of overall survey sample.
- Appendix 3: Cross-tabulation of self-reported and measured BMI for sub-samples in SLÁN 2007.
- Appendices 4-6: Nutrient intake and Irish dietary recommendations and guidelines.
- Appendix 7: Compliance with multiple Food Pyramid shelves.

3. ANTHROPOMETRIC MEASURES – RESULTS

3. ANTHROPOMETRIC MEASURES – RESULTS

This chapter provides the results based on the self-reported anthropometric data of 9,735 respondents who participated in the overall SLÁN 2007 survey, as well as measured anthropometric data from two sub-samples involving (i) a sub-sample of 967 respondents aged 18-44; and (ii) a sub-sample of 1,207 respondents aged 45. The sub-samples were representative of the overall study sample for their age groups (*for full details, see Chapter 2, Table 1*). In addition to self-reporting, these respondents had their height and weight measured by trained interviewers[5], so that body mass index (BMI) could be calculated from these data and then compared to the self-reported measurements. Waist circumference for these respondents was also measured by trained personnel and the data used as an indicator of central obesity.

BODY MASS INDEX

Obesity has been defined as a condition in which excess body fat has accumulated to an extent that health is adversely affected. Body mass index (BMI) is used to estimate the prevalence and associated risks of overweight and obesity within a population. The BMI is calculated as follows:[6]

$$\text{BMI kg/m}^2 = \frac{\text{Weight (kg)}}{\text{Height (m) x Height (m)}}$$

All respondents were asked to report their own height and weight. All measurements were converted to metres and kilogrammes, and used to calculate BMI scores. Based on these scores, respondents were classified into several weight categories (*see Table 3*).

Table 3: BMI score and corresponding weight category

BMI (kg/m²)	Weight category
Below 18.5	Underweight
18.5 – 24.9	Healthy
25.0 – 29.9	Overweight
30.0 – 34.9	Obese Class I
35.0 – 39.9	Obese Class II
At least 40.0	Obese Class III

[5] Interviewers were trained in height and weight measurement by an expert from the Irish Heart Foundation. Training was conducted according to protocol developed for SLÁN 2007. All equipment used was to international standards and calibrated regularly according to manufacturer operating instructions and international norms. Complete details of training provided to interviewers and of equipment used can be found in the SLÁN Standard Operating Procedures on the SLÁN website, www.slan07.ie.

[6] The formula provided for BMI is only valid for adults; BMI calculations for children and teenagers are age- and gender-specific.

The results are presented below in the following sections:

- Self-reported BMI for all respondents in 2007.
- Comparison of self-reported height, weight and BMI for 1998, 2002 and 2007.
- Comparison of self-reported and measured height, weight and BMI for sub-samples in 2007.
- Overall distribution of BMI and central obesity from the combined sub-samples, SLÁN 2007.

This is followed by an international comparison of overweight and obesity.

INTERPRETATIONS OF SELF-REPORTED *VERSUS* MEASURED DATA

Before giving the results, it must be said that there are inherent challenges when collecting data to determine the BMI distribution of a population. Self-reported data are highly useful in that they are cost-effective and enable large numbers of respondents to be sampled. However, this type of data tends to *underestimate* the true prevalence of overweight and obesity (Yun *et al*, 2006). This was also the case in SLÁN 2007 (*see Appendix 3, Tables A3-1 and A3-2*). Despite this limitation, self-reported data continue to be widely used in international research to determine longitudinal trends in BMI distribution.

In comparison, measured anthropometric data from a representative sample are more accurate than self-reported data and is the preferred method when determining the true extent of overweight and obesity. However, the collection of measured data requires trained interviewers and therefore the number of respondents that can be sampled is often limited due to time and cost restrictions. Thus, while the analysis of self-reported anthropometric data facilitates trend assessment, the best estimates of the prevalence of overweight and obesity are derived from measured data.

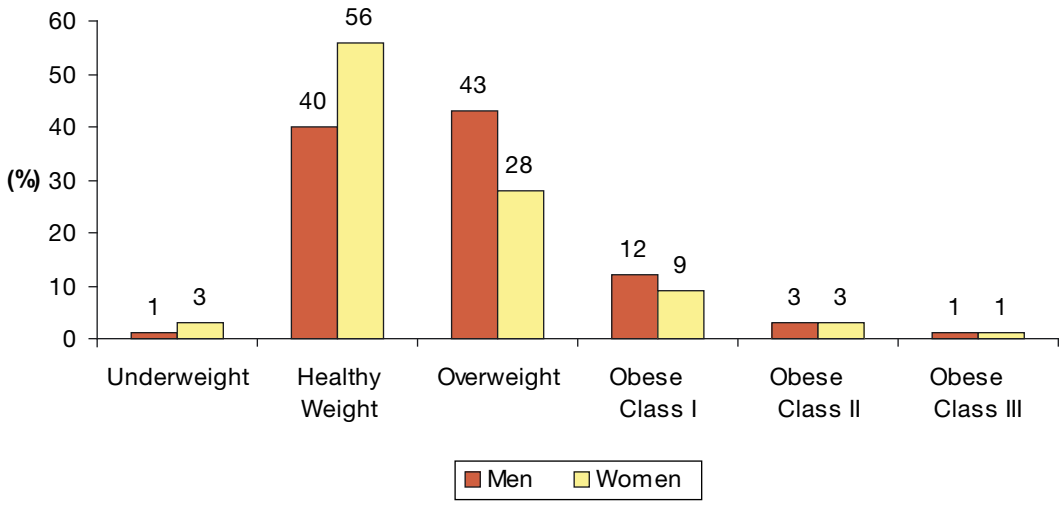
From the self-reported data, it will be seen below that overweight and obesity has generally levelled off across the three SLÁN surveys of 1998, 2002 and 2007. While this trend is encouraging, it is important to bear in mind that the *true prevalence* of overweight and obesity in 2007 based on measured data was higher. Approximately 2 out of 3 Irish adults were at an unhealthy weight, while almost one out of 4 was obese. Furthermore, when comparing measured anthropometric data from the 1999 North/South Ireland Food Consumption Survey (Irish Universities Nutrition Alliance, 2001) to data from SLÁN 2007, there was a substantial increase in obesity over this time period, particularly among Irish women. The North/South study estimated that, in 1999, 39% of Irish adults were overweight (46% men and 33% women) and 18% were obese (20% men and 16% women). The SLÁN survey in 2007 estimated that 38% of Irish adults were overweight (44% men and 31% women) and 23% were obese (22% men and 23% women). Full details are given below.

DISTRIBUTION OF SELF-REPORTED BMI FOR ALL RESPONDENTS IN 2007

Figure 1 shows the distribution of underweight, healthy, overweight and obese men and women in 2007 calculated from self-reported heights and weights among a sample of 9,735 adults. The obese category was further broken down into three sub-classes – Obese Classes I, II and III. Overall, 2% of respondents were underweight, less than half (48%) were classified as healthy weight and more than one-third (36%) were overweight. While 14% of respondents

were obese, most were categorised in Obese Class I. Men (43%) were more likely than women (28%) to be overweight and to be classified as Obese Class I (men 12% and 9% women). However, equal percentages of men and women were in Obese Classes II and III.

Figure 1: Self-reported BMI distribution, by gender (2007)



COMPARISON OF SELF-REPORTED HEIGHT, WEIGHT AND BMI IN SLÁN 1998, 2002 AND 2007

Table 4 shows the mean height and weight of men and women in 1998, 2002 and 2007. Patterns were the same across all years, with mean height decreasing with age.[7] The observed decrease in height across the age range can be partially attributed to a true loss of height with age, but it may also reflect a secular trend to increased height in younger generations.

Across the three surveys, mean weight increased for both men and women until the age of 64 years, after which it decreased. Overall, self-reported mean weight increased between 1998 and 2002. However, between 2002 and 2007, self-reported mean weight decreased slightly or remained similar for men and women across the age groups. There were two exceptions to this trend: there was an increase in mean weight reported among men aged 18-29 (2002: 76.1kg; 2007: 77.3kg) and among men aged 65+ (2002: 76.1kg; 2007: 79.7kg).

[7] 12% of overall respondents were aged 65-80 years and 3% were over 80.

Table 4: Self-reported height, weight and BMI, by gender, age and year (1998, 2002 and 2007)

	SLÁN 1998			SLÁN 2002			SLÁN 2007		
	Height (m)	Weight (kg)	BMI (kg/m²)	Height (m)	Weight (kg)	BMI (kg/m²)	Height (m)	Weight (kg)	BMI (kg/m²)
	Mean (SD)			Mean (SD)			Mean (SD)		
Men									
18-29	1.78 (0.07)	75.0 (10.9)	23.8 (3.2)	1.80 (0.09)	76.1 (9.9)	23.8 (3.4)	1.79 (0.08)	77.3 (12.4)	24.1 (3.6)
30-44	1.77 (0.07)	80.2 (11.6)	26.0 (3.7)	1.77 (0.07)	83.2 (11.8)	26.8 (3.9)	1.78 (0.08)	83.3 (13.8)	26.4 (4.1)
45-64	1.74 (0.07)	81.0 (11.6)	26.8 (3.7)	1.76 (0.07)	85.1 (12.2)	27.7 (3.7)	1.76 (0.07)	84.5 (12.1)	27.3 (3.8)
65+	1.73 (0.07)	75.9 (11.1)	25.5 (3.5)	1.74 (0.07)	76.1 (12.0)	25.4 (3.8)	1.74 (0.07)	79.7 (12.7)	26.3 (3.8)
Women									
18-29	1.65 (0.07)	62.3 (10.1)	23.0 (3.8)	1.66 (0.06)	65.1 (11.6)	23.7 (4.1)	1.65 (0.07)	62.8 (11.3)	23.1 (3.9)
30-44	1.63 (0.07)	65.2 (11.7)	24.6 (4.5)	1.64 (0.07)	67.3 (12.7)	25.2 (4.7)	1.64 (0.07)	67.1 (12.8)	24.8 (4.3)
45-64	1.62 (0.07)	66.4 (10.8)	25.6 (4.6)	1.63 (0.07)	68.5 (12.4)	26.1 (4.8)	1.62 (0.07)	68.7 (12.8)	25.9 (4.4)
65+	1.61 (0.07)	61.9 (12.0)	24.1 (4.4)	1.60 (0.07)	65.9 (12.9)	25.5 (4.9)	1.62 (0.07)	66.0 (12.7)	25.1 (4.3)

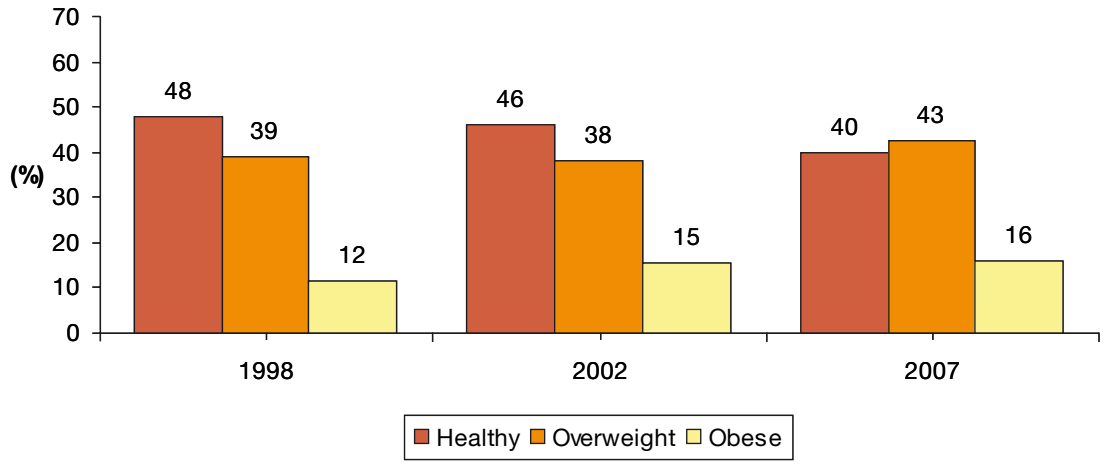
BMI distribution varied across the three SLÁN surveys (1998, 2002 and 2007) by gender, age, social class and marital status (*see Table 5*).

Self-reported BMI distribution, by gender

Figures 2 and 3 show trends in the distribution of healthy weight, overweight and obese men and women, respectively, in 1998, 2002 and 2007.

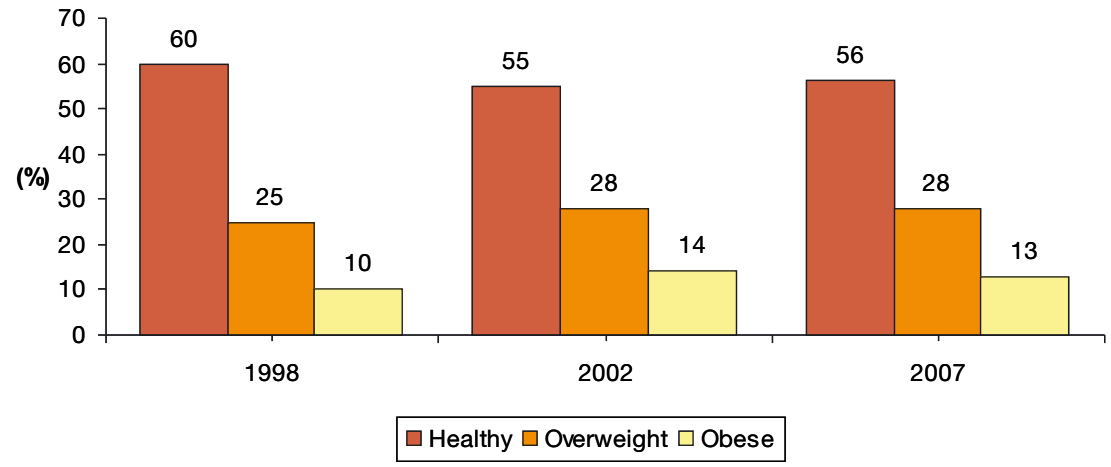
As Figure 2 shows, the percentage of men classified as healthy weight remained stable between 1998 (48%) and 2002 (46%), but decreased in 2007 (40%). Similarly, the percentage of overweight men remained stable between 1998 (39%) and 2002 (38%), but increased to 43% in 2007. The prevalence of obesity among men increased between 1998 (12%) and 2002 (15%), but remained stable in 2007 (16%).

Figure 2: Self-reported BMI distribution among men, by year (1998, 2002 and 2007)



As Figure 3 shows, the percentage of women in the healthy weight category decreased between 1998 (60%) and 2002 (55%), but remained stable between 2002 and 2007 (56%). The percentage of overweight women increased between 1998 (25%) and 2002 (28%) and levelled off in 2007 (28%). The prevalence of obesity among women increased between 1998 (10%) and 2002 (14%) and stabilised in 2007 (13%).

Figure 3: Self-reported BMI distribution among women, by year (1998, 2002 and 2007)



Self-reported BMI distribution, by age

BMI distribution varied by age (*see Table 5*). Among respondents in the age group 18-29, the percentage classified as overweight was similar between 1998 (21%) and 2002 (19%), but it increased in 2007 (23%), although prevalence of obesity was generally similar (1998: 5%; 2002: 6%; 2007: 6%). Between 1998 and 2007, there was an increase in the percentage of respondents aged 30-44 classified as overweight (1998: 32%; 2007: 37%) or obese (1998: 13%; 2007: 15%). This pattern was also present among respondents aged 45-64, with 41% classified as overweight in 1998, rising to 44% in 2007, and 16% as obese in 1998, increasing to 19% in 2007. Among respondents aged 65 and over, the percentage classified as overweight increased between 1998 (32%) and 2007 (40%), as did levels of obesity (1998: 12%; 2007: 14%).

Self-reported BMI distribution, by social class

Changes in obesity rates varied across social class (*see Table 5*). For respondents in social classes 1-4, the prevalence of overweight increased between 1998 (SC 1-2: 28%; SC 3-4: 29%) and 2002 (SC 1-2: 32%; SC 3-4: 32%). Conversely, the prevalence decreased among respondents in social classes 5-6 (1998: 34%; 2002: 29%). By 2007, however, the prevalence of overweight had increased across all social classes (SC 1-2: 39%; SC 3-4: 36%; SC 5-6: 36%). The percentage of obese respondents in social classes 1-2 increased steadily between 1998 (9%), 2002 (11%) and 2007 (13%), while in social classes 3-4 it increased between 1998 (10%) and 2002 (14%) and stabilised in 2007 (14%). Among those in social classes 5-6, the prevalence of obesity increased between 1998 (11%) and 2002 (18%) and levelled off in 2007 (17%).

Self-reported BMI distribution, by marital status

BMI distribution varied by marital status (*see Table 5*). The percentage of respondents who were overweight or obese was higher among married/cohabiting respondents than among those who were single/never married. However, single/never married respondents were more likely to be younger than their married/cohabiting counterparts, which may account for differences in BMI distributions. The percentage of married/cohabiting respondents who were overweight increased slightly between 1998 (38%) and 2007 (41%). Among widowed/separated/divorced respondents, the prevalence of overweight increased from 1998 (32%) to 2002 (40%), but then stabilised in 2007 (39%). Among single/never married respondents, the prevalence of overweight decreased between 1998 (25%) and 2002 (22%), but increased in 2007 (27%). Between 1998 and 2002, the prevalence of obesity increased for both married/cohabiting respondents (1998: 13%; 2002: 18%) and widowed/separated/divorced respondents (1998: 14%; 2002: 18%). However, by 2007, the prevalence of obesity had stabilised for married/cohabiting respondents (17%) and decreased for widowed/separated/divorced respondents (13%). The prevalence of obesity was stable for single/never married respondents between 1998 (8%) and 2007 (9%).

Table 5: Socio-demographic distribution of self-reported BMI levels, by year (1998, 2002 and 2007)*

	SLÁN 1998			SLÁN 2002			SLÁN 2007		
	Healthy	Overweight	Obese	Healthy	Overweight	Obese	Healthy	Overweight	Obese
	(N = 2,574) %	(N = 1,647) %	(N = 544) %	(N = 2,286) %	(N = 1,655) %	(N = 742) %	(N = 4,667) %	(N = 3,452) %	(N = 1,327) %
Gender									
Men	48	39	12	46	38	15	40	43	16
Women	60	25	10	55	28	14	56	28	13
Age group									
18-29	71	21	5	73	19	6	67	23	6
30-44	53	32	13	46	35	17	47	37	15
45-64	42	41	16	33	44	22	36	44	19
65+	47	32	12	44	36	16	44	40	14
Social class									
SC 1-2	61	28	9	54	32	11	47	39	13
SC 3-4	58	29	10	52	32	14	48	36	14
SC 5-6	53	34	11	53	29	18	44	36	17
Marital status**									
Married/ Cohabiting	47	38	13	41	39	18	41	41	17
Widowed/ Separated/ Divorced	43	32	14	39	40	18	45	39	13
Single/ Never married	64	25	8	66	22	9	60	27	9

* Percentages may not add up to 100% since the underweight category has been excluded.

** Marital status has been included in this table because 1998 and 2002 SLÁN figures showed self-reported BMI to vary by marital status.

COMPARISON OF SELF-REPORTED AND MEASURED HEIGHT, WEIGHT AND BMI FOR SUB-SAMPLES IN 2007 (N = 2,174)

Two sub-samples of respondents (a sub-group of 967 younger respondents aged under 45 and a sub-group of 1,207 older respondents aged 45 and over) had their height and weight measured by trained interviewers, in addition to self-reporting their height and weight in the main survey. This allowed a comparison to be made between self-reported and measured height and weight within the sub-samples to assess the extent of misclassification. Since different sampling strategies were used for the two sub-groups (*see Chapter 2, 'Population and sampling'),* the data are presented separately.

Sub-sample aged under 45 (N = 967)

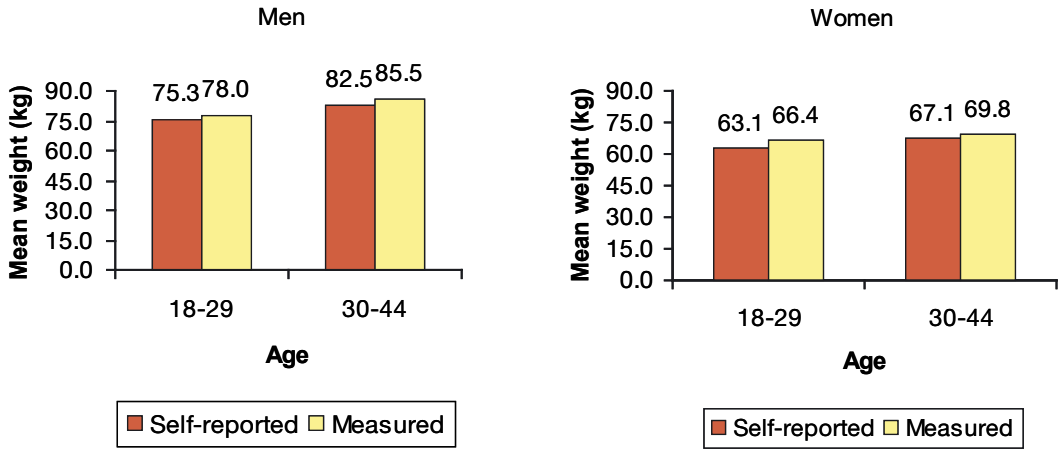
The mean and standard deviation of measured and self-reported height, weight and BMI by gender and age group were compared among respondents in the younger sub-sample who had valid measurements for both types of data collection methods (*see Table 6*). Respondents were able to report their height accurately, with very little difference between the overall mean self-reported (SR) and measured (Meas) values (men SR: 1.78m; Meas: 1.77m; women SR: 1.64m; Meas: 1.63m) and this did not vary by age group.

Table 6: Comparison of measured and self-reported height, weight and BMI among respondents aged under 45, by gender and age group (2007)

	Measured height (m)	Self-reported height (m)	Measured weight (kg)	Self-reported weight (kg)	Measured BMI (kg/m^2)	Self-reported BMI (kg/m^2)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Men						
18-29 years	1.79 (0.07)	1.79 (0.07)	78.0 (14.2)	75.3 (12.6)	24.5 (4.3)	23.5 (3.6)
30-44 years	1.76 (0.07)	1.76 (0.08)	85.5 (15.3)	82.5 (12.7)	27.7 (4.7)	26.7 (4.0)
Women						
18-29 years	1.63 (0.07)	1.64 (0.07)	66.4 (13.3)	63.1 (11.5)	24.9 (5.0)	23.5 (4.2)
30-44 years	1.64 (0.07)	1.65 (0.07)	69.7 (14.7)	67.0 (13.1)	26.0 (5.1)	24.6 (4.3)

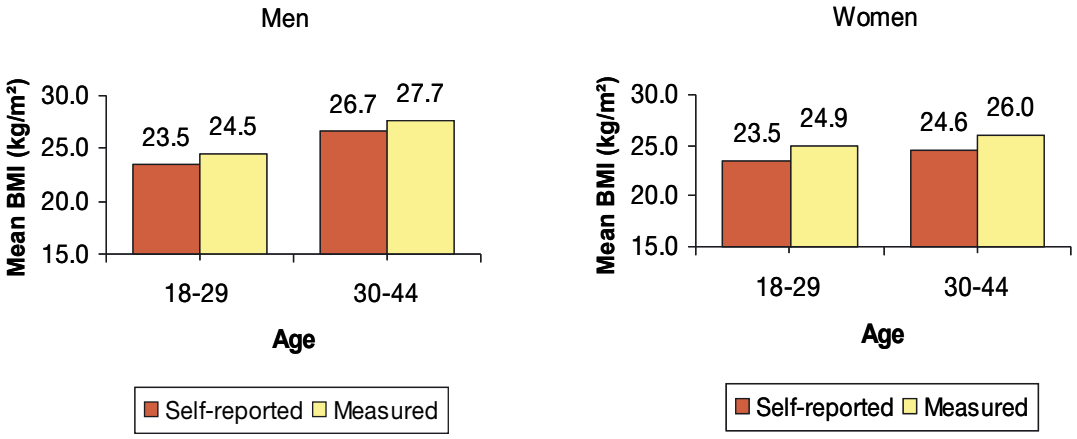
However, self-reported weight was underestimated by respondents in this younger sub-sample across age groups, with a consequent underestimation of BMI (*see Figure 4*). Self-reported weight was lower than measured weight for both men and women. Mean self-reported weight for women was 4% lower than measured weight (SR: 65.5kg; Meas: 68.4kg), while mean self-reported weight for men was 3% lower than measured weight (SR: 79.57kg; Meas: 82.2kg).

Figure 4: Comparison of mean self-reported and measured weight for men and women aged under 45, by age group



Thus, due to the underestimation of self-reported weight by respondents in the younger sub-sample, mean self-reported BMI was lower than measured BMI (*see Figure 5*). The mean difference between self-reported and measured BMI was greater among women than men. Mean self-reported BMI was 1.5 BMI units lower than measured BMI for women (SR: 24.1kg/m^2; Meas: 25.6kg/m^2), while for men it was 1.0 BMI unit lower than measured BMI (SR: 25.3kg/m^2; Meas: 26.3kg/m^2).

Figure 5: Comparison of mean self-reported and measured BMI for men and women aged under 45, by age group

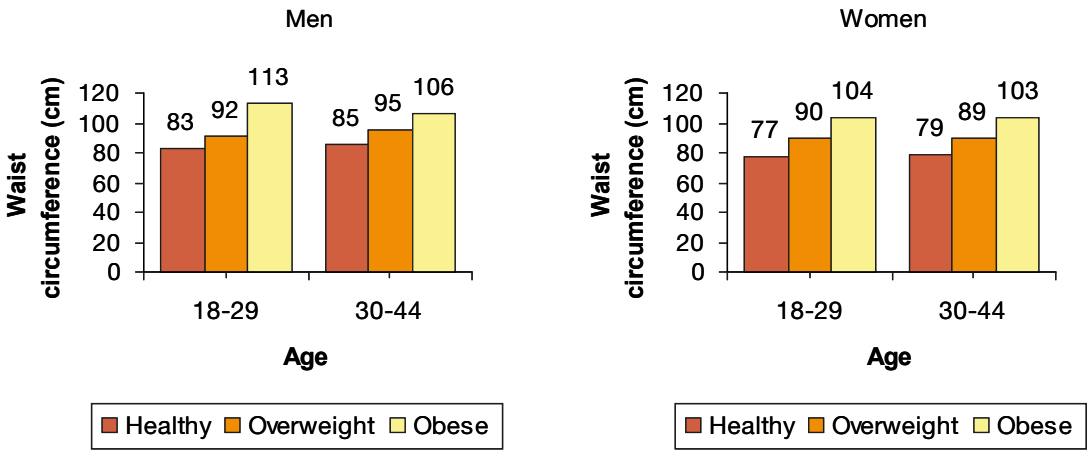


Waist circumference measurements

In addition to measuring height and weight, waist circumference was also measured for 416 men and 536 women in the younger sub-sample (aged under 45). Waist circumference at cut-off points of >94cm (37in) for men and >80cm (31.5in) for women are used as measures of central obesity (Alberti *et al*, 2005). Mean waist circumference was greater for men than for women (91.8cm compared to 85.3cm). Mean waist circumference varied by age and social class for both men and women. Women had a mean waist circumference above the 80cm threshold for central obesity across age groups (age 18-29: 83.8cm; age 30-44: 86.3cm) and across social classes (SC 1-2: 84.6cm; SC 3-4: 84.9cm; SC 5-6: 88.1cm). Men in the age group 30-44 had a mean waist circumference above the 94cm threshold (age 18-29: 87.8cm; age 30-44: 95.1cm), while social class differences were not evident (SC 1-2: 92.1cm; SC 3-4: 91.2cm; SC 5-6: 92.1cm).

There was a significant correlation between measured waist circumference and measured BMI ($p<0.001$) – as waist circumference increased, so too did BMI. Figure 6 shows increasing waist circumference with BMI category for both men and women.

Figure 6: Mean waist circumference and BMI distribution for men and women aged under 45, by age group



Sub-sample aged 45 and over (N = 1,207)

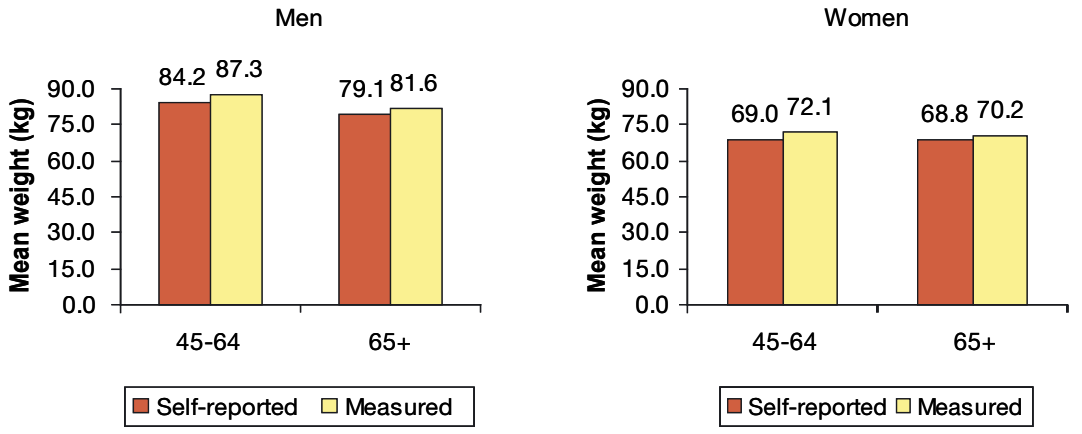
The mean and standard deviation of measured and self-reported height, weight and BMI by gender and age group were compared among respondents in the older sub-sample who had valid measurements for both types of data collection methods (*see Table 7*). Overall, mean self-reported (SR) and measured (Meas) values for height were fairly similar among respondents (men SR: 1.75m; Meas: 1.73m; women SR: 1.62m; Meas: 1.60m). However, respondents in this older sub-sample were more likely to underestimate their height than those in the younger sub-sample (*see Table 6*).

Table 7: Comparison of measured and self-reported height, weight and BMI among respondents aged 45 and over, by gender and age group (2007)

	Measured height (m)	Self-reported height (m)	Measured weight (kg)	Self-reported weight (kg)	Measured BMI (kg/m²)	Self-reported BMI (kg/m²)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Men						
45-64 years	1.74 (0.06)	1.76 (0.06)	87.3 (13.3)	84.2 (11.3)	28.7 (4.0)	27.4 (3.6)
65+ years	1.71 (0.07)	1.75 (0.06)	81.6 (13.5)	79.1 (12.2)	27.8 (4.1)	26.0 (3.7)
Women						
45-64 years	1.60 (0.08)	1.62 (0.06)	72.1 (15.4)	69.0 (12.3)	28.4 (7.7)	26.3 (4.7)
65+ years	1.58 (0.06)	1.62 (0.06)	70.2 (13.9)	68.8 (13.1)	28.1 (5.0)	26.2 (4.7)

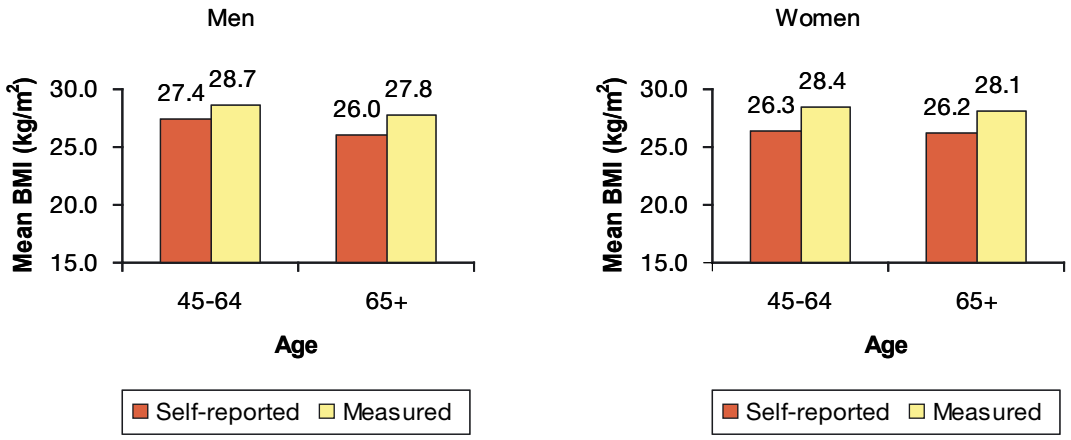
Similar to the younger sub-sample, self-reported weight was underestimated by both men and women across all age groups in the older sub-sample, with a consequent underestimation of BMI (*see Figure 7*). Mean self-reported weight was 3% lower than measured weight among men (SR: 82.6kg; Meas: 85.5kg) and approximately 4% lower among women (SR: 68.9kg; Meas: 71.4kg).

Figure 7: Comparison of mean self-reported and measured weight for men and women aged 45 and over, by age group



Again, due to this underestimation of self-reported weight by respondents in the older sub-sample, self-reported BMI was lower than measured BMI (*see Figure 8*). The mean difference was more prominent among women. Mean self-reported BMI was 2.0 BMI units lower than measured BMI for women (SR: 26.3kg/m²; Meas: 28.3kg/m²), while for men it was 1.4 BMI units lower than measured BMI (SR: 27.0kg/m²; Meas: 28.4kg/m²).

Figure 8: Comparison of mean self-reported and measured BMI for men and women aged 45 and over, by age group

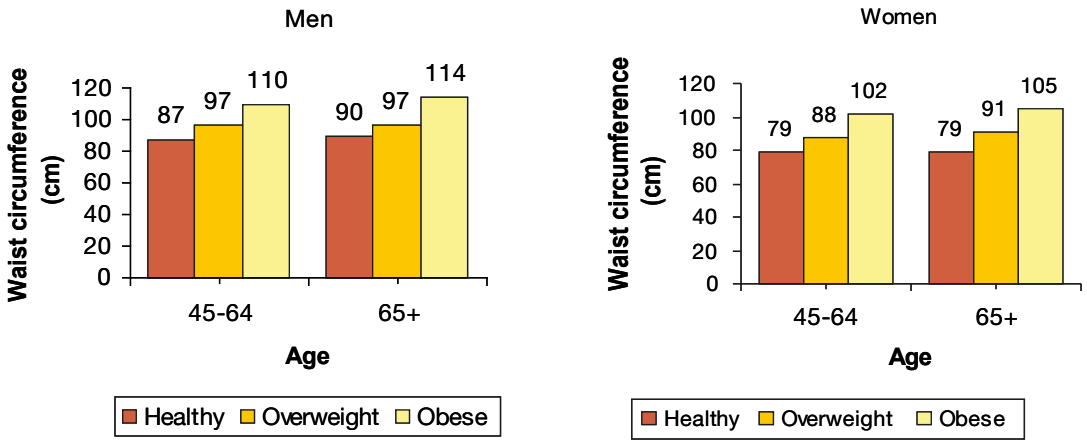


Waist circumference measurements

As with the younger sub-sample, standard waist circumference cut-off points were also applied to the older sub-sample (aged 45 and over), with >94cm (37in) for men and >80cm (31.5in) for women being used as measures of central obesity. Waist circumference measurements were included from 523 men and 679 women. Mean waist circumference was greater for men than for women (99.5cm compared to 90.5cm). Mean waist circumference measurements exceeded the thresholds for central obesity in the case of all respondents across age groups and social classes. Women had a mean waist circumference above the 80cm threshold across age groups (age 45-64: 89.8cm; age 65+: 91.8cm) and across social classes (SC 1-2: 87.9cm; SC 3-4: 90.0cm; SC 5-6: 92.1cm). Men, too, exceeded the 94cm threshold irrespective of age (age 45-64: 99.4cm; age 65+: 99.9cm) or social class (SC 1-2: 99.8cm; SC 3-4: 99.7cm; SC 5-6: 100.0cm).

As with younger respondents, there was also a significant positive correlation between measured waist circumference and measured BMI for both men and women ($p<0.001$). Again, as waist circumference increased, so too did BMI (*see Figure 9*).

Figure 9: Mean waist circumference and BMI distribution for men and women aged 45 and over, by age group

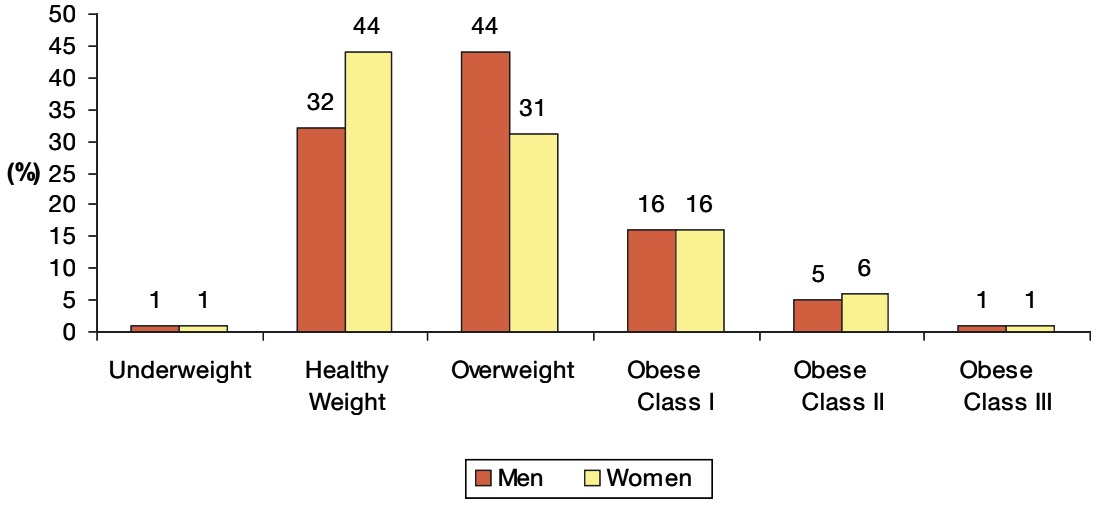


OVERALL DISTRIBUTION OF BMI AND CENTRAL OBESITY FROM THE COMBINED SUB-SAMPLES, SLÁN 2007

After combining the measured BMI data for the two sub-samples under- and over-45 years of age, Figure 10 shows the overall BMI distribution of healthy weight (18.5-24.9kg/m^2), overweight (25-29.9kg/m^2) and obese (>30kg/m^2) men and women in 2007 as calculated from measured data. The obese category was sub-divided into Obese Class I (30-34kg/m^2), Obese Class II (35-39kg/m^2) and Obese Class III (≥40kg/m^2).

Overall, 2% of all respondents were found to be underweight, while 38% had BMIs that were within the healthy range (*see Figure 10*). However, more than one-third (38%) were overweight and almost one-quarter (23%) were obese, with the majority of the latter being classified in Obese Class I. Men (44%) were more likely than women (31%) to be overweight, although similar percentages of men and women were in Obese Class I (men: 16%; women: 16%), Obese Class II (men: 5%; women: 6%) and Obese Class III (men: 1%; women: 1%).

Figure 10: BMI distribution based on measured anthropometric data, by gender (2007)



Direct comparison within the combined sub-samples of respondents clearly shows that self-reported data *underestimate the true prevalence of overweight and obesity* when compared to the measured data (*see Figure 11*). These findings demonstrate that although self-reported data are beneficial for trend analysis, regular ongoing population surveys with measured anthropometric data are needed in order to monitor the true extent of obesity in the Irish population due to biases inherent with self-reported data.

Figure 11: BMI distributions comparing measured and self-reported anthropometric data for the combined sub-samples, by gender (2007)

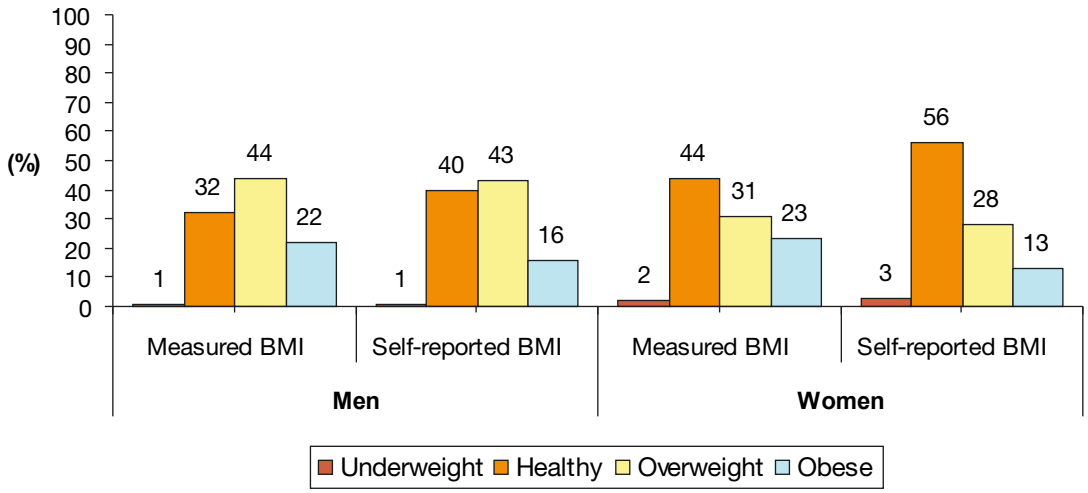


Table 8 shows a further socio-demographic breakdown of overweight and obesity. Overall, the prevalence of overweight and obesity was lower among respondents aged under 45, with the exception that the prevalence of overweight was broadly similar among respondents in social classes 5-6 in both younger and older sub-samples.

In the combined sub-samples of younger and older respondents, the prevalence of overweight and obesity increased until 65 years of age, after which a modest decrease occurred. A social class gradient was evident for obesity, although not for overweight levels: respondents from SC 5-6 were more likely to be obese than those in SC 1-2.

In total, 60% of respondents from the combined sub-samples of younger and older respondents had a waist circumference exceeding the threshold for central obesity – >94cm (37in) for men and >80cm (31.5in) for women. As seen in Table 9, women were more likely to be centrally obese, as were older respondents. While a strong social class gradient was evident within the sub-sample of older respondents, this diminished when combined with the sub-sample of younger respondents.

Table 8: Socio-demographic distribution of overweight and obese respondents, based on measured anthropometric data

	Sub-sample aged under 45 years (N = 967)		Sub-sample aged 45 years and over (N = 1,203)*		Total combined sub-samples (N = 2,170)	
	Overweight %	Obese %	Overweight %	Obese %	Overweight %	Obese %
Gender						
Men	42	16	49	31	45	22
Women	26	18	39	32	32	24
Age group						
18-29	27	11	–	–	27	11
30-44	39	22	–	–	39	22
45-64	–	–	45	32	45	32
65+	–	–	41	30	41	30
Social class						
SC 1-2	35	17	48	28	40	22
SC 3-4	33	17	42	33	37	24
SC 5-6	40	20	43	37	42	29

* Although data were collected from 1,207 respondents for the older sub-sample, the total N in this table does not add up to this figure due to missing and/or invalid data.

Table 9: Socio-demographic distribution of respondents exceeding central obesity thresholds, based on measured waist circumference

	Sub-sample aged under 45 years (N = 952)* %	Sub-sample aged 45 years and over (N = 1,202)** %	Total combined sub-samples (N = 2,154) %
Gender			
Men	37	65	49
Women	65	76	70
Age group			
18-29	37	–	37
30-44	60	–	60
45-64	–	70	70
65+	–	72	72
Social class			
SC 1-2	52	67	58
SC 3-4	49	68	57
SC 5-6	47	79	63

* Although data were collected from 967 respondents for the younger sub-sample, the total N in this table does not add up to this figure due to missing and/or invalid data.

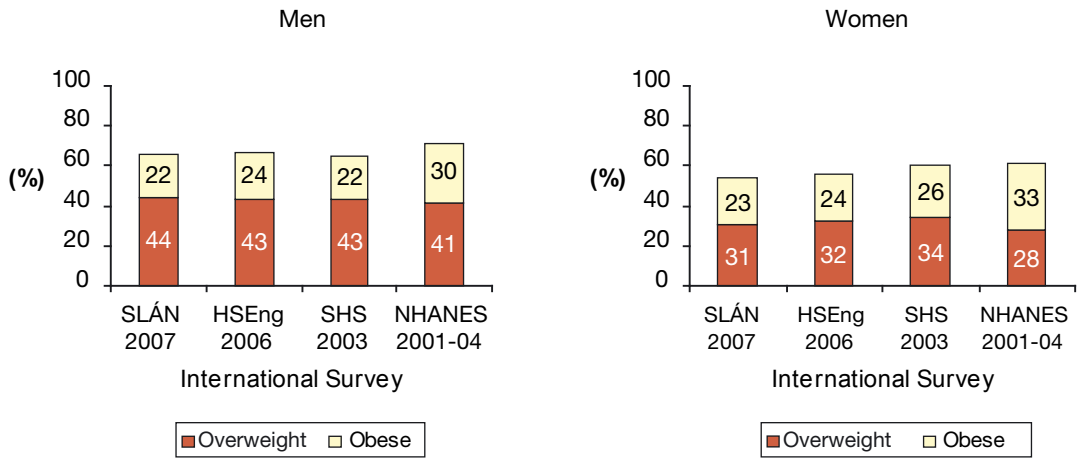
** Although data were collected from 1,207 respondents for the older sub-sample, the total N in this table does not add up to this figure due to missing and/or invalid data.

INTERNATIONAL COMPARISONS OF OVERWEIGHT AND OBESITY

Self-reported results from SLÁN 2007 were compared to the United States National Health Interview Survey (NHIS) 2006 which used comparable survey methods (Pleis and Lethbridge-Çejku, 2007). The prevalence of overweight based on self-reported measurements was similar between NHIS 2006 and SLÁN 2007: approximately one-third of respondents were overweight in both surveys (SLÁN 2007: 36%; NHIS 2006: 35%) and gender patterns were also equivalent (SLÁN 2007: 43% men and 28% women; NHIS 2006: 42% men and 28% women). However, the prevalence of obesity based on self-reported data was considerably higher in NHIS 2006: 26% of American respondents were obese compared to 14% of Irish respondents.

While self-reported anthropometric measures continue to be widely used in research, some international surveys have employed trained interviewers to measure height and weight to calculate BMI scores. These surveys include the Health Survey for England (HSEng) 2006, for respondents aged 16 and over (Craig and Mindell, 2008); the Scottish Health Survey (SHS) 2003, also for respondents aged 16 and over (Scottish Executive, 2005); and the US National Health and Nutrition Examination Survey (NHANES) 2001-2004, for respondents aged 20 and over (National Center for Health Statistics, 2007). Survey results may not be directly comparable since respondents' age limits for participation varied slightly between them. Nonetheless, comparisons reveal that the prevalence of overweight and obesity for men and women was broadly similar in Ireland, England and Scotland, while the prevalence of obesity was higher in the USA (*see Figure 12*). As seen in Figure 12, similar to SLÁN 2007, the three surveys cited show that men were more likely to be overweight than women (SLÁN 2007: 44% men and 31% women; HSEng: 43% men and 32% women; SHS: 43% men and 34% women; NHANES: 41% men and 28% women). Most of the surveys found that women were slightly more likely than men to be obese (SLÁN 2007: 22% men and 23% women; HSEng: 24% men and 24% women; SHS: 22% men and 26% women; NHANES: 30% men and 33% women).

Figure 12: Comparison of international survey results of prevalence of overweight and obesity, based on measured anthropometric data, by gender



SUMMARY

- Based on self-reported data, more than one-third of respondents (36%) were overweight and 14% were obese. Men were more likely than women to be overweight (43% compared to 28%) or obese (16% compared to 13%), while women were more likely than men to be underweight (3% compared to 1%).
- Based on self-reported measurements, the percentage of men who are overweight has increased since 1998 (1998: 39%; 2002: 38%; 2007: 43%). This pattern was also evident among women (1998: 25%; 2002: 28%; 2007: 29%). Obesity levels based on self-reported data, although higher than 1998, have stabilised among men (1998: 12%; 2002: 15%; 2007: 15%) and have slightly decreased among women (1998: 10%; 2002: 14%; 2007: 12%). However, these trends should be interpreted cautiously due to the limitations of self-reported data.
- Consistent with international research, BMI based on self-reported height and weight measurements provided an underestimation of the true prevalence of overweight and obesity. Based on measured data, higher percentages of respondents were found to be overweight and obese, thus highlighting the extent of these conditions among Irish adults. In 2007, approximately 2 out of 3 Irish adults were at an unhealthy weight (either overweight or obese) and almost one out of 4 adults was obese.
- Comparison of measured anthropometric data from the 1999 North/South Ireland Food Consumption Survey (Irish Universities Nutrition Alliance, 2001) to data from SLÁN 2007 shows that there was a substantial increase in obesity over this time period, particularly among Irish women. The North/South study estimated that 39% of Irish adults were overweight (46% men and 33% women) and 18% were obese (20% men and 16% women). In SLÁN 2007, over one-third (38%) of respondents were overweight (44% men and 31% women) and almost one-quarter (23%) were obese (22% men and 23% women).
- Central obesity (as defined on the basis of large waist circumference) is associated with increased risk of diabetes and cardiovascular disease, beyond the risk associated with generalised obesity. The maximum waist circumference threshold for men is 94cm (37in) and for women 80cm (31.5in). The majority of respondents (60%) in the combined sub-samples of older and younger respondents in SLÁN 2007 had a mean waist circumference exceeding the threshold for central obesity. Women were more likely (70%) to be centrally obese than men (49%).
- Based on measured data, the prevalence of overweight and obesity in Ireland was broadly similar to that reported from England (2006) and Scotland (2003), and approximately 5% lower than in the USA (2004).

4. FOOD NUTRIENT INTAKES – RESULTS

4. FOOD NUTRIENT INTAKES – RESULTS

This chapter examines intake patterns of overall food energy in terms of the primary sources of energy (i.e. protein, carbohydrates and fats). A varied diet deriving energy from each of these macronutrients is essential to overall well-being, although consumption should not exceed dietary guidelines. Intake patterns for several key micronutrients (vitamins and minerals) are also analysed. Micronutrients sustain the biochemical functions of the body. Complying with current dietary recommendations for micronutrients, which have been based on the physiological needs of the Irish population, decreases the risk of deficiency-related health conditions.

The main macronutrient and micronutrient intakes were estimated using data from the Food Frequency Questionnaire (FFQ) of SLÁN 2007. Data is compared to SLÁN 1998 and 2002. Where parametric assumptions were met, mean values are reported. Median values are reported for non-parametric distributions. To identify the distribution of nutrient intakes, Tables A4-1 and A4-2 in Appendix 4 list the overall mean, standard deviation, 10th, 50th and 90th percentile for all of the major and minor nutrients in 1998, 2002 and 2007. For nutrients not discussed in the text, results stratified by gender, age group and social class are given in Tables A4-3 and A4-4 of Appendix 4. For purposes of comparison, the Irish dietary recommendations for nutrients, as set by the Food Safety Authority of Ireland, is given in Table A5-1 of Appendix 5.

LEVELS OF REPORTING

A phenomenon that has been long associated with dietary surveys, irrespective of data collection method used, is under- and over-reporting[8] (Black and Cole, 2001) and SLÁN 2007 was no exception. Reporting levels may impact overall energy and nutrient intakes levels and must be taken into consideration when interpreting results.

Table 10 shows the socio-demographic distribution of the different types of reporters (under-, regular and over-) based on energy intake. Overall, reporting of energy remained broadly similar: in 1998, 54% of respondents were likely to have inaccurately reported their energy intake compared to 58% in 2007. Despite minor differences in reporting levels between 1998 and 2007, general patterns of reporting remained the same. Levels of reported energy intake varied by gender, age and BMI categories in 2007. Men (54%) were more likely than women (37%) to under-report their energy intake, whereas approximately twice the percentage of women (16%) to men (8%) over-reported their energy intake. A higher percentage of those aged 18-29 over-reported compared to those in the older age groups. Overweight and obese respondents were more likely to be classified as under-reporters, compared to underweight or healthy weight respondents, whereas underweight respondents were more likely to over-report their energy intake.

[8] Under-, regular, and over-reporting of energy intake were determined using cut-off limits based on physiologically plausible levels of energy intake. For further details, see Chapter 2, 'Reporting of levels of dietary intake'.

Table 10: Socio-demographic distribution of respondents reporting energy intake, by year (1998 and 2007)*

	Under-reporting		Regular reporting		Over-reporting	
	1998 (N = 4,091) %	**2007** (N = 4,799) %	**1998** (N = 1,561) %	**2007** (N = 3,289) %	**1998** (N = 169) %	**2007** (N = 850) %
Gender						
Men	52	54	39	38	9	8
Women	34	37	51	47	15	16
Age group						
18-29	33	39	48	44	19	17
30-44	41	44	47	44	12	12
45-64	50	53	43	39	7	8
65+	49	45	42	44	9	11
Social class						
SC 1-2	33	52	54	39	13	9
SC 3-4	42	44	44	44	14	12
SC 5-6	40	46	46	40	14	14
BMI category						
Underweight	38	20	42	57	20	23
Healthy weight	35	39	50	48	15	13
Overweight	50	54	41	40	9	6
Obese	57	64	36	31	7	5
Total	**42**	**46**	**46**	**42**	**12**	**12**

* Ns do not add up to the total sample that participated in the FFQ due to missing and/or invalid data.

Overall, 43% of respondents reported that they were actively trying to manage their weight. Table 11 examines reporting levels among those respondents who were trying to lose, gain or maintain their current weight. Compared to those who were trying to gain or maintain their current weight, respondents who were trying to lose weight were more likely to under-report their energy intake. However, respondents trying to gain weight were more likely to over-report than respondents trying to lose or maintain their current weight.

Table 11: Levels of reporting, by weight management (2007)*

Weight management	Under-reporting (N = 1,970) %	Regular reporting (N = 1,447) %	Over-reporting (N = 363) %
Lose weight	55	36	9
Maintain current weight	47	42	11
Gain weight	35	46	19

* Ns do not add up to the total number of respondents who reported that they were trying to manage their weight due to missing and/or invalid data.

Table 12 shows respondents' levels of reporting in relation to how they completed the FFQ. A higher percentage of respondents who completed the FFQ without assistance were classified as under-reporters, while higher percentages who received some assistance were classified as over-reporters.

Table 12: Levels of reporting, by method of questionnaire completion (2007)*

	Under-reporting (N = 3,891) %	Regular reporting (N = 3,583) %	Over-reporting (N = 1,033) %
Completed FFQ without assistance	48	41	11
Completed FFQ with some assistance	40	45	15
Completed FFQ in interview format	45	44	12

* Ns do not add up to the total sample that participated in the FFQ (9,223) due to missing and/or invalid data.

MACRONUTRIENTS

The main macronutrient intakes were estimated from the FFQ data and analysed using a specially designed computer program called FFQ_Software, Version 1.0 (*see Chapter 2, 'FFQ analysis'*).

Achievement of macronutrient intake recommendations can be presented as individual-based goals or overall mean population goals. Utilising individual-level cut-off points, as used here, is one approach to determine compliance with macronutrient intake guidelines. However, a second approach to assess the diets of groups can be seen in Table A6-1 of Appendix 6. This alternative method demonstrates the maximum size of a sub-group of the total population with macronutrient intake levels lying within a frequency distribution that is consistent with population targets.

Food energy

Only food energy will be reported here. The FFQ is not a reliable instrument to assess alcohol consumption and thus caloric intake from alcohol has been excluded from subsequent analyses. However, alcohol can impact on total energy intake depending on the frequency of drinking. In SLÁN 2007, approximately one-fifth (19%) of respondents did not drink in the past year, 30% drank 2-3 times per week and 8% drank at least 4 times per week. Overall, 28% of respondents engaged in risky drinking behaviour in the past year (i.e. the consumption of 6 or more standard drinks on one occasion). Further data on alcohol consumption is available in the SLÁN 2007 Main Report (Morgan *et al*, 2008).

The overall mean daily food energy intake in 2007 was 2,278kcal/day. Mean food energy intake was significantly higher ($p<0.001$) among men (2,384kcal/day) than women (2,173kcal/day) and among those in social classes 3-4 (2,310kcal/day) and 5-6 (2,351kcal/day) compared to those in social classes 1-2 (2,169kcal/day). Food energy intake decreased significantly ($p<0.001$) as age increased (age 18-29: 2,520kcal/day; 30-44: 2,378kcal/day; 45-64: 2,110kcal/day; 65+: 1,986kcal/day). Figure 13 shows the mean daily food energy intake of men and women broken down across four age groups.

Figure 13: Distribution of mean daily food energy intake, by gender and age (2007)

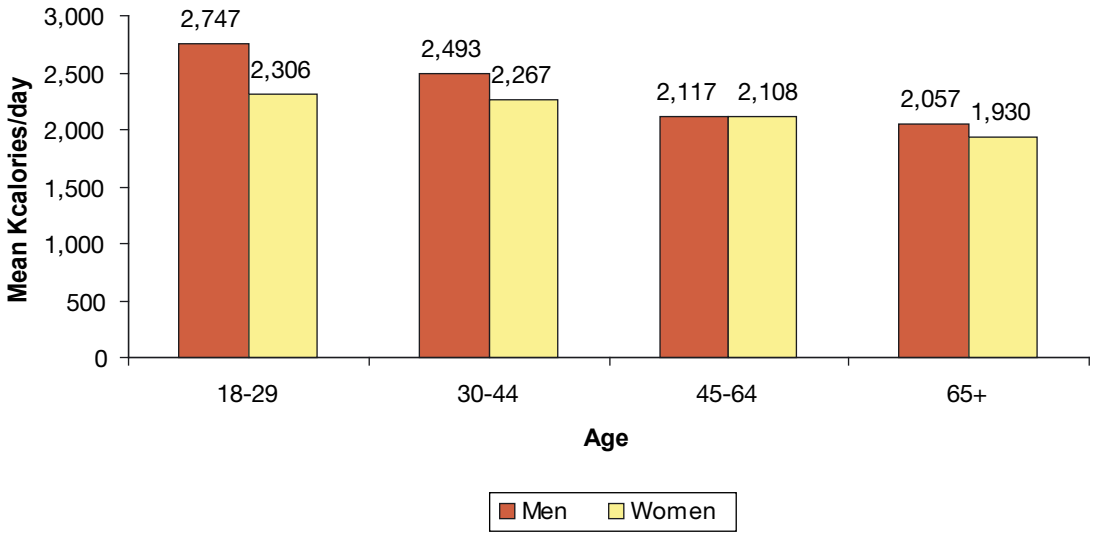
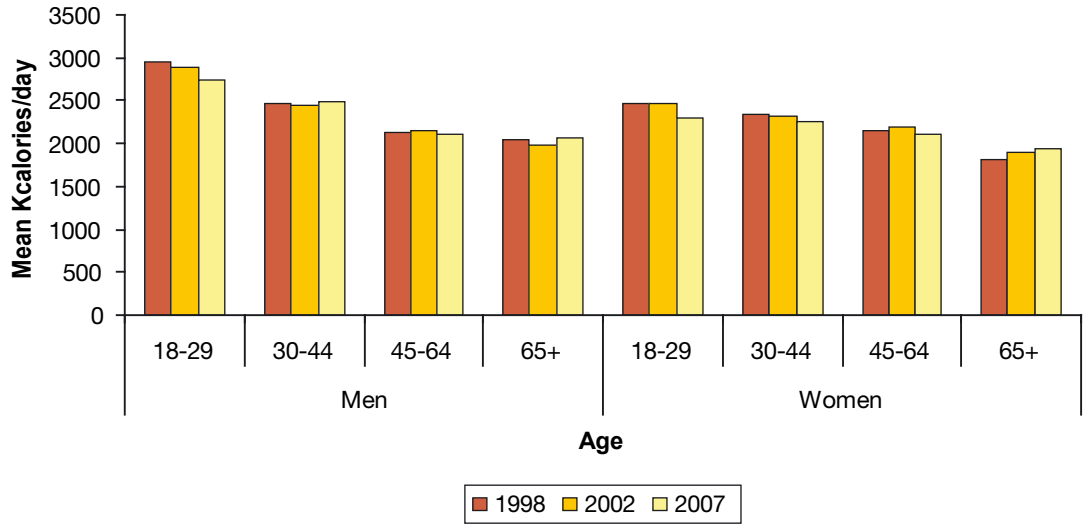


Figure 14 shows a comparison of the mean food energy intake distribution (in kcal/day) for men and women across age groups for the SLÁN surveys of 1998, 2002 and 2007. Food energy intake patterns remained broadly similar for all three surveys, with men and those in the younger age groups having higher daily food energy intakes.

Figure 14: Distribution of mean daily food energy intake, by gender, age and year (1998, 2002 and 2007)



Without sufficient physical activity to balance caloric intake, excess daily food energy intake will result in weight gain. An under-expenditure of approximately 500kcal/day is equivalent to a weight increase of approximately 0.45kg (about 1lb) per week.

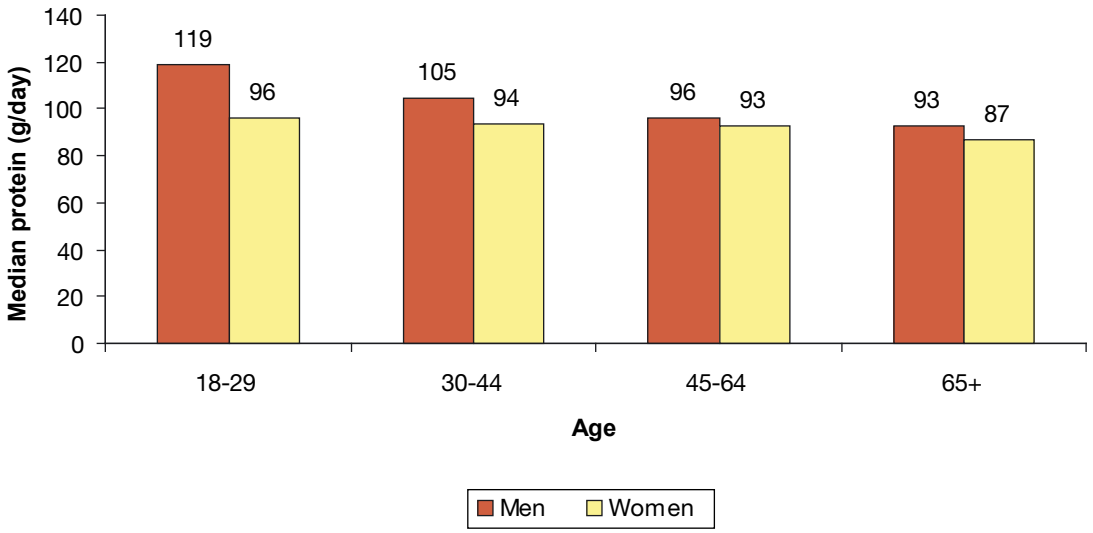
Protein

It is recommended that protein should contribute between 10%-15% of daily food energy intake (Health Promotion Policy Unit, 1987). In SLÁN 2007, 17% of food energy was derived from protein for both men and women, which is higher than the recommendation. There were no strong differences in percentage contribution of protein to energy by age or social class. Overall, 13% of respondents had a protein intake contributing between 10% and 15% of food energy, while the majority (87%) had a protein intake contributing to greater than 15%.

However, the recommended dietary allowance (RDA) for absolute daily intake of protein varies according to gender, age, weight and physical activity levels. National guidelines, issued by the Food Safety Authority of Ireland (FSAI, 1999), range from 54g/day of protein for moderately active men aged over 75 years to 84g/day for very active men between the ages of 18 and 64. Protein intake recommendations for women are less than those for men, ranging from 42g/day for moderately active women aged over 75 years to 69g/day for lactating women (FSAI, 1999). Details of the RDA for protein by age and gender are given in Table A5-2 of Appendix 5.

Overall, median daily protein intake was significantly higher ($p<0.001$) for men (103g/day) than for women (93g/day), for those in the younger age groups (age 18-29: 107g/day; 30-44: 100g/day; 45-64: 99g/day; 65+: 89g/day) and for those in lower social classes (SC 1-2: 94g/day; SC 3-4: 99g/day; SC 5-6: 102g/day). Figure 15 shows the gender and age distribution of the median daily protein intake. Median protein intakes across all ages for men and women were higher than the FSAI recommendations (*see above*). Men aged 18-29 had a significantly higher ($p<0.001$) protein intake compared to men and women across all other age groups. While recommended protein intake should vary according to activity level, no significant differences were seen between protein intake and physical activity levels in either men or women.

Figure 15: Distribution of median daily total protein intake, by gender and age (2007)



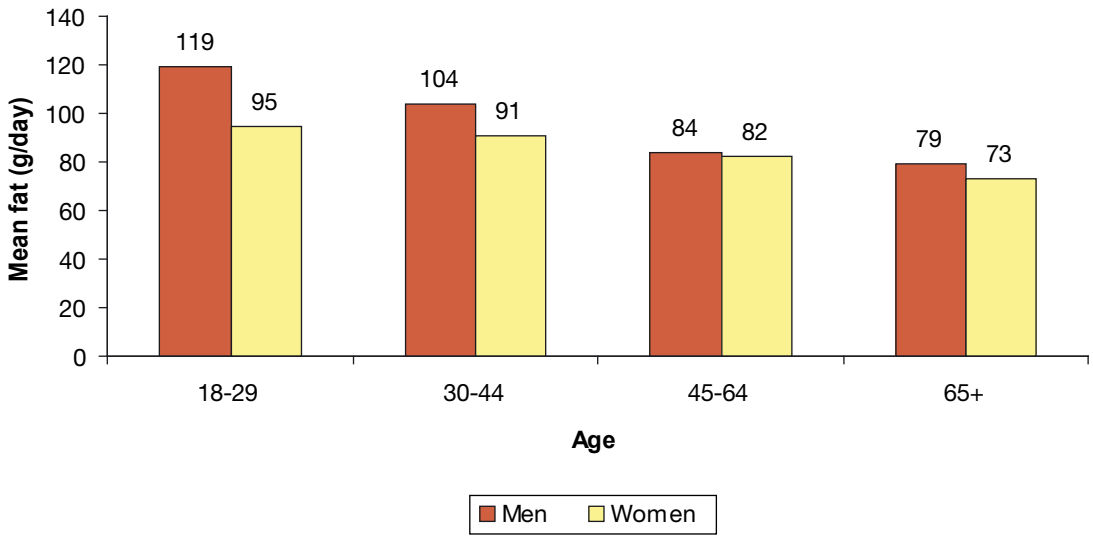
Median daily protein intakes were broadly similar throughout the three SLÁN surveys for men (1998: 100g/day; 2002: 108g/day; 2007: 103g/day) and for women (1998: 91g/day; 2002: 95g/day; 2007: 93g/day). Patterns also remained similar, with men across most age groups and younger respondents consuming higher amounts of protein.

Fat

It is recommended that daily intake of fat should contribute to no more than 35% of food energy. In SLÁN 2007, mean fat intake per day contributed to 36% of food energy, which is above the recommended level (Health Promotion Policy Unit, 1987). The percentage of daily fat intake contributing to food energy was similar for men and women (37% and 36%), but was modestly higher among respondents in the younger age groups (age 18-29: 38%; 30-44: 37%; 45-64: 35%; 65+: 34%), as well as those in social classes 5-6 (SC 1-2: 36%; SC 3-4: 37%; SC 5-6: 38%). Almost one-quarter of respondents (24%) had a daily fat intake contributing between 30% and 35% of food energy, while the fat intake of more than half of those surveyed (58%) contributed to over 35% of food energy.

Mean absolute intakes of fat followed similar patterns, with significantly more men than women reporting higher mean intakes (men: 98g/day; women: 86g/day), as well as younger participants (age 18-29: 107g/day; 30-44: 98g/day; 45-64: 83g/day; 65+: 76g/day) and those in lower social classes (SC 1-2: 86g/day; SC 3-4: 95g/day; SC 5-6: 98g/day). Figure 16 shows the gender and age distribution of mean daily total fat intake, with the highest intake being among young men, aged 18-29.

Figure 16: Distribution of mean daily total fat intake, by gender and age (2007)



While the percentage of energy contributed from fat remains above the recommendation, fat intake has actually decreased across the three SLÁN surveys for men (1998: 102g/day; 2002: 104g/day; 2007: 98g/day) and for women (1998: 91g/day; 2002: 90g/day; 2007: 86g/day). This apparent decrease in fat intake may be a by-product of under-reporting by respondents. Nonetheless, men and those in the younger age groups consumed higher quantities of fat per day across the three surveys compared to their female counterparts.

Fatty acid distribution

Overall in 2007, higher quantities of saturated fat (SFA) were consumed than either monounsaturated fat (MUFA) or polyunsaturated fat (PUFA), with mean consumption values of 33g/day, 30g/day and 17g/day respectively. These intakes contributed to 13% of food energy for SFA, 12% for MUFA and 7% for PUFA. Table 13 shows the mean fatty acid intake distribution across gender, age and social class. The population goal in relation to SFA intake is to reduce intake to less than 10% of food energy (Health Promotion Policy Unit, 1987). However, as Table 13 shows, men and women of all ages and social classes were above this goal.

Table 13: Distribution of mean fatty acid intake, by gender, age and social class (2007)

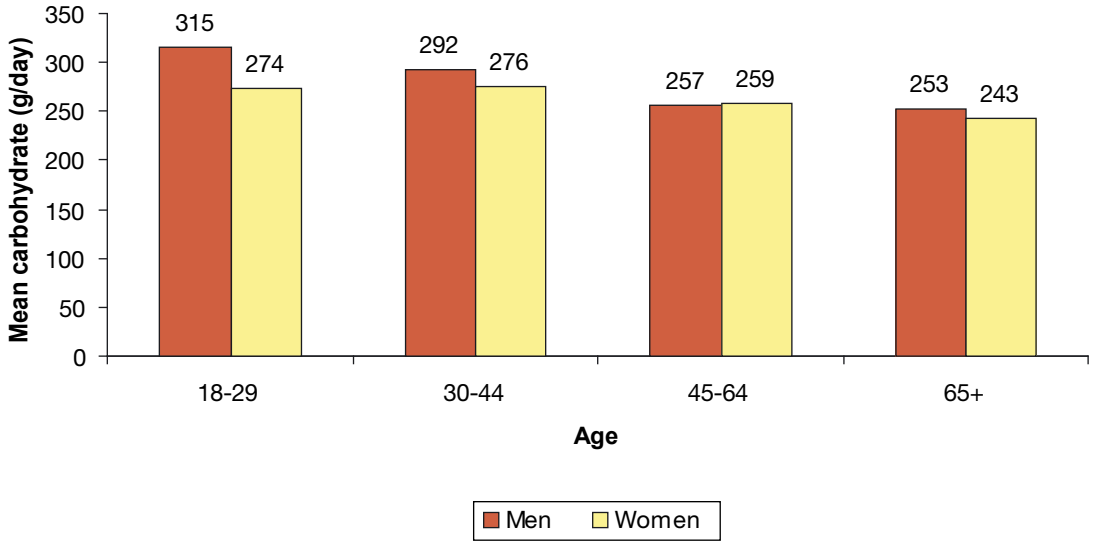
Mean	Gender		Age group (years)				Social class		
	Men	Women	18-29	30-44	45-64	65+	1-2	3-4	5-6
Total fat (g/day)	98	86	107	98	83	76	86	95	98
SFA (g/day)	36	30	39	35	30	28	30	34	36
MUFA (g/day)	32	27	34	31	26	23	27	30	31
PUFA (g/day)	16	16	19	18	15	13	16	17	17
Food energy (kcal/day)	2,384	2,173	2,521	2,378	2,110	1,986	2,169	2,310	2,351
Fat (% of food energy intake)	37	36	38	37	35	34	36	37	38
SFA (% of food energy intake)	14	12	14	13	13	13	12	13	14

Carbohydrates

It is recommended that 55% of daily food energy be derived from carbohydrates. In SLÁN 2007, overall mean carbohydrate intake contributed 48% of food energy, which was lower than the recommendation. The percentage that carbohydrates contributed to food energy was lower for men (47%) than for women (49%), higher for those in social classes 1-2 compared to other groups (SC 1-2: 49%; SC 3-4: 48%; SC 5-6: 47%) and higher in the older age groups (age 18-29: 47%; 30-44: 48%; 45-64: 49%; 65+: 50%) (*see Figure 17*).

However, in absolute terms, mean daily carbohydrate intake was higher among men (282g/day) than women (266g/day), as well as among younger participants (age 18-29: 294g/day; 30-44: 284g/day; 45-64: 258g/day; 65+: 247g/day) and those in lower social classes (SC 1-2: 266g/day; SC 3-4: 275g/day; SC 5-6: 276g/day). Figure 17 shows the gender and age distribution of mean daily total carbohydrate intake, with the highest intake being among young men, aged 18-29.

Figure 17: Distribution of mean daily total carbohydrate intake, by gender and age (2007)



Comparing SLÁN surveys, mean daily carbohydrate intake was lower in 2007 (men: 282g/day; women: 266g/day) than in 2002 (men: 293g/day; women: 281g/day) or in 1998 (men: 300g/day; women: 279g/day). However, the overall percentage contribution to food energy remained similar (1998: 49%; 2002: 48%; 2007: 47%).

Contribution of macronutrients to food energy

The relative contribution to food energy intake was calculated for protein, fat and carbohydrates (*see Table 14*). The percentage contribution to daily food energy intake from protein and fat was above the recommended guidelines for both men and women across all age groups and was below that recommended for carbohydrates.

Table 14: Distribution of percentage contribution to food energy, by gender and age (2007)*

		Men Age group (years)				Women Age group (years)			
		18-29	30-44	45-64	65+	18-29	30-44	45-64	65+
Food energy (kcal/day)		2,747	2,493	2,117	2,057	2,306	2,267	2,108	1,930
Nutrient	Recommended	% contribution to food energy intake							
Protein	10%-15%	17	17	18	17	16	16	17	17
Fat	30%-35%	38	37	35	34	37	36	35	33
Carbohydrates	55%	45	46	48	49	47	48	49	50

* Some figures may not add up to 100% due to rounding errors in calorie conversion.

Table 15 shows the percentage contribution to food energy and daily intake (g/day) for protein, fat and carbohydrates in 1998, 2002 and 2007. When interpreting the percentage contribution to food energy, it is important to also give consideration to absolute macronutrient energy intake since absolute intake may change without affecting the relative distribution of energy contribution.[9] It can be seen that the percentage of food energy derived from protein, fat and carbohydrates has remained stable across the years for men and women; however, there were minor variations in intake across the three surveys. In absolute terms, there were modest decreases in fat and carbohydrate intake, and a modest increase in protein intake. Despite changes in absolute intake, the percentage contribution to food energy from carbohydrates remained below the 55% recommendation (*see Table 14*), while the percentage contribution from fat exceeded the 30%-35% recommendation, particularly in younger age groups. Furthermore, it is highly plausible that the percentage contribution from fat was *underestimated* due to under-reporting of energy intake in the FFQ.

Table 15: Distribution of percentage contribution to food energy, by gender and year (1998, 2002 and 2007)*

Nutrient	Men						Women					
	1998		2002		2007		1998		2002		2007	
	%	g/day	%	g/day	%	g/day	%	g/day	%	g/day	%	g/day
Protein	16	100	17	108	17	103	16	91	16	95	17	93
Fat	36	101	37	104	36	98	36	91	35	90	35	86
Carbohydrates	48	300	47	293	47	282	49	279	49	281	48	266

* Some figures may not add up to 100% due to rounding errors in calorie conversion.

[9] When comparing the percentage contribution of nutrients to food energy for 1998, 2002 and 2007, it is important to remember that additional foods were added to the FFQ in 2007 that may have affected reported food energy intake.

Comparison of SLÁN 2007 macronutrient intake with other studies

Results from SLÁN 2007 are not directly comparable to studies of nutrient and energy intake that are based on food diaries or on 24-hour recall. Nevertheless, differences can be seen when comparing SLÁN 2007 to studies from the Irish Universities Nutrition Alliance (IUNA) North/South Ireland Food Consumption Survey, 1999 (Irish Universities Nutrition Alliance, 2001); the United Kingdom National Diet and Nutrition Survey (NDNS), 2000-01 (Office for National Statistics, 2001); and the US National Health and Nutrition Examination Survey (NHANES),1999-2000 (Wright *et al*, 2003) (*see Table 16*). These differences may, however, be an artefact of the methods used.

Table 16: Comparison of SLÁN 2007 macronutrient intake with international studies

	SLÁN 2007	IUNA[1]	NDNS[2]	NHANES[3]
Men				
Food energy (kcal/day)	2,384	2,472	2,110	2,475
Protein (% of food energy intake)	17	17	16	15
Fat (% of food energy intake)	36	37	36	33
Carbohydrates (% of food energy intake)	47	46	48	51
Women				
Food energy (kcal/day)	2,173	1,761	1,554	1,833
Protein (% of food energy intake)	17	16	16	15
Fat (% of food energy intake)	35	37	35	33
Carbohydrates (% of food energy intake)	48	47	49	53

1 IUNA = Irish Universities Nutrition Alliance North/South Ireland Food Consumption Survey, 1999. 7-day diet diary. Ages 18-64 years.

2 NDNS = United Kingdom National Diet and Nutrition Survey, 2000-01. 7-day diet diary. Ages 19-64 years.

3 NHANES = US National Health and Nutrition Examination Survey, 1999-2000. 24-hour diet recall. Ages 20 years and over. Figures were taken directly from the NHANES report and may not add up to 100% due to rounding errors.

Reported daily food energy intake for men in SLÁN 2007 was similar to findings from IUNA and NHANES, but was roughly 270kcal higher than findings from NDNS. However, reported daily intakes for women were notably higher in SLÁN 2007 compared to the three other studies. SLÁN 2007 found Irish women's daily food energy intake was approximately 375-600kcal higher than British and American women's intakes. SLÁN 2007 estimated that Irish women consumed approximately 400 calories more than figures that were reported in IUNA. Although differences in food energy intake were evident, the percentage contribution to food energy from protein, fat and carbohydrates were broadly similar across the surveys.

Implications of different dietary survey methods

Differences in energy and macronutrient consumption can be partially attributed to data collection methods:

- SLÁN 2007 used a semi-quantitative FFQ to determine average consumption of different foods over the past year.
- IUNA used a 7-day estimated food diary, in which foods and drinks were recorded by respondents for 7 days and quantification was conducted using 8 methods as part of a quantification protocol.
- NDNS used a 7-day diet diary to record quantities of food consumed and the location.
- NHANES used 24-hour dietary recall from respondents.

Each data collection method has well-documented strengths and limitations related to their intended use, ease of administration and validity; none are immune, however, to the problem of under-reporting.

In brief, the FFQ has been used as an epidemiological tool to assess dietary intakes for several decades (Willett, 1994). It is designed to measure long-term dietary intake and is commonly used in epidemiological studies of habitual food intake among large populations. Weighed 7-day food records are traditionally seen as the 'gold standard' in dietary assessment, where the subjects record and weigh everything they consume for a period of 7 days. The 7-day estimated food diaries are an adaptation of the weighed method, which still require the participant to record all foods and drinks consumed and to estimate the quantity consumed based on a photographic atlas, manufacturers' information, etc. This method requires the participant to be literate and highly motivated, and places a high burden on them; however, it is often considered to be the most accurate and precise method for determining energy intake. The 24-hour recall method was designed to quantitatively assess current nutrient intake. This method requires only short-term memory and the burden on the participant is less in comparison with food records. However, one of the main technical issues of a 24-hour recall is its limited ability to reliably measure an individual's habitual diet. While the 24-hour recall and the dietary record may be considered more accurate, for large-scale population studies the FFQ – as used in SLÁN 2007 – is the preferred instrument. An ideal compromise, however, would be a combination of a 24-hour recall and a FFQ to provide a more comprehensive overview of dietary habits.

Historical comparison in the Irish context

In the past 50 years, 6 national dietary surveys have been carried out in Ireland. These were the National Nutrition Surveys (NNS) of 1948 and 1990; SLÁN 1998; IUNA (1999); SLÁN 2002; and SLÁN 2007. With the exception of SLÁN 1998 and SLÁN 2002, these surveys employed different methods, but nevertheless they demonstrate longitudinal patterns in the Irish diet (*see Table 17*). These surveys find that reported daily food energy intake was highest in 1948, and that by 1990, food energy intake had decreased by approximately 800kcal. However, since 1990, reported daily food energy intake has remained relatively stable. The percentage contribution to food energy from protein, fat and carbohydrates has also remained similar since 1990, with a higher contribution to daily food energy from fat and protein compared to 1948. However, recent trends should be interpreted with caution since it is highly likely that the percentage contribution, particularly from fat, may be affected by under-reporting of energy intake in the FFQ.

Table 17: Comparison of national Irish dietary surveys*

	NNS 1948[1]	NNS 1990[2] (N = 1,214)	SLÁN 1998 (N = 6,539)	IUNA 1999 (N = 1,379)	SLÁN 2002 (N = 5,992)	SLÁN 2007[3] (N = 9,223)
Food energy (kcal/day)	3,104	2,331	2,351	2,102	2,360	2,278
Protein (% of food energy intake)	13	15	16	16	17	17
Fat (% of food energy intake)	29	36	36	37	36	36
Carbohydrates (% of food energy intake)	58	49	49	47	48	47

* Figures may not add up to 100% due to rounding errors in calorie conversion.

[1] Energy intake may include alcohol; food energy could not be determined. The NNS 1948 sampled 2,500 families throughout Ireland; the exact number of respondents was unavailable. To assess the habitual dietary patterns of each family, an investigator made an initial visit to weigh and measure all food in the house. Seven days later, the investigator returned to measure and to weigh all food again, to determine the exact quantity of food consumed by the family.

[2] The NNS 1990 sampled 676 adults (18+ years) and 538 children (under 18 years). The survey used a 7-day diet history method, with a photographic atlas of 120 foods commonly eaten in Ireland. Respondents were asked to provide information on eating patterns and their usual food and drink intake over the past week.

[3] While 10,364 respondents participated in the main SLÁN 2007 survey, 9,223 respondents completed the FFQ.

Summary

- A phenomenon associated with dietary surveys is under- and over-reporting by respondents. In SLÁN 2007, cut-off limits based on physiologically plausible levels of habitual food energy intake were applied to identify under-, regular and over-reporters. Overall, 46% of respondents under-reported their food energy intake, 42% regular reported and 12% over-reported. Adjustments were not made to account for over- and under-reporting unless otherwise stated.
- Respondents consumed a mean daily food energy intake of 2,278kcal/day, which was similar to consumption in 2002 (2,360kcal/day) and 1998 (2,351kcal/day).
- Without sufficient physical activity to balance caloric intake, excess daily food energy intake will result in weight gain. An under-expenditure of approximately 500kcal/day is equivalent to a weight increase of approximately 0.45kg (about 1lb) per week.
- For food energy intake, it is recommended that 55% of energy derives from carbohydrates, 10%-15% from protein and less than 35% from fat. Among all respondents, mean daily carbohydrate intake contributed to 47% of food energy, which was lower than the recommendation. Overall, while 13% of respondents had a protein intake of 10%-15% of food energy (as recommended), the majority (87%) had a protein intake greater than 15% of food energy. Almost one-quarter of respondents (24%) consumed the recommended fat intake of 30%-35% of food energy, while more than half (58%) had a fat intake contributing to more than 35% of food energy.

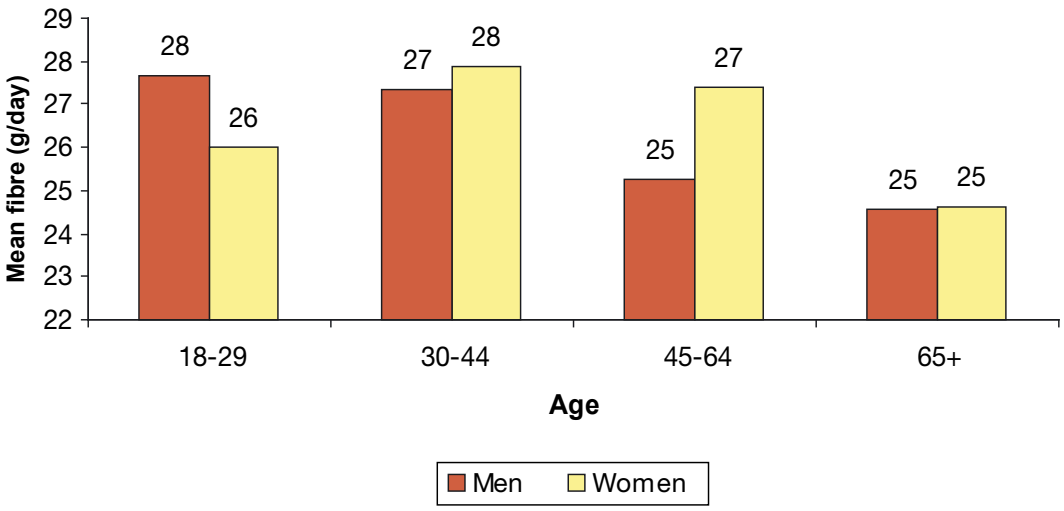
- The absolute daily intake (g/day) of carbohydrates and fat has decreased modestly since 1998, while protein intake has increased. However, between 1998 and 2007, the percentage contribution to food energy from protein has remained stable (1998: 16%; 2007: 17%), similarly for fat (1998: 36%; 2007: 36%) and carbohydrates (1998: 49%; 2007: 47%). However, these trends should be interpreted with caution since it is highly likely that the percentage contribution, particularly from fat, was underestimated due to under-reporting of energy intake by respondents in the FFQ.

FIBRE

The current recommendation for fibre intake is 25-35g/day (Health Promotion Policy Unit, 1987). While more than one-quarter of SLÁN 2007 respondents (28%) consumed the recommended amount of fibre each day, the majority (52%) consumed less than 25g/day.

Overall, mean daily fibre intake was 26.8g/day, which is towards the lower limit of the recommended guideline of 25-35g/day. Little variation was seen between men (26.4g/day) and women (26.9g/day) or between social class groups (SC 1-2: 26.5g/day; SC 3-4: 26.8g/day; SC 5-6: 26.2g/day). However, significant differences ($p<0.001$) were seen across age groups, with those in the younger age groups consuming significantly higher intakes of fibre (age 18-29: 27.1g/day; 30-44: 27.6g/day; 45-64: 26.3 g/day; 65+: 24.6g/day) (*see Figure 18*).

Figure 18: Distribution of mean daily fibre intake, by gender and age (2007)



Summary

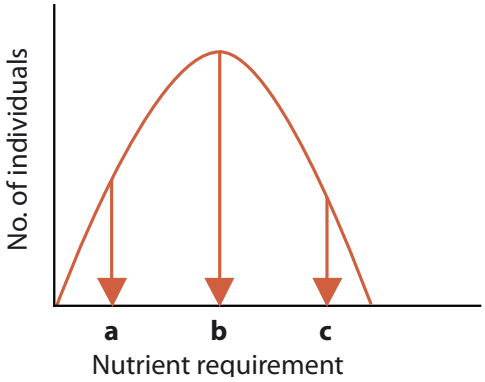
- Overall, mean daily fibre intake was 26.8g/day, which is towards the lower limit of the recommended 25-35g/day. While more than one-quarter of respondents (28%) consumed an amount of fibre within the recommended daily range, the majority (52%) consumed less than 25g/day.

MICRONUTRIENTS – VITAMINS AND MINERALS

Mean micronutrient intake levels are assessed using current Irish recommended dietary allowances (RDA), average requirements (AR) and lowest threshold intakes (LTI). The mean population intake is compared with the RDA and the percentage of respondents consuming more than the AR is examined to determine the nutritional adequacy of the Irish diet. These three dietary reference points (RDA, AR and LTI) are based on the dietary recommendations of the EU Scientific Committee for Food and they define, rather than a single value RDA, individual nutrient requirements based on a population distribution. The single value RDA is often misinterpreted as the lowest acceptable intake of a nutrient when, in fact, it is substantially more than an individual requires. Thus, the establishment of a tri-level reference based on a population distribution minimises confusion (FSAI, 1999; Scientific Committee for Food, 1993). Figure 19 demonstrates how references levels are devised based on a population distribution:

- Point 'c' represents the RDA (also known as the Population Reference Intake) and is the equivalent of the population mean plus two standard deviations. The RDA should meet the nutritional requirement of nearly all healthy people in the group (approximately 97.5%).
- Point 'b' represents the AR and is the mean requirement of the population. On a population level, as the proportion of the population with a nutrient intake less than the AR increases, the likelihood of a deficiency for that nutrient increases.
- Point 'a' represents the LTI and is the equivalent of the population mean minus two standard deviations. The LTI represents the intake below which nearly all individuals will be unable to maintain metabolic integrity according to the criterion chosen. The LTI is primarily used to assess the nutrient intake of individuals. However, if a substantial proportion of a population consumes less than the LTI, the population may be at risk of nutrient deficiency and further investigation should follow.

Figure 19: Distribution of individual requirements for a nutrient



a Lowest threshold intake (LTI)
b Average requirement (AR)
c Recommended dietary allowance (RDA)

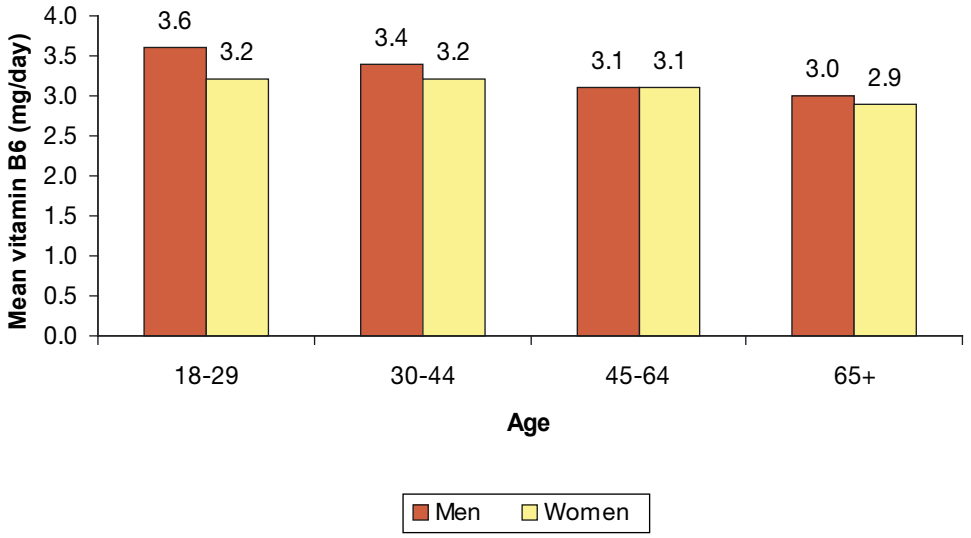
VITAMINS

Daily intakes for 6 major vitamins are reported below – B6, B12, C, D, E and folate. Intake details for the remaining 6 vitamins (by gender, age and social class) are included in Table A4-3 of Appendix 4. The following analyses do not take into account additional nutrient contribution from vitamin supplements and are based purely on reported dietary intakes.

Vitamin B6

The AR for vitamin B6 for men and women is 1.3mg/day and 1.0mg/day respectively. Overall, 99% of SLÁN 2007 respondents (98% men and 99% women) reported intake levels above the AR, suggesting adequate consumption of vitamin B6. The RDA for vitamin B6 for men and women is 1.5mg/day and 1.1mg/day respectively. Men and women across all ages consumed sufficient quantities of vitamin B6 to reach their RDA, with men having significantly higher mean intakes than women (3.3mg/day and 3.1mg/day respectively). Figure 20 shows the gender and age distribution of vitamin B6 intake. Vitamin B6 intake varied significantly ($p<0.001$) by age group: younger men and women had higher levels of vitamin B6 in their diet than their older counterparts (age 18-29: 3.4mg/day; 30-44: 3.3mg/day; 45-64: 3.1mg/day; 65+: 2.9mg/day). Those in social classes 1-2 had a significantly lower ($p=0.007$) dietary vitamin B6 intake (3.1mg/day) compared to those in social classes 3-4 (3.2mg/day) and 5-6 (3.2mg/day).

Figure 20: Distribution of mean daily vitamin B6 intake, by gender and age (2007)

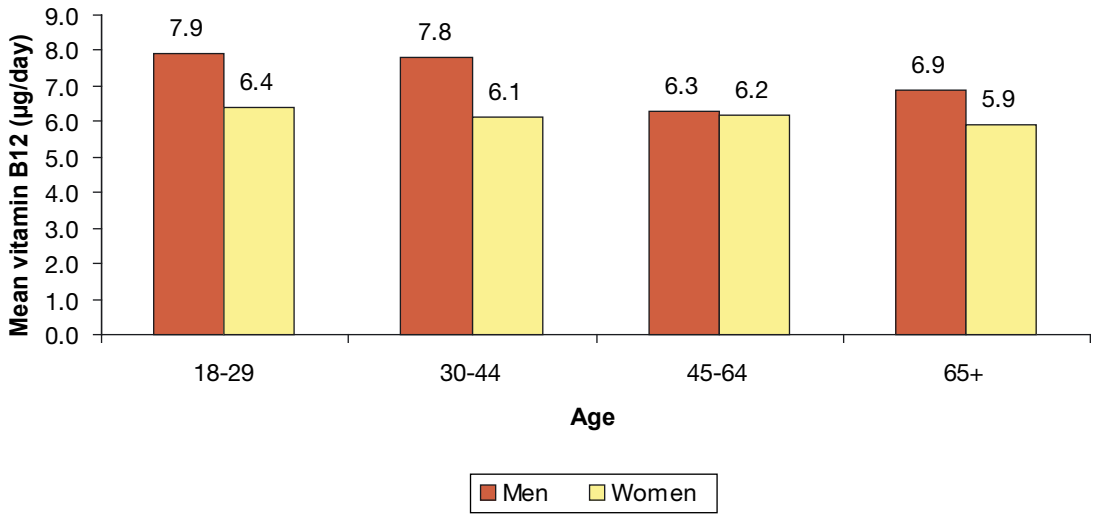


Patterns of dietary vitamin B6 intake in 2007 were broadly similar to those in 1998 and 2002. Mean intake for all men was 3.2mg/day in 1998; 3.3 mg/day in 2002; and 3.3mg/day in 2007. Mean intake for all women was 3.0mg/day in 1998; 3.1mg/day in 2002; and 3.1mg/day in 2007.

Vitamin B12

The AR for vitamin B12 for both men and women is 1.0µg/day. Overall, 99% of SLÁN 2007 respondents (100% men and 99% women) reported intake levels above the AR, suggesting adequate consumption of vitamin B12. The RDA for vitamin B12 for both men and women is 1.4µg/day. Across all ages, both men and women consumed in excess of this requirement (*see Figure 21*). Mean intake was significantly higher ($p<0.001$) for men than women (7.2µg/day and 6.2µg/day respectively). With the exception of respondents in the 45-64 age group, men consumed more than women across all other age groups. Those in higher social classes had a significantly lower ($p<0.001$) mean daily intake than those in lower social classes (SC 1-2: 6.1µg/day; SC 3-4: 6.7µg/day; SC 5-6: 7.6µg/day).

Figure 21: Distribution of mean daily vitamin B12 intake, by gender and age (2007)

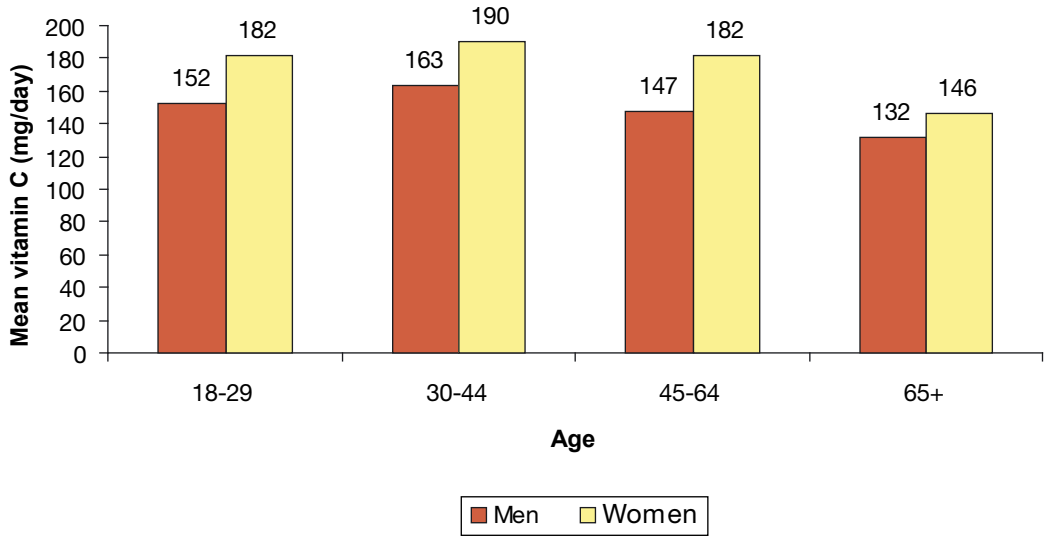


Patterns of dietary vitamin B12 intake were similar in 1998 and 2002, but intake levels were higher in 2007. Mean intake for all men was 6.5µg/day in 1998; 6.4µg/day in 2002; and 7.2µg/day in 2007. Mean intake for all women was 5.7µg/day in 1998; 5.4µg/day in 2002; and 6.2µg/day in 2007.

Vitamin C

The AR for vitamin C is 46mg/day. Overall, 94% of respondents (92% men and 95% women) reported intake levels above the AR, suggesting adequate consumption of vitamin C. The RDA for vitamin C is 60mg/day. As seen in Figure 22, overall mean intakes for both men and women were over twice the recommended levels (151.1mg/day for men and 178.9mg/day for women). Respondents in the 30-44 age group had significantly higher ($p<0.001$) vitamin C intakes compared to the other age groups (age 18-29: 167.4mg/day; 30-44: 176.3mg/day; 45-64: 164.6mg/day; 65+: 139.8mg/day), as did those in social classes 1-2 (SC 1-2: 175.6mg/day; SC 3-4: 165.0mg/day; SC 5-6: 147.6mg/day).

Figure 22: Distribution of mean daily vitamin C intake, by gender and age (2007)

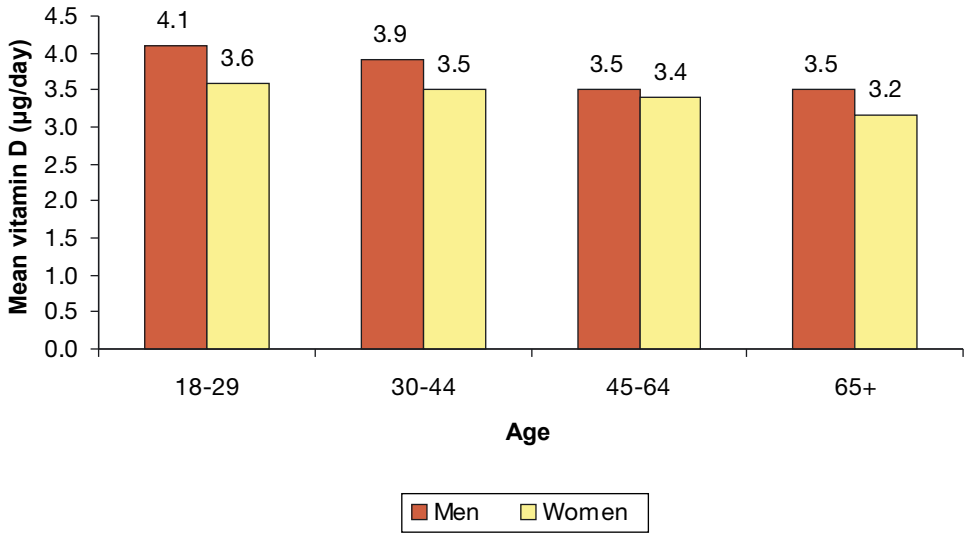


Dietary vitamin C intake increased between 1998 and 2007. Mean intake for all men was 110.9mg/day in 1998; 132.2mg/day in 2002; and 151.1mg/day in 2007. Mean intake for all women was 134.8mg/day in 1998; 169.0mg/day in 2002; and 178.9mg/day in 2007.

Vitamin D

Currently, there is no AR for vitamin D; however, this vitamin can be synthesised from direct sunlight. The RDA for vitamin D is 0-10µg/day. As seen in Figure 23, mean intakes for both men and women fell within the lower limits of the recommended intake range (3.8µg/day for men and 3.5µg/day for women). Compared to other groups, significantly higher ($p<0.001$) dietary intakes were consumed by men, those in the younger age groups (age 18-29: 3.8µg/day; 30-44: 3.7µg/day; 45-64: 3.5µg/day; 65+: 3.3µg/day) and those in the lower social classes (SC 1-2: 3.5µg/day; SC 3-4: 3.7µg/day; SC 5-6: 3.8µg/day).

Figure 23: Distribution of mean daily vitamin D intake, by gender and age (2007)



Mean intake levels for dietary vitamin D were similar across the three SLÁN surveys for men (3.7µg/day in 1998; 3.5µg/day in 2002; 3.8µg/day in 2007) and for women (3.3µg/day in 1998; 3.3µg/day in 2002; 3.5µg/day in 2007).

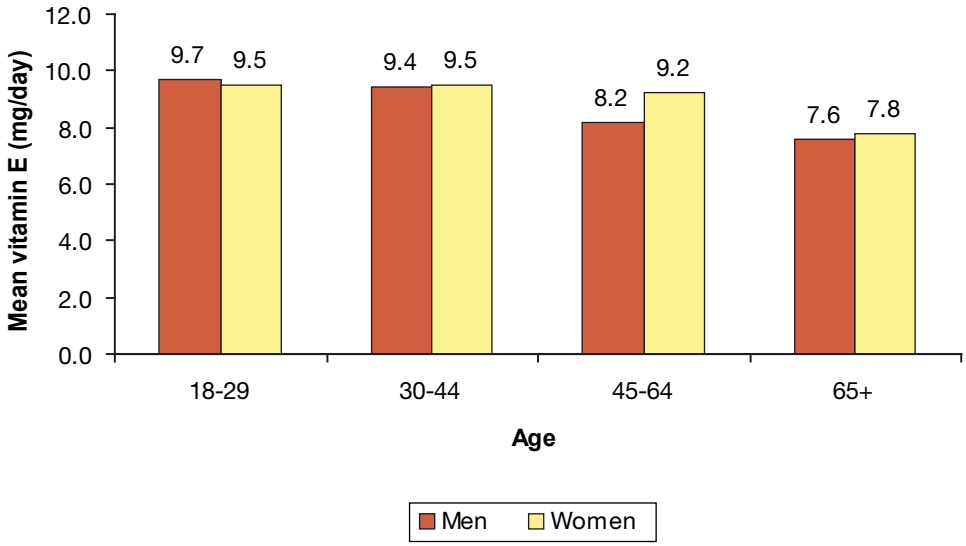
Vitamin E

The Food Safety Authority of Ireland (FSAI) is in the process of establishing an AR and RDA for vitamin E.[10] However, the EU Scientific Committee for Food (1993) has recommended that vitamin E intake levels should not fall below 4mg/day for men and 3mg/day for women. Overall, 93% of SLÁN 2007 respondents (89% men and 96% women) reported intakes above these levels: mean intakes for men were 8.8mg/day, while mean intakes for women were 9.1mg/day. Those in the younger age groups consumed significantly higher ($p<0.001$) quantities of vitamin E

[10] Since vitamin E is a fat-soluble vitamin, intake levels are dependent on dietary polyunsaturated fatty acids (PUFA) intake. As PUFA intakes are highly variable between individuals, establishing an AR or RDA that would meet the nutritional needs of a population has proved challenging.

(age 18-29: 9.5mg/day; 30-44: 9.4mg/day; 45-64: 8.7mg/day; 65+: 7.7mg/day), which corresponded with the pattern of consumption of polyunsaturated fatty acids (PUFA). Figure 24 shows the gender and age breakdown for daily dietary vitamin E intake in 2007.

Figure 24: Distribution of mean daily vitamin E intake, by gender and age (2007)

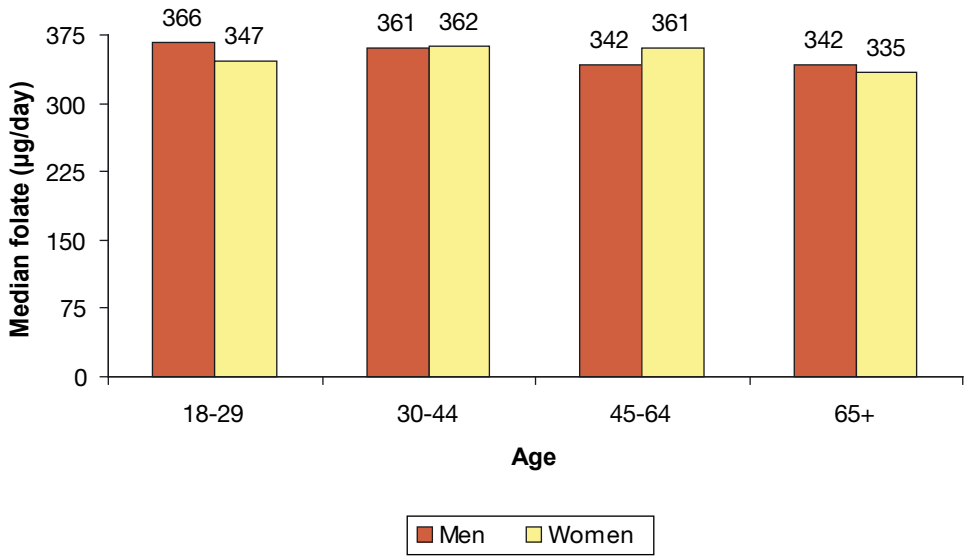


While intake patterns for dietary vitamin E were broadly similar across the three SLÁN surveys for men (8.9mg/day in 1998; 9.9mg/day in 2002; 8.8mg/day in 2007) and for women (9.0mg/day in 1998; 9.9mg/day in 2002; 9.1mg/day in 2007), consumption of vitamin E has decreased since 2002 to levels reported in 1998.

Folate

The AR for folate is 230µg/day. Overall, 82% of SLÁN 2007 respondents (82% men and 82% women) reported intake levels above the AR, suggesting a proportion of the Irish population may have inadequate intake of this vitamin. Since sufficient folate intake has been associated with a decreased risk of neural tube defects, it is essential for women to take during their child-bearing years; indeed, recommendations for folate are higher during pregnancy and lactation. Almost one in 5 women had an estimated folate intake below the AR; this was most prominent among young women (age 18-29: 20%; 30-44: 16%; 45-64: 17%; 65+: 19%). The RDA for folate for men and women is 300µg/day. Overall, mean folate intakes were above the recommended level for men (354.0µg/day) and women (353.6µg/day). Intakes were not significantly higher among women than men, but were significantly higher ($p<0.001$) among those in the 30-44 age group (age 18-29: 356.2µg/day; 30-44: 361.4µg/day; 45-64: 351.4µg/day; 65+: 338.4µg/day) and among those in social classes 3-6 (SC 1-2: 345.8µg/day; SC 3-4: 355.3µg/day; SC 5-6: 358.0µg/day) ($p=0.002$). Figure 25 shows the gender and age distribution for folate intake in 2007.

Figure 25: Distribution of mean daily folate intake, by gender and age (2007)



Over the three SLÁN surveys, mean folate intake increased between 1998 and 2002, and decreased modestly in 2007 for men (339.2µg/day in 1998; 366.9µg/day in 2002; 354.0µg/day in 2007) and for women (336.3µg/day in 1998; 370.1µg/day in 2002; 353.6µg/day in 2007).

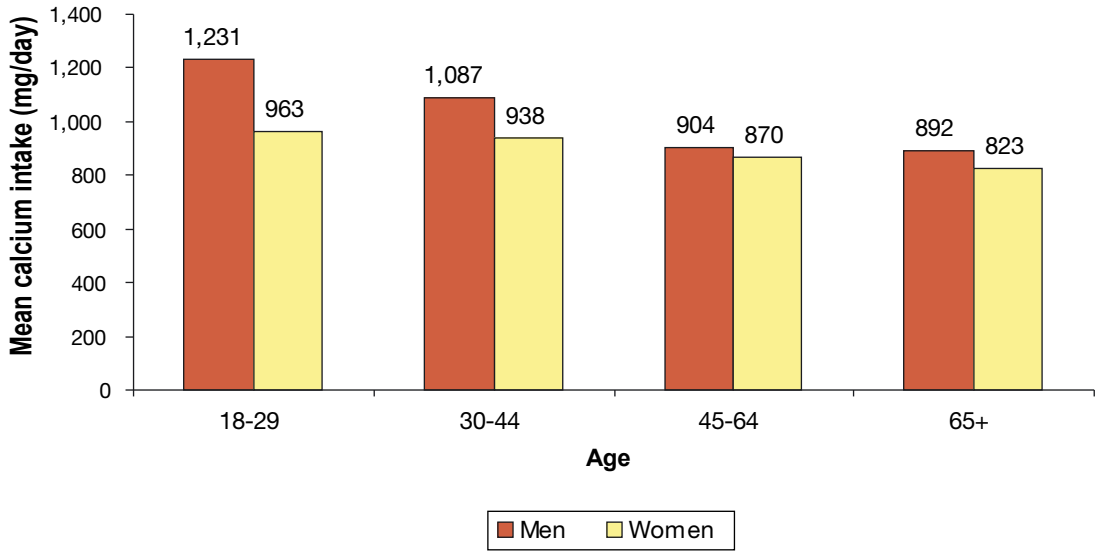
MINERALS

Daily intakes for 5 major minerals are reported below – calcium, iron, zinc, potassium and salt (a derivative of the mineral sodium). Intake details for the remaining 12 minerals (by gender, age and social class) are included in Table A4-4 of Appendix 4. The following analyses do not take into account additional nutrient contribution from mineral supplements and are based purely on reported dietary intakes.

Calcium

The AR for calcium for both men and women is 615mg/day, with higher amounts recommended for women during pregnancy and lactation. Overall, 79% of SLÁN 2007 respondents (82% men and 76% women) reported intake levels above the AR, suggesting that a proportion of the Irish population, particularly women, may have inadequate intake of this mineral. The RDA for calcium is 800mg/day. Mean intake levels were above the recommended amount for both men (1,041.2mg/day) and women (906.3mg/day), with intake levels significantly higher ($p<0.001$) among men. Calcium intakes were found to vary significantly by age (age 18-29: 1,094.7mg/day; 30-44: 1,012.9mg/day; 45-64: 887.0mg/day; 65+: 853.3mg/day) and by social class (SC 1-2: 938.3mg/day; SC 3-4: 985.8mg/day; SC 5-6: 998.1mg/day), with those in the younger age groups and those in the lower social classes having significantly higher ($p<0.001$) daily intakes. Figure 26 shows the gender and age distribution of calcium intake in 2007.

Figure 26: Distribution of mean daily calcium intake, by gender and age (2007)



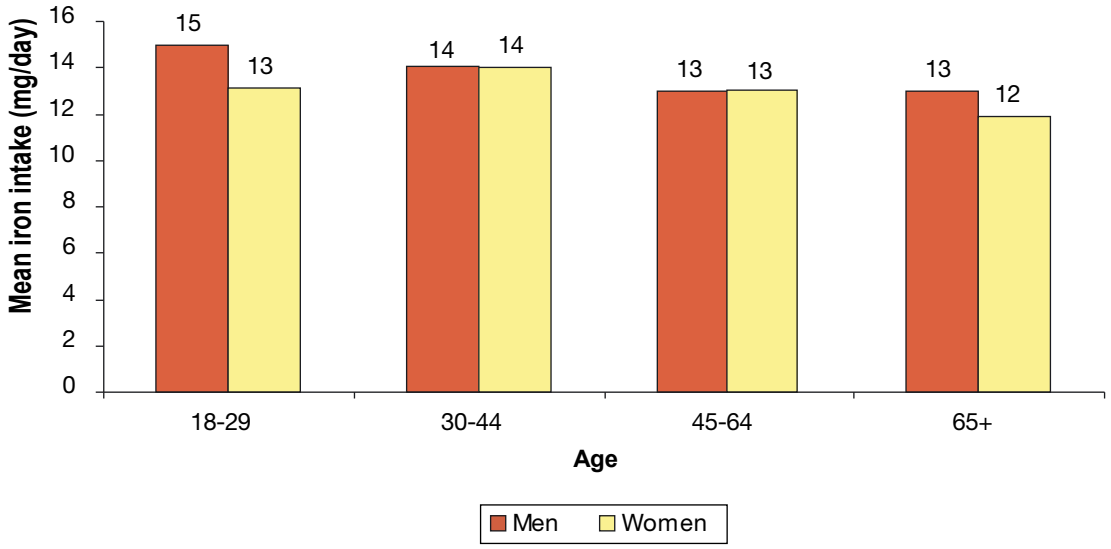
In comparison to 1998, mean calcium intakes in 2007 have increased for men (956.0mg/day in 1998; 1,067.7mg/day in 2002; 1,041.2mg/day in 2007) and remained broadly similar for women (913.2mg/day in 1998; 946.0mg/day in 2002; 906.3mg/day in 2007).

Iron

The AR for iron is 7.7mg/day for men and 10.8mg/day for women. Overall, 73% of SLÁN 2007 respondents (87% men and 59% women) reported intake levels above the AR, suggesting that a proportion of the Irish population, particularly women, may have inadequate iron intake. The RDA for adult men of all ages is 10mg/day, while the requirement for women is 14mg/day. In 2007, mean intake of iron by men (13.5mg/day) was significantly higher ($p=0.001$) than that of women (13.1mg/day). Men across all age groups consumed more than the RDA of 10mg/day (age 18-29: 14.7mg/day; 30-44: 14.0mg/day; 45-64: 12.6mg/day; 65+: 12.6mg/day), while women consumed less than the RDA of 14mg/day across all age groups (age 18-29: 13.3mg/day; 30-44: 13.6mg/day; 45-64: 13.0mg/day; 65+: 12.1mg/day).

Iron intake was found to decrease significantly as age increased (age 18-29: 14.0mg/day; 30-44: 13.8mg/day; 45-64: 12.8mg/day; 65+: 12.3mg/day) and it was significantly higher ($p<0.001$) in social classes 3-6 than in social classes 1-2 (SC 1-2: 13.0mg/day; SC 3-4: 13.4mg/day; SC 5-6: 14.0mg/day). Figure 27 shows the gender and age distribution of daily iron intake in 2007.

Figure 27: Distribution of mean daily iron intake, by gender and age (2007)

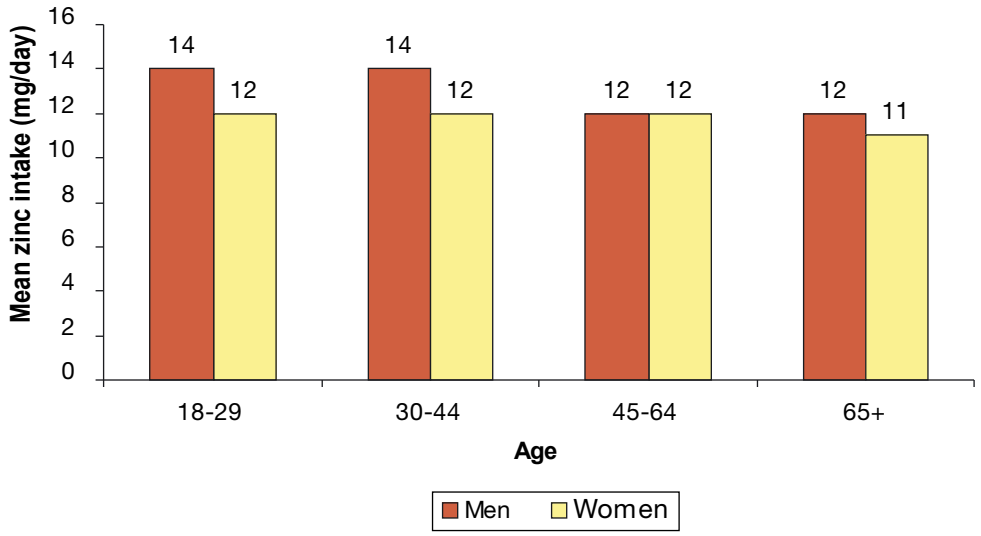


Overall, across the three SLÁN surveys, mean iron intakes were similar since 1998 for both men (13.3mg/day in 1998; 13.5mg/day in 2002; 13.5mg/day in 2007) and women (12.8mg/day in 1998; 13.3mg/day in 2002; 13.1mg/day in 2007).

Zinc

The AR for zinc is 7.5mg/day for men and 5.5mg/day for women. Overall, 91% of SLÁN 2007 respondents (88% men and 94% women) reported intake levels above the AR, suggesting an adequate consumption of zinc for women, but a possible deficiency among men. The RDA for zinc is 9.5mg/day for men and 7.0mg/day for women. In 2007, mean intake was above the recommended amount for both men (13.1mg/day) and women (11.7mg/day). Men, younger respondents (age 18-29: 13.1mg/day; 30-44: 12.7mg/day; 45-64: 11.8mg/day; 65+: 11.5mg/day) and those in lower social classes reported significantly higher ($p<0.001$) intakes of zinc (SC 1-2: 11.8mg/day; SC 3-4: 12.5mg/day; SC 5-6: 13.0mg/day). Figure 28 shows the gender and age distribution of zinc intake in 2007.

Figure 28: Distribution of mean daily zinc intake, by gender and age (2007)



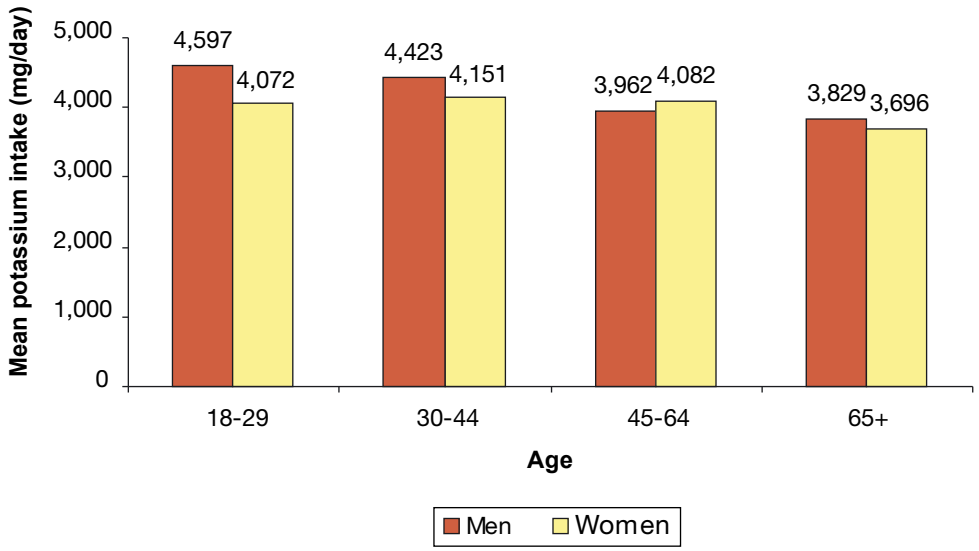
Overall, across the three SLÁN surveys, reported mean daily intake of zinc increased between 1998 and 2007 for both men (12.3mg/day in 1998; 12.7mg/day in 2002; 13.1mg/day in 2007) and women (11.3mg/day in 1998; 11.3mg/day in 2002; 11.7mg/day in 2007).

Potassium

Currently, there is no AR for potassium in Ireland; however, the RDA for potassium is 3,100mg/day. Overall, 75% of SLÁN 2007 respondents (76% men and 74% women) reported intake levels above the RDA – a level which is substantially more than an individual requires. In 2007, the mean reported daily intake for potassium was 4,140.7mg/day, which is higher than the recommendation. As seen in Figure 29, there was a significant difference ($p<0.001$) between the mean potassium intake for men (4,247.3mg/day) and women (4,038.4mg/day). Younger respondents also had significantly higher ($p<0.001$) mean intakes than their older counterparts (age 18-29: 4,329.5mg/day; 30-44: 4,287.2mg/day; 45-64: 4,021.8mg/day; 65+: 3,754.1mg/day). However, there was no significant difference in potassium intake levels across social class groups (SC 1-2: 4,100.2mg/day; SC 3-4: 4,181.4mg/day; SC 5-6: 4,138.8mg/day).

Potassium intake patterns were found to differ by gender. For men, potassium intake decreased significantly ($p<0.001$) as age increased (age 18-29: 4,596.8mg/day; 30-44: 4,422.8mg/day; 45-64: 3,961.5mg/day; 65+: 3,829.1mg/day). In contrast, potassium intake among women increased between the ages of 18 and 44, and decreased significantly ($p<0.001$) after 45 years of age (age 18-29: 4,072.4mg/day; 30-44: 4,151.0mg/day; 45-64: 4,083.0mg/day; 65+: 3,695.5mg/day).

Figure 29: Distribution of mean daily potassium intake, by gender and age (2007)



Overall, across the three SLÁN surveys, mean potassium intakes have increased since 1998 for both men (3,980.2mg/day in 1998; 4,163.9mg/day in 2002; 4,247.3mg/day in 2007) and women (3,765.4mg/day in 1998; 3,995.4mg/day in 2002; 4,038.4mg/day in 2007).

Salt

The report by the Food Safety Authority of Ireland on the scientific evidence and recommendations of public policy on salt and health in Ireland (FSAI, 2005) advises Irish adults to have a maximum target for sodium intake of 1.6g/day, which is equivalent to 4g of salt per day. At a population level, the advised target for sodium intake is 2.4g/day, which is equivalent to 6g of salt per day.

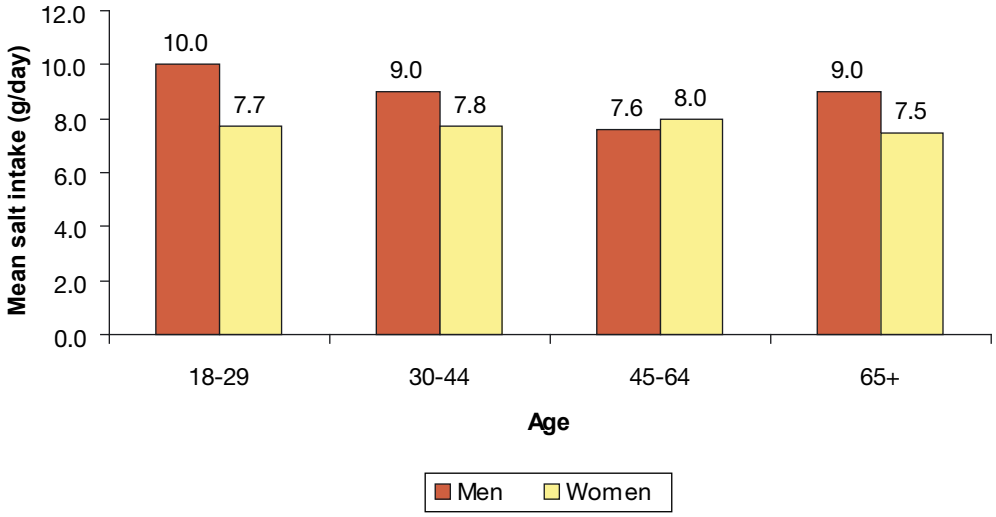
The following analysis excludes discretionary salt added during cooking and at the table, and therefore may underestimate the total salt intake by 15%-20%. However, it should be noted that since estimations of salt intake were calculated using the McCance and Widdowson's Food Composition Tables (1997), no adjustments were made for salt reductions in foods achieved by the food industry since the publication of these tables. Thus, although it is possible that reported daily salt intake may be underestimated in this analysis due to the exclusion of discretionary salt, this may, in fact, be countered by recent reductions in the salt content of foods, which have not been addressed here.

In 2007, 93% of respondents (94% men and 92% women) reported a daily salt intake that exceeded the physiological requirement of 4g/day, while 71% of respondents (74% men and 69% women) had an estimated salt intake that exceeded population guidelines of 6g/day. Mean daily salt intake was higher than individual and population-level targets among both men (8.7g/day) and women (8.0g/day).[11] A significant age gradient was also evident ($p<0.001$): overall, salt intake decreased from 18-64 years, but increased slightly among the older age group of 65+ (age 18-29: 8.9g/day; 30-44: 8.5g/day; 45-64: 7.9g/day; 65+: 8.1g/day). However,

[11] Additional work, funded by Safe Food, is currently ongoing to define these estimates, based on 24-hour urine collections.

when stratified by gender, it is evident that this age pattern is primarily due to differences in salt consumption among men, not among women (*see Figure 30*). While salt intakes were higher for all ages among men, younger men, in particular, aged 18-29 had substantially higher intakes than older men (age 18-29: 9.6g/day; 30-44: 8.8g/day; 45-64: 8.0g/day; 65+: 8.5g/day) or women across all age groups (age 18-29: 8.1g/day; 30-44: 8.1g/day; 45-64: 7.8g/day; 65+: 7.8g/day). A significant social class gradient was also evident ($p<0.001$), with lower intakes reported in the higher social classes (SC 1-2: 7.8g/day; SC 3-4: 8.4g/day; SC 5-6: 8.9g/day).

Figure 30: Distribution of mean daily salt intake, by gender and age (2007)



Overall, reported mean salt intake was similar across the three SLÁN surveys for both men (8.7g/day in 1998; 8.6g/day in 2002; 8.7g/day in 2007) and women (8.0g/day in 1998; 8.0g/day in 2002; 8.0g/day in 2007).

Salt intake and salt usage

Approximately one-third of SLÁN 2007 respondents reported 'always'/'usually' adding salt to their food while cooking (30%) or at the table (32%). While one-fifth of respondents (20%) reported that they 'always'/'usually' do both (i.e. add salt to their food while cooking and also at the table), one-third (35%) reported that they 'rarely'/'never' do either (neither add salt to their food while cooking nor at the table).

Comparing salt intake from the FFQ with reported salt usage, respondents who regularly added salt while cooking and/or to food at the table had significantly higher ($p<0.001$) intakes than those who rarely added salt (*see Table 18*).

Table 18: Mean salt intake and reported salt usage while cooking and at the table

	Salt added while cooking	Salt added to food at the table	Salt added while cooking *and* added to food at the table
	Mean salt intake g/day	Mean salt intake g/day	Mean salt intake g/day
Always/usually	8.4	8.5	8.6
Sometimes	8.4	8.4	8.6
Rarely/never	8.1	8.0	8.0

Salt intake and food consumption

Much of the salt consumed on a daily basis is 'hidden' salt, i.e. either naturally occurring or added to foods during the manufacturing process. The foods with the highest salt/sodium content tend to be processed foods. Table 19 details the mean daily salt intake of SLÁN 2007 respondents, broken down into food groups. As can be seen, foods that contributed the highest percentage of salt to the Irish diet were foods from the bottom shelf of the Food Pyramid (i.e. cereals, breads and potatoes), contributing 34% of daily salt intake from food. Meat, fish and poultry products contributed 22% of daily salt intake, while soups, sauces and spreads were the third highest contributors of salt, at 14%. Sweets and savoury snacks, which contain little to no nutritional value, contributed to 8% of salt intake.

Table 19: Contribution of food groups to overall salt intake

Food groups	Sodium (g)	Salt (g)	Contribution to overall salt intake %
Cereals, breads, and potatoes*	1.1	2.7	34
Meat, fish and poultry	0.7	1.8	22
Soups, sauces and spreads	0.5	1.1	14
Vegetables	0.4	0.9	11
Dairy products and fats	0.3	0.8	10
Sweets and savoury snacks	0.2	0.6	8
Drinks	0.0	0.1	1
Fruits	0.0	0.0	0
Milk	0.0	0.0	0

* Cereals and breads are the primary contributors to salt intake. However, potatoes were also included in this category since the FFQ analysis software did not permit the separation of these food items.

Micronutrient deficiencies

Determining micronutrient deficiencies based on the FFQ may be inaccurate due to the exclusion of vitamin and mineral supplements, as well as the effects of under-reporting. However, if a large proportion of the population reports consuming less than the average requirement (AR) or the lowest threshold intake (LTI), then, despite these limitations, it is plausible that a deficiency truly exists at the population level.

To assess micronutrient deficiencies, the percentage of respondents with nutrient intake levels below the LTI, AR and recommended dietary allowance (RDA) was examined. Then, respondents who under-reported food energy intakes were removed and the percentages below these reference points were re-examined to determine if deficiencies persist.

Based on the FFQ analysis for all respondents, there were several possible nutrient inadequacies in the Irish diet. Overall, about one-fifth (18%) of men and women consumed less than the AR for folate and 12% of men had an estimated daily zinc intake below the AR (*see Table 20*). A large proportion of men and women were consuming less than the recommended levels of calcium, although women were more likely to have an intake level below the AR (18% men and 24% women) and the LTI (5% men and 9% women). Overall, 13% of men had an estimated daily intake of iron below the AR and 11% had an intake below the LTI. In comparison, women were more than twice as likely as men to have a daily iron intake below the AR (41%), although the percentage below the LTI (11%) was similar to men. Of all the possible micronutrient deficiencies examined, the high percentage of women consuming less than the AR for iron is of particular concern.

Table 20: Percentage of all respondents below the LTI, AR and RDA for key dietary micronutrients, by gender*

	LTI		AR		RDA	
Micronutrient	**Men %**	**Women %**	**Men %**	**Women %**	**Men %**	**Women %**
Vitamin B6 (mg)	–	–	2	1	3	1
Vitamin B12 (mg)	0	1	1	1	1	2
Vitamin C (mg)	3	2	7	5	14	9
Folate (µg)	4	5	18	18	40	41
Calcium (mg)	5	9	18	24	37	45
Iron (mg)	11	13	13	41	30	66
Zinc (mg)	3	2	12	6	26	14
Potassium (mg)	1	1	–	–	24	26

* Recommendations from the Food Safety Authority of Ireland (FSAI) are in the process of being established for vitamin E and sodium; a LTI has not yet been established for vitamin B6; an AR is currently in the process of being established for potassium.

However, when respondents who under-reported their food energy intake were removed from the analysis, most micronutrient levels were adequate for both men and women, with very few respondents consuming less than the LTI or the AR for almost all micronutrients (*see Table 21*). From this analysis, it no longer appeared that there were folate deficiencies among men and women, or zinc, calcium or iron deficiencies among men. However, there were two exceptions: almost one-fifth of women (18%) had iron intake levels below the AR and 9% of women had calcium intake levels below the AR. Thus, it is likely that Irish women are at risk of iron deficiency and may have a borderline risk of calcium deficiency.

Table 21: Percentage of respondents excluding under-reporters below the LTI, AR and RDA for key dietary micronutrients, by gender*

	LTI		AR		RDA	
Micronutrient	**Men %**	**Women %**	**Men %**	**Women %**	**Men %**	**Women %**
Vitamin B6 (mg)	–	–	0	0	0	0
Vitamin B12 (mg)	0	0	0	0	0	1
Vitamin C (mg)	1	0	2	2	5	4
Folate (µg)	0	1	3	4	12	21
Calcium (mg)	1	2	4	9	12	25
Iron (mg)	1	1	1	18	4	49
Zinc (mg)	0	0	1	1	4	3
Potassium (mg)	0	0	–	–	3	7

* Recommendations from the Food Safety Authority of Ireland (FSAI) are in the process of being established for vitamin E and sodium; a LTI has not yet been established for vitamin B6; an AR is currently in the process of being established for potassium.

Summary

- Mean micronutrient intake levels were assessed using current Irish recommended dietary allowances (RDA), average requirements (AR) and lowest threshold intakes (LTI), all of which are based on the dietary recommendations of the EU Scientific Committee for Food. Rather than a single target, these three reference values define individual nutrient requirements based on a population distribution.
- The RDA for vitamin B6 is 1.5mg/day for men and 1.1mg/day for women. Mean daily intake levels of vitamin B6 for both men (3.3mg/day) and women (3.1mg/day) exceeded this recommendation in 2007. Almost all respondents had adequate vitamin B6 intake, with 99% of respondents (98% men and 99% women) reporting intake levels above the AR of 1.3mg/day for men and 1.0mg/day for women. On average, both men and women consumed more than the RDA of 1.4µg/day of vitamin B12 (men: 7.2µg/day; women: 6.2µg/day). Almost all respondents had adequate vitamin B12 intake, with 99% of respondents (100% men and 99% women) reporting intake levels above the AR of 1.0mg/day.

- On average, both men and women consumed more than twice the RDA of 60mg/day of vitamin C (men: 151.1mg/day; women: 178.9mg/day). Overall, 94% of respondents (92% men and 95% women) reported intake levels above the AR of 46mg/day, suggesting adequate consumption of vitamin C.
- The Food Safety Authority of Ireland is in the process of establishing an AR and RDA for vitamin E, although the EU Scientific Committee for Food (1993) has recommended that vitamin E intake levels should not fall below 4mg/day for men and 3mg/day for women. In SLÁN 2007, mean daily intakes of vitamin E were well in excess of this level, with men consuming 8.8mg/day and women 9.1mg/day. Overall, 93% of respondents (89% men and 96% women) reported intake levels above these minimum thresholds.
- Mean folate intake in 2007 was above the RDA of 300µg/day (men: 354.0µg/day; women: 353.6µg/day). Folate is associated with a decreased risk of neural tube defects and thus adequate intake is essential for women of child-bearing age. Overall, 18% of females had a folate intake level below the AR of 230µg/day; however, young females were the most likely to have a level below this requirement (age 18-29: 20%; 30-44: 16%; 45-64: 17%; 65+: 19%).
- Mean calcium intake has increased among men, but was broadly similar for women, between 1998 (men: 956.0mg/day; women: 913.2mg/day) and 2007 (men: 1,067.7mg/day; women: 903.6mg/day) and was above the RDA of 800mg/day. However, 24% of women had calcium intake levels below the AR of 615mg/day, suggesting that the Irish female population may have inadequate calcium intake. Nonetheless, mean vitamin D intake was within the lower limit of the RDA of 0-10µg/day (men: 3.8µg/day; women: 3.5µg/day).
- The RDA for zinc is 9.5mg/day for men and 7.0mg/day for women. Overall, mean daily intake of zinc was above that recommended for both genders (men: 13.1mg/day; women: 11.7mg/day). The AR for zinc is 7.5mg/day for men and 5.5mg/day for women. Overall, 91% of respondents (88% men and 94% women) reported intake levels above the AR, suggesting a possible deficiency among men.
- The mean reported daily intake for potassium was 4,140.7mg/day (men: 4,247.3mg/day; women: 4,038.4mg/day), which exceeds the RDA of 3,100mg/day. Overall, 75% of respondents (76% men and 74% women) reported intake levels above the RDA – a level which is substantially more than an individual requires. An AR for potassium is currently in the process of being established.
- Overall, mean iron intake was similar for both men and women between 1998 (men: 13.3mg/day; women: 12.8mg/day) and 2007 (men: 13.5mg/day; women: 13.1mg/day). On average, women consumed less than the RDA of 14mg/day of iron across the three SLÁN survey years. Overall, 42% of women had iron levels below the AR of 10.8mg/day, suggesting a risk of iron deficiency among Irish women.

- Estimated mean salt intake has remained similar among men and women between 1998 (men: 8.7g/day; women: 8.0g/day) and 2007 (men: 8.7g/day; women: 8.0g/day). Overall, in 2007, 71% of respondents (74% men and 69% women) exceeded the advised target for sodium intake of 2.4g/day, which is equivalent to 6g of salt per day. These estimates exclude discretionary salt (added during cooking and at the table) and therefore underestimate the total salt intake by 15%-20%. Thus, the estimated mean population salt intake in this study exceeds the population target of 6g/day for adults set by the Food Safety Authority of Ireland. However, it should be noted that this target is set at a level well in excess of physiological requirements. One-third (34%) of salt intake from food was derived from cereals, breads and potatoes.

5. COMPLIANCE WITH FOOD PYRAMID – RESULTS

5. COMPLIANCE WITH FOOD PYRAMID – RESULTS

This chapter will recap briefly on the results presented in the SLÁN 2007 Main Report (Morgan *et al*, 2008) on compliance with the dietary recommendations of the Irish Food Pyramid across gender, age and social class. A detailed breakdown of each shelf is then examined in terms of its constituent food groups (e.g. rice and pasta on the cereals, breads and potatoes shelf) and their contribution to the mean daily serving intakes, also analysed by gender, age and social class. In addition to individual shelf compliance, overall compliance with the Food Pyramid is explored and the number of SLÁN 2007 respondents who met the dietary recommendations of the Food Pyramid is analysed in terms of gender, age and social class.

HEALTHY EATING GUIDELINES – THE IRISH FOOD PYRAMID

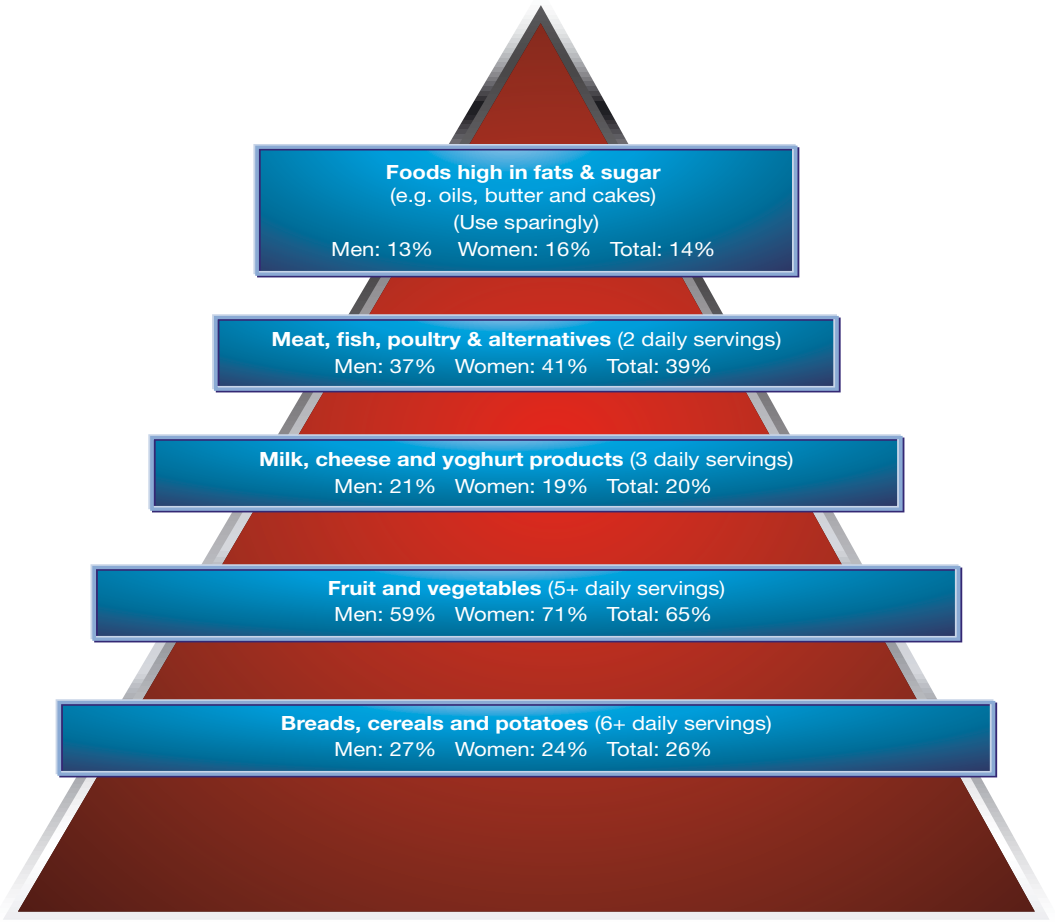
Irish healthy eating guidelines encourage people to eat a variety of foods based on the Food Pyramid. Findings are presented below on consumption from each shelf of the Food Pyramid by SLÁN 2007 respondents, by gender, age and social class. As with the nutrients analysis based on food energy intake (*see Chapter 4*), outliers and extreme values were removed from this analysis (*see Chapter 2, 'Statistical methods'*).

Figure 31 summarises compliance in 2007 with the recommended number of servings from each shelf of the Food Pyramid. The constituent breakdown of each shelf is described in detail below.

In summary:

- approximately one-quarter of respondents (26%) were complying with the recommended 6+ daily servings of cereals, breads and potatoes, significantly more men (27%) than women (24%) ($p<0.001$);
- almost two-thirds (65%) consumed 5+ daily servings of fruit and vegetables, significantly more women (71%) than men (59%) ($p<0.001$);
- only one-fifth (20%) were complying with the recommended 3 daily servings of dairy products (milk, cheese and yoghurts), with similar percentages of men (21%) and women (19%) meeting this target;
- almost two-fifths (39%) were complying with the recommended 2 daily servings of meat, fish, poultry and alternatives, with women more likely to meet this target (41%) than men (37%);
- less than one-fifth (14%) were complying with the recommended under-3 daily servings of foods high in fats and sugar (e.g. oils, butter, margarines and cakes), with women again being more likely to meet this target (16%) than men (13%).

Figure 31: Percentage of respondents consuming the recommended number of daily servings from each shelf of the Food Pyramid



CEREALS, BREADS AND POTATOES

For the general adult population, it is recommended that 6 or more servings of foods from the cereals, breads and potatoes shelf (including rice and pasta) be consumed each day.

Overall in 2007, the mean number of servings consumed from this shelf of the Food Pyramid was 4.9, with men consuming more servings than women (5.0 servings and 4.9 servings respectively). Examining the individual food constituents of this shelf (i.e. cereals, breads, potatoes, rice and pasta), it can be seen that consumption of the different types of food varies by gender, age and social class (*see Table 22*). Men consumed more servings of breads and significantly more potatoes ($p<0.001$) on a daily basis than women, whereas women consumed more cereals, although differences were not significant. Across social class groups, those in SC 5-6 consumed more breads and potatoes and less rice and pasta than those in SC 1-4. Compared to those in the younger age groups, respondents aged 65 and over consumed a significantly lower number of servings of breads ($p<0.001$), but a higher number of servings of cereals ($p<0.001$) and potatoes ($p<0.001$). Augmenting this generation difference in dietary habits, younger respondents consumed more rice and pasta.

Table 22: Mean number of daily servings of food constituents from the cereals, breads and potatoes shelf, by gender, age and social class

	Breads Mean (SD)	Cereals Mean (SD)	Potatoes Mean (SD)	Rice Mean (SD)	Pasta Mean (SD)
Gender					
Men	2.39 (2.03)	0.93 (1.06)	1.34 (1.03)	0.20 (0.35)	0.16 (0.24)
Women	2.31 (1.99)	0.96 (1.00)	1.21 (0.93)	0.21 (0.40)	0.15 (0.22)
Age group					
18-29	2.06 (1.90)	0.91 (0.90)	1.16 (0.86)	0.26 (0.49)	0.21 (0.26)
30-44	2.23 (1.94)	0.90 (0.97)	1.20 (0.95)	0.26 (0.42)	0.21 (0.25)
45-64	2.50 (2.09)	0.97 (1.05)	1.35 (1.06)	0.16 (0.25)	0.11 (0.18)
65+	1.76 (2.08)	1.06 (1.26)	1.46 (1.05)	0.08 (0.18)	0.04 (0.14)
Social class					
SC 1-2	2.20 (1.89)	0.93 (1.02)	1.14 (0.88)	0.25 (0.45)	0.18 (0.22)
SC 3-4	2.36 (2.02)	0.94 (1.02)	1.32 (1.05)	0.19 (0.33)	0.15 (0.22)
SC 5-6	2.52 (2.05)	0.94 (1.00)	1.39 (1.08)	0.17 (0.30)	0.14 (0.26)

FRUIT AND VEGETABLES

Although the Food Pyramid recommends consuming 5 daily servings of foods from the fruit and vegetables shelf, there are added health benefits to consuming more than this target. For this reason, respondents whose daily consumption exceeded 5 servings were also considered as meeting this recommendation, along with those respondents meeting the Food Pyramid target of 5 daily servings. It should also be noted that peas and beans were included in the fruit and vegetables shelf in accordance with the most current version of the Food Pyramid from the Department of Health and Children.

Overall in 2007, the mean number of servings consumed from this shelf of the Food Pyramid was 7.1, with women consuming significantly more daily servings than men (7.7 and 6.5 servings respectively) ($p<0.001$). Exploring the contribution of each food constituent of this shelf to the overall daily serving intake, it can be seen that a higher number of servings of vegetables were consumed on a daily basis than fruit – mean vegetables intake was 4.2 servings while mean fruit intake was 2.8 servings.

A breakdown of consumption by gender, age and social class shows that vegetable intake was greater than fruit intake across all socio-demographic characteristics (*see Table 23*). Women consumed significantly more fruit and vegetables than men ($p<0.001$). Across age groups, those aged 30-64 consumed more fruit and vegetables than either their younger or their older counterparts. There was a significant social class gradient ($p<0.001$), with those in the higher social classes consuming more fruit and vegetables than those in the lower social classes.

Table 23: Mean number of daily servings of food constituents from the fruit and vegetables shelf, by gender, age and social class

	Fruit Mean (SD)	Vegetables Mean (SD)
Gender		
Men	2.6 (2.4)	3.9 (2.6)
Women	3.1 (2.8)	4.6 (3.2)
Age group		
18-29	2.8 (2.7)	4.1 (2.9)
30-44	3.0 (2.8)	4.5 (2.8)
45-64	3.0 (2.6)	4.4 (3.1)
65+	2.5 (2.1)	3.9 (2.9)
Social class		
SC 1-2	3.0 (2.5)	4.5 (2.8)
SC 3-4	2.8 (2.5)	4.3 (3.0)
SC 5-6	2.6 (2.6)	3.9 (2.8)

MILK, CHEESE AND YOGHURTS

It is recommended that 3 servings of foods from the milk, cheese and yoghurt shelf be consumed each day. While 3 daily servings are recommended, it must be cautioned that over- or underconsumption of these foods may have a negative impact on nutritional health. Overall, 20% of respondents reported consuming 3 daily servings of milk, cheese and yoghurt products. While nearly one-fifth (19%) of respondents reported consuming more than 3 daily servings of dairy produce, the majority (61%) of respondents reported consuming less than the 3 recommended daily servings. Detailed information on over- and underconsumption of milk, cheese and yoghurts is available in the SLÁN 2007 Main Report (Morgan *et al*, 2008).

Overall in 2007, the mean number of servings of dairy produce consumed per day was 2.4 servings. Men consumed significantly more servings than women (2.7 servings and 2.2 servings respectively) ($p<0.001$). Exploring the contribution of each food constituent of this shelf to the overall daily serving intake, it can be seen that a higher number of servings of milk were consumed on a daily basis than yoghurts and dairy desserts (e.g. ice cream, milk puddings, custards) or cheese – mean milk intake was 1.9 servings, mean yoghurt/dairy dessert intake was 0.27 servings and mean cheese intake was 0.39 servings.

Exploring the socio-demographic intake for the three constituents of this shelf (*see Table 24*), men were found to consume significantly more milk servings on a daily basis than women, as did those in the younger age group of 18-29 ($p<0.001$). Those in social classes 1-2 consumed

significantly fewer servings of milk on a daily basis than those in social classes 3-6 ($p<0.05$). Consumption of yoghurts and dairy desserts did not vary by gender; however, it did vary by age group, with those in the 18-29 and 65+ age groups consuming more servings on a daily basis. A significant social class gradient existed: as consumption of yoghurts and dairy desserts increased, affluence decreased ($p<0.001$). Little difference was seen in cheese consumption across gender or social class groups; however, as age increased, significantly fewer servings of cheese were consumed ($p<0.001$).

Table 24: Mean number of daily servings of food constituents from the milk, cheese and yoghurt shelf, by gender, age and social class

	Milk Mean (SD)	Yoghurts/Dairy desserts Mean (SD)	Cheese Mean (SD)
Gender			
Men	2.1 (1.4)	0.27 (0.4)	0.39 (0.4)
Women	1.6 (1.2)	0.28 (0.4)	0.39 (0.5)
Age group			
18-29	2.2 (1.4)	0.28 (0.4)	0.43 (0.5)
30-44	1.9 (1.4)	0.26 (0.4)	0.42 (0.4)
45-64	1.6 (1.2)	0.26 (0.4)	0.37 (0.4)
65+	1.6 (1.2)	0.30 (0.5)	0.32 (0.42)
Social class			
SC 1-2	1.8 (1.3)	0.24 (0.4)	0.39 (0.4)
SC 3-4	1.9 (1.4)	0.28 (0.4)	0.40 (0.4)
SC 5-6	1.9 (1.4)	0.29 (0.5)	0.37 (0.4)

MEAT, FISH, POULTRY AND ALTERNATIVES

It is recommended that 2 servings of foods from the meat, fish, poultry and alternatives shelf be consumed each day. ('Alternatives' include eggs, vegetarian quiche, tofu, soya meat and vegeburgers.) As with the milk, cheese and yoghurt shelf, over- or underconsumption from this shelf may have a negative impact on nutritional health.

Overall in 2007, 39% of respondents reported consuming 2 daily servings of meat, fish, poultry and alternatives. While 41% reported consuming more than 2 servings of these protein products, one-fifth (20%) reported consuming less than the 2 recommended servings. Detailed information on over- and underconsumption of meat, fish, poultry and alternatives is available in the SLÁN 2007 Main Report (Morgan *et al*, 2008).

The mean number of servings of foods from this shelf was 2.5 servings. Men consumed significantly more servings than women (2.7 servings and 2.3 servings respectively) ($p<0.001$). A higher mean number of servings of meat were consumed daily than the other foods from this shelf – meat: 1.78 servings; fish: 0.48 servings; poultry: 0.36 servings; alternatives: 0.36 servings. Exploring the socio-demographic intake for the 4 food constituents of this shelf (*see Table 25*), it can be seen that men consumed significantly more meat ($p<0.001$) than women. There was also a significant age gradient, with younger respondents consuming more servings of meat each day than older respondents ($p<0.001$). Social class, too, showed a significant gradient, with those in the lower social classes consuming more meat servings per day ($p<0.001$) than those in the higher social classes.

Across the other food categories, fish consumption varied significantly by age, with younger respondents consuming more mean daily servings than older respondents ($p<0.001$), and also by social class, with respondents in social classes 5-6 consuming more mean daily servings ($p<0.001$). Younger respondents consumed significantly more servings of poultry ($p<0.001$). In terms of meat alternatives, men consumed significantly more servings compared to women ($p<0.001$). Age and social class gradients were also evident, with older respondents and those in the lower social classes consuming significantly more daily servings of meat alternatives ($p<0.001$).

Table 25: Mean number of daily servings of food constituents from the meat, fish, poultry and alternatives shelf, by gender, age and social class

	Meat Mean (SD)	Fish Mean (SD)	Poultry Mean (SD)	Alternatives* Mean (SD)
Gender				
Men	1.9 (1.2)	0.49 (0.5)	0.36 (0.4)	0.39 (0.4)
Women	1.6 (1.0)	0.48 (0.5)	0.36 (0.3)	0.36 (0.3)
Age group				
18-29	2.0 (1.3)	0.55 (0.6)	0.45 (0.5)	0.37 (0.4)
30-44	1.8 (1.2)	0.52 (0.6)	0.37 (0.3)	0.36 (0.3)
45-64	1.6 (1.0)	0.44 (0.4)	0.30 (0.2)	0.36 (0.3)
65+	1.6 (1.0)	0.40 (0.4)	0.27 (0.2)	0.44 (0.4)
Social class				
SC 1-2	1.6 (1.0)	0.47 (0.4)	0.35 (0.3)	0.34 (0.3)
SC 3-4	1.8 (1.2)	0.48 (0.5)	0.37 (0.4)	0.38 (0.4)
SC 5-6	1.9 (1.2)	0.52 (0.6)	0.35 (0.4)	0.40 (0.4)

* Alternatives include eggs, vegetarian quiche, tofu, soya meat and vegeburgers.

FOODS HIGH IN FATS AND SUGAR

It is recommended that less than 3 servings of foods from the top shelf of the Food Pyramid (e.g. oils, butter, margarines and cakes) be consumed each day. On average in 2007, respondents consumed 7.3 daily servings of these types of foods, with men consuming significantly higher quantities than women (7.6 servings and 7.0 servings respectively) ($p<0.001$). This number of servings is substantially higher than the recommendation in the Food Pyramid to 'use sparingly', i.e. consume less than 3 daily servings.

It is important to note that unlike consumption for the other shelves of the Food Pyramid, which often demonstrated clear intake patterns by age or social class, the overconsumption of foods from the top shelf, rich in fats and sugar, was broadly similar across all levels of these socio-demographic characteristics (*see Table 26*). Furthermore, there was little difference in the consumption of food constituents from this shelf – all of them were consumed almost equally, with almost half of the mean daily servings (7.3 servings) coming from each constituent.

The excess number of servings of foods high in fats and sugar is of particular concern since these types of food possess little to no nutritional value and may contribute to adverse health conditions.

Table 26: Mean number of daily servings of food constituents from the top shelf (foods high in fats and sugar), by gender, age and social class

	Fats, salt and sauces Mean (SD)	Sweets and snacks (including soft drinks) Mean (SD)
Gender		
Men	3.7 (2.7)	3.9 (3.4)
Women	3.6 (2.6)	3.5 (3.0)
Age group		
18-29	3.6 (2.5)	3.8 (3.2)
30-44	3.8 (2.8)	3.7 (3.3)
45-64	3.6 (2.8)	3.4 (3.0)
65+	3.4 (2.3)	4.0 (3.4)
Social class		
SC 1-2	3.5 (2.5)	3.4 (2.8)
SC 3-4	3.7 (2.7)	3.7 (3.4)
SC 5-6	3.9 (3.1)	4.0 (3.2)

COMPLIANCE PATTERNS WITHIN FOOD PYRAMID

The Food Pyramid is an educational tool to help monitor dietary needs. Table 27 shows the percentage of respondents who reported consuming the recommended daily number of servings from the cereals, breads and potatoes shelf, the fruit and vegetables shelf, and the top shelf, and whether or not they consumed the recommended number of servings from both the milk, cheese and yoghurt shelf and the meat, fish, poultry and alternatives shelf. For example, as seen in Table 27, respondents who consumed less than 3 daily servings of milk, cheese and yoghurt (MCY) were the least likely to consume 5 or more daily servings of fruit and vegetables (63% compared to 66% consuming 2 servings of MCY and 71% consuming 3+ servings of MCY). This pattern also held true for respondents consuming less than 2 servings of meat, fish, poultry and alternatives (MFPA) (52% compared to 62% consuming 2 servings of MFPA and 75% consuming 2+ servings of MFPA).

Table 27: Percentage consuming more, less or the recommended number of daily servings from the milk, cheese and yoghurt shelf and the meat, fish, poultry and alternatives shelf

	Milk, cheese and yoghurt			Meat, fish, poultry and alternatives		
	Less than 3 servings (N = 5,541) %	3 servings (N = 1,784) %	More than 3 servings (N = 1,704) %	Less than 2 servings (N = 1,781) %	2 servings (N = 3,543) %	More than 2 servings (N = 3,708) %
Cereals, breads and potatoes (6+ servings)	22	28	35	16	21	35
Fruit and vegetables (5+ servings)	63	66	71	52	62	75
Milk, cheese and yoghurts (3 servings)	–	–	–	19	18	22
Meat, fish, poultry and alternatives (2 servings)	42	36	32	–	–	–
Foods high in fats and sugar (<3 servings)	17	12	8	27	15	8

It is of interest when individuals do not consume the recommended number of servings from a particular shelf because it may affect their food consumption patterns for another shelf. This is evident when performing a cross-tabulation of the percentage of respondents who consumed more or less than the recommended 2 daily servings from the meat, fish, poultry and alternatives (MFPA) shelf and those who consumed more or less than the recommended 3 daily servings from the milk, cheese and yoghurt (MCY) shelf (*see Figure 32*). A higher percentage of those who consumed less than the recommended 3 daily servings from the MCY were more

likely to comply with the recommended 2 daily servings from the MFPA shelf (42% compared to 36% who consumed 3 servings of MCY and 32% who consumed more than 3 servings of MCY). More strikingly than this, however, is that fact that those consuming more than the recommended 3 daily servings from the MCY shelf were also consuming more than the recommended 2 daily servings from the MFPA shelf (55% compared to 45% who consumed 3 servings of MCY and 36% who consumed less than 3 servings of MCY).

Non-compliance with the MCY shelf and the MFPA shelf has implications for iron and calcium intake. While underconsumption from these two shelves may lead to nutrient deficiencies, overconsumption may lead to increased fat intake and has been associated with adverse health conditions.

Figure 32: Respondents consuming more or less than the recommended 2 daily servings of meat, fish, poultry and alternatives (MFPA), compared with those consuming more or less than the recommended 3 daily servings from the milk, cheese and yoghurt shelf

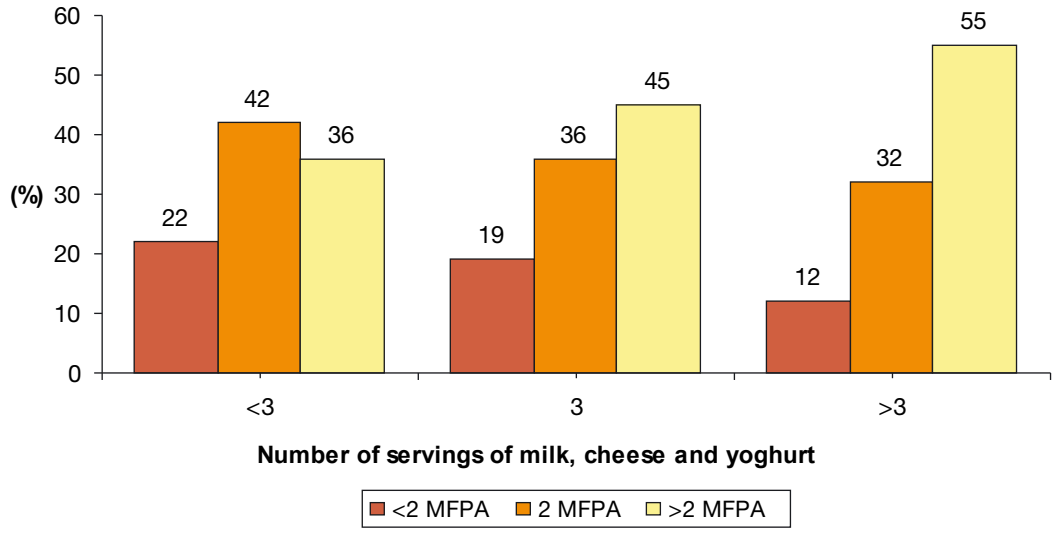


Table 28 examines compliance patterns within individual shelves of the Food Pyramid. Respondents who consumed 6+ servings of cereals, breads and potatoes were the most likely to consume the recommended 5+ servings of fruit and vegetables (77%), but were the least likely to consume sparingly (less than 3 servings) of foods high in fats and sugar (5%).

Respondents who complied with the top shelf (i.e. foods high in fats and sugar) recommendation were the least likely to comply with shelf recommendations for cereals, breads and potatoes (10%), fruit and vegetables (47%) and milk, cheese and yoghurts (16%). However, they were the most likely to adhere to shelf recommendations for meat, fish, poultry and alternatives: about two-fifths (41%) of these respondents consumed the recommended 2 daily servings of protein compared to only one-fifth (21%) of those respondents who were complying with the recommended 6+ daily servings of carbohydrates (cereals, breads and potatoes).

Table 28: Compliance patterns within Food Pyramid shelves (read from left to right)

Food Pyramid shelves	Cereals, breads and potatoes %	Fruit and vegetables %	Milk, cheese and yoghurts %	Meat, fish, poultry and alternatives %	Foods high in fats and sugar %
Cereals, breads and potatoes (6+ servings)	**100**	77	21	21	5
Fruit and vegetables (5+ servings)	31	**100**	20	37	10
Milk, cheese and yoghurt (3 servings)	28	66	**100**	36	11
Meat, fish, poultry and alternatives (2 servings)	21	62	18	**100**	15
Foods high in fats and sugar (<3 servings)	10	47	16	41	**100**

The overall pattern of respondents consuming 5 or more servings of fruit and vegetables compared with those consuming 3 servings of milk, cheese and yoghurt was broadly similar. However, in contrast, respondents complying with the recommendations for meat, fish, poultry and alternatives were less likely to consume 6 or more servings of cereals, breads and potatoes (21%), but were more likely to comply with top-shelf recommendations on foods high in fats and sugar (15%).

OVERALL COMPLIANCE WITH FOOD PYRAMID

The Food Pyramid is a dietary guideline that emphasizes a varied diet. Foods from *all* of the shelves should be eaten, in the recommended amounts, for a healthy diet; just eating foods from individual shelves is not sufficient. Thus, people complying with multiple shelves of the Food Pyramid are more likely to meet nutritional requirements than those who do not.

Analysis of overall compliance of SLÁN 2007 respondents with the Food Pyramid demonstrates:

- approximately one-third (34%) met the recommendations for 1 shelf only;
- 39% met the recommendations for 2 shelves;
- 15% met the recommendations for 3 shelves;
- 2% met the recommendations for 4 shelves;
- less than 1% met the recommendations for all 5 shelves;
- 10% did not meet the recommendations for *any* of the shelves.

Women and older respondents were more likely to comply with the recommendations for multiples shelves of the Food Pyramid (*see Figures 33 and 34*). Respondents in social classes 5-6 met fewer overall shelf recommendations than those in social classes 1-4. Gender, age and social class patterns are shown in further detail in Table A7-1 of Appendix 7.

Figure 33: Percentage of men complying with shelf recommendations of Food Pyramid, by age

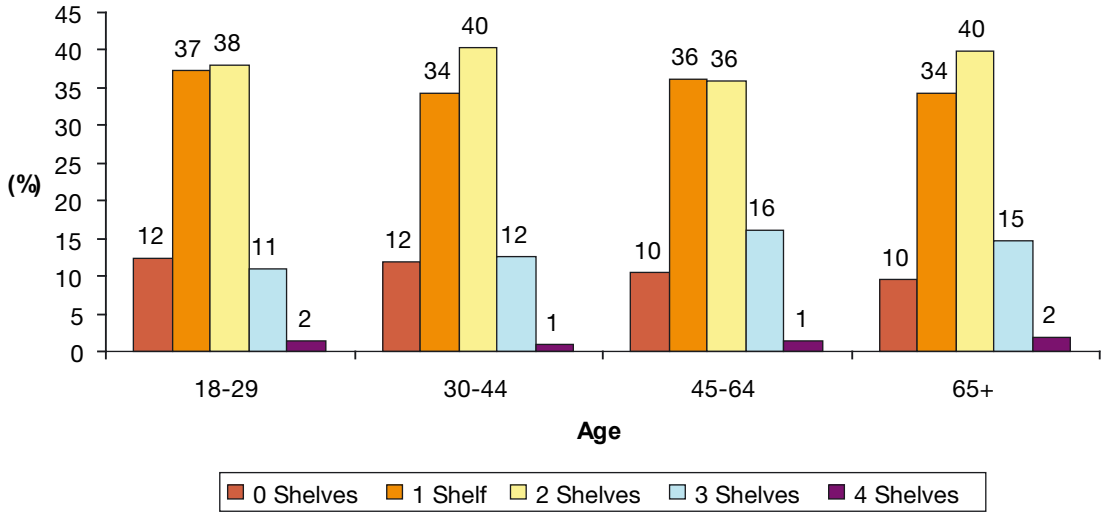
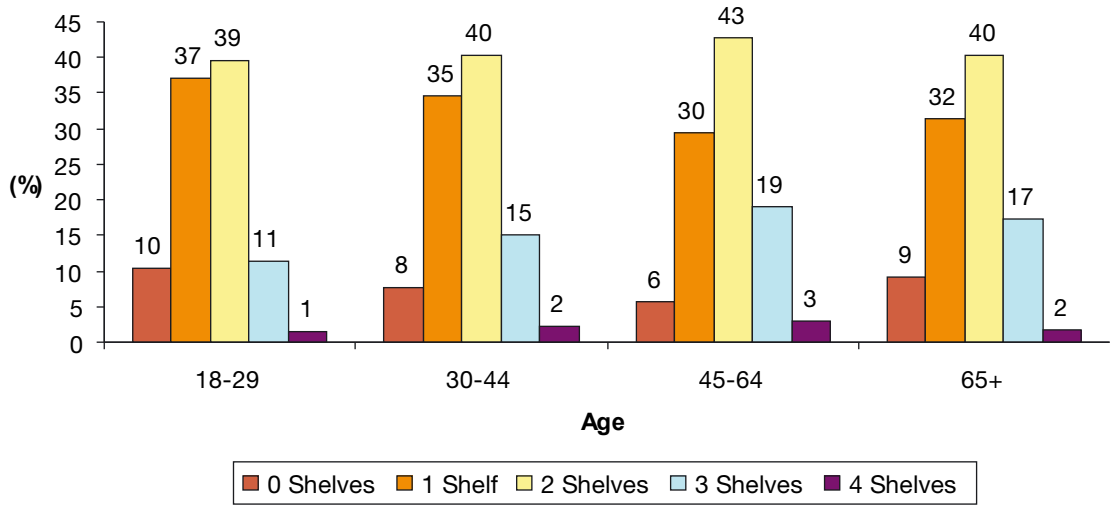


Figure 34: Percentage of women complying with shelf recommendations of Food Pyramid, by age



SUMMARY

- A major concern in the Irish diet is the overconsumption of foods high in fats and sugar, such as oils, butters, cakes and biscuits. On average, respondents consumed 7.3 daily servings of these types of food, which according to the Food Pyramid should be 'used sparingly' (i.e. less than 3 daily servings).
- On average, respondents consumed a mean of 4.9 daily servings of cereals, breads and potatoes, which is less than the 6 or more recommended daily servings.
- Respondents consumed a mean of 7.1 daily servings of fruit and vegetables, which exceeds the Food Pyramid recommendation of 5 daily servings. Overall, 65% of respondents were consuming at least 5+ daily servings of fruit and vegetables, with women on average consuming more (7.7 servings) than men (6.5 servings).
- The average number of milk, cheese and yoghurt servings consumed was 2.4 servings per day, lower than the recommended 3 daily servings. Men, on average, consumed more (2.7 servings) than women (2.2 servings).
- Respondents consumed a mean of 2.7 daily servings of meat, fish, poultry and alternatives, which exceeds the recommendation of 2 daily servings. Mean consumption was higher among men (2.7 servings) than women (2.3 servings).
- Respondents who consumed sparingly of foods high in fats and sugar were the most likely to meet the Food Pyramid recommendation of 2 daily servings of meat, fish, poultry and alternatives. However, respondents consuming the recommended 6 or more daily servings of cereals, breads and potatoes were the most likely to also consume at least 5 daily servings of fruit and vegetables.
- Less than 1% of respondents met the recommendations for all 5 shelves of the Food Pyramid, while 10% did not comply with the recommendations for *any* of the shelves. Almost three-quarters (73%) only met the recommendations for 1 or 2 of the shelves.

6. OTHER DIETARY HABITS – RESULTS

6. OTHER DIETARY HABITS – RESULTS

MEAL HABITS

Respondents were asked whether or not they ate a breakfast, main meal and light meal on the day prior to completing the survey. If they reported eating a meal, they were asked to indicate if this meal was eaten at home, eaten elsewhere but taken from home, or purchased from a food outlet (e.g. a canteen, deli, restaurant or fast food restaurant).

There were no evident variations in mean BMI among respondents who reported that they ate a breakfast, main meal and light meal on the day prior to the survey versus those who did not. Similarly, there was little difference in mean BMI among respondents who ate at home the day prior to the survey versus those who did not.

Breakfast

Overall, 10% of SLÁN 2007 respondents did not eat breakfast on the day prior to completing the survey. Most respondents (80%) who did eat breakfast did so at home, while 3% brought a packed breakfast from home and 7% purchased their breakfast from a food outlet. Of those respondents who purchased their breakfast, most ate at a canteen (3%), although this varied by age (age 18-29: 5%; 30-44: 4%; 45-64: 1%; 65+: 0%).

Main meal

Few respondents (4%) did not eat a main meal on the day prior to the survey. Of those who did eat a main meal on the day prior to the survey, the majority (83%) did so at home. Only 1% of respondents brought a packed meal from home, while 12% purchased their main meal from a food outlet. Of those respondents who purchased their main meal, most were likely to eat at a restaurant (5%), although this varied by age and social class. Younger respondents were more likely than older ones to eat their main meal at a restaurant (age 18-29: 6%; 30-44: 6%; 45-64: 4%; 65+: 3%), as were respondents in social classes 1-2 (SC 1-2: 7%; SC 3-4: 4%; SC 5-6: 4%). Overall, only 1% of respondents reported eating a take-away from a fast food restaurant as their main meal.

Light meal

Overall, 6% of respondents did not eat a light meal on the day prior to completing the survey. Of those who did eat a light meal on the day prior to the survey, the majority (60%) ate it at home. Of those who ate their light meal outside their home, 11% brought a packed meal from home and nearly one-quarter (23%) purchased their light meal in a food outlet. Younger respondents were more likely to eat their light meal at a canteen (age 18-29: 15%; 30-44: 9%; 45-64: 5%; 65+: 0%), as were respondents in social classes 1-2 (SC 1-2: 10%; SC 3-4: 7%; SC 5-6: 8%). Although an overall larger percentage of respondents purchased their light meal, similar to main meal patterns, only 1% reported eating take-away food from a fast food restaurant as their light meal.

Summary

- Overall, 10% of respondents did not eat a breakfast on the day prior to completing the survey, compared to 4% who did not eat a main meal and 6% who did not eat a light meal. Most respondents consumed their breakfast (80%) and their main meal (83%) at home. However, while the majority of respondents (60%) consumed their light meal at home, nearly one-quarter (23%) purchased their light meal from a food outlet, such as a canteen or restaurant.

HOUSEHOLD FOOD AFFORDABILITY

Respondents were asked to indicate how often they could afford to buy enough food for their household. Five response options were available: 'always', 'usually', 'sometimes', 'rarely' or 'never'. Overall, most respondents (96%) reported that they could 'always' (84%) or 'usually' (12%) afford to buy food. There were no gender differences in food affordability; however, younger respondents were less likely to 'always' be able to afford food (age 18-29: 78%; 30-44: 84%; 45-64: 89%; 65+: 88%). Respondents aged 18-29 were the only age group that reported that they were 'rarely' or 'never' able to afford food (2%). Respondents in social classes 5-6 were the least likely to 'always' be able to afford food (SC 1-2: 92%; SC 3-4: 84%; SC 5-6: 79%). 4% of respondents in SC 5-6 were 'sometimes' able to afford food, compared to only 1% of respondents in SC 1-2.

Differences in Food Pyramid shelf compliance were evident when comparing respondents who reported they could 'always' afford food to those who could 'sometimes'/'rarely'/'never' afford food. Respondents who were 'always' able to afford food were more likely to consume, on a daily basis, 5 or more servings of fruit and vegetables (68% compared to 54%); 2 servings of meat, fish, poultry and alternatives (42% compared to 26%); and less than the 3 recommended servings of milk, cheese and yoghurt (62% compared to 52%). In contrast, respondents who could 'sometimes'/'rarely'/'never' afford food were more likely to consume, on a daily basis, 6 or more servings of cereals, breads and potatoes (31% compared to 26%); more than the 2 recommended servings of meat, fish, poultry and alternatives (52% compared to 38%); and more than the 3 recommended servings of milk, cheese and yoghurt (25% compared to 18%).

Patterns in overall Food Pyramid compliance were broadly similar among respondents who reported different levels of household food affordability. There was one exception to this: compared to respondents who reported that they could 'always' afford to buy food, those who reported that they 'sometimes'/'rarely'/'never' were able to afford food were almost twice as likely not to meet any of the shelf recommendations of the Food Pyramid (17% versus 9% respectively).

Summary

- Most respondents (96%) were 'always' or 'usually' able to afford food. Respondents aged 18-29 and those in social classes 5-6 were the least likely to 'always' be able to afford food.

- Compared to respondents who reported that they could 'always' afford to buy food, respondents who could 'sometimes'/'rarely'/'never' afford food were more likely to consume, on a daily basis, 6 or more servings of cereals, breads and potatoes; more than the 2 recommended servings of meat, fish, poultry and alternatives; and more than the 3 recommended servings of milk, cheese and yoghurt. Furthermore, they were almost twice as likely not to meet any of the shelf recommendations of the Food Pyramid (17% versus 9% respectively).

POSITIVE LIFESTYLE BEHAVIOURS

That lifestyle behavioural factors, such as smoking, diet, physical activity and alcohol consumption, influence health is well documented. However, their combined impact on the general population is less well known. Khaw *et al* (2008) identified 4 positive lifestyle behaviours (PLBs) – consuming 5 or more daily servings of fruit and vegetables; being a non-smoker; having a moderate alcohol intake; and being physically active. In a study of a UK population, research found a 14-year difference in life expectancy between individuals practising none of these behaviours relative to those practising all 4 of them – the equivalent of a 4-fold difference in total mortality in men and women. Thus, small differences in lifestyle may make a big difference to the health of the population. The socio-demographic distribution of these positive lifestyle behaviours in the SLÁN 2007 population is examined below.

Lifestyle factors

The PLBs chosen for this analysis were similar to those selected by Khaw *et al* (2008):

- Consuming 5 or more daily servings of fruit and vegetables. Servings were calculated from the FFQ.[12]
- Being a non-smoker, as defined by the question 'Have you yourself smoked at least 100 cigarettes in your entire life?'. If a respondent answered 'No' to this question, they were defined as a non-smoker for this analysis.
- Being physically active. Physically active respondents were those with International Physical Activity Questionnaire (IPAQ) scores that categorised them as having either moderate or high activity levels.
- Being a moderate drinker of alcohol. Moderate drinkers were defined as those respondents who drank up to 14 units in the previous 7 days.

Overall, 1% of SLÁN 2007 respondents reported none of the 4 PLBs, while 10% reported one PLB, 27% reported 2 PLBs, 39% reported 3 PLBs and 23% reported 4 PLBs.

[12] While this analysis determined fruit and vegetables intake based on the number of servings reported in the FFQ, the original Khaw *et al* (2008) study determined intake by assessing plasma vitamin C levels. Study participants with a level greater than 50mmol/l were categorised as consuming 5 or more daily servings of fruit and vegetables.

Table 29 shows the distribution of the number of PLBs practised by respondents, broken down by gender and age. The number of PLBs demonstrated did not vary strongly by age group, although differences by gender and social class were evident. Men reported practising fewer PLBs than women. Respondents in social classes 5-6 were more likely to report one or 2 PLBs compared to those in social classes 1-2, who were more likely to report 3 or 4 PLBs.

Respondents who reported that their general health was either 'excellent' or 'very good' were more likely to demonstrate 4 PLBs (26%) than those who reported their health as either 'good' (19%) or 'fair'/'poor' (13%).

Table 29: Socio-demographic distribution of number of positive lifestyle behaviours (PLBs) practised among respondents (2007)

	No PLBs %	1 PLB %	2 PLBs %	3 PLBs %	4 PLBs %
Gender					
Men	1	13	32	36	18
Women	1	6	23	43	27
Age group					
18-29	1	9	28	38	24
30-44	1	9	27	41	22
45-64	1	10	26	39	24
65+	2	12	30	37	19
Social class					
SC 1-2	1	8	25	41	25
SC 3-4	1	11	29	38	21
SC 5-6	2	12	30	38	18

Summary

- There is evidence that 4 major positive lifestyle behaviours (PLBs) – i.e. eating 5 or more daily servings of fruit and vegetables, being a non-smoker, a moderate drinker and being physically active – exert a profound impact on health. There is an estimated 14-year difference in life expectancy between individuals practising none of these behaviours relative to those practising all 4 behaviours. In SLÁN 2007, 1% of respondents reported none of the 4 PLBs, 10% reported one PLB, 27% reported 2 PLBs, 39% reported 3 PLBs and 23% reported 4 PLBs. Respondents in social classes 1-2 were more likely to report 4 PLBs (25%) relative to those in social classes 3-4 (21%) and social classes 5-6 (18%). Respondents who reported 4 PLBs were more likely to report that their general health was 'excellent' or 'good'.

7. CONCLUSIONS AND POLICY IMPLICATIONS

7. CONCLUSIONS AND POLICY IMPLICATIONS

The high prevalence of overweight and obesity in Irish adults poses a major threat to the health and well-being of the Irish population, with significant negative implications for healthcare expenditure over the next decade. Obesity levels have risen substantially, as can clearly be seen by comparing IUNA 1999 to SLÁN 2007. The rapid increase in obesity in Irish women is of particular concern and highlights the need to prioritise the recommendations of the 2005 Report of the National Task Force on Obesity.

Central obesity (as defined on the basis of large waist circumference) is associated with increased risk of diabetes and cardiovascular disease, beyond the risk associated with generalised obesity (high BMI). The high prevalence of central obesity in Irish men and women highlights the need for greater awareness of this simple marker of adiposity among health professionals and the general public.

Self-reported data on height and weight underestimate the prevalence of obesity, particularly in women, when compared with measured data. There is a need for regular ongoing population surveys that include measurements of height, weight and waist circumference to monitor the evolution of the obesity epidemic in Ireland.

Analysis of the Food Pyramid in SLÁN 2007 suggests that a significant proportion of the excess calories in the Irish diet are derived from the top shelf of the Food Pyramid, i.e. foods high in fats and sugar. These findings highlight the limitations to date of traditional public health approaches to the promotion of a healthy diet and the need for policy measures to reduce caloric intake and portion sizes from the food items on the top shelf. They also raise fundamental questions about future nutritional policy on food labelling and advertising.

Dietary salt intake remains well in excess of physiological requirements. Thus, there is an urgent need to augment current work with the food sector to reduce the salt content of breads, cereals and other processed foods.

The data in this report provide a comprehensive overview of the nutritional status of the Irish population in 2007 and will serve as an important benchmark for ongoing monitoring of the situation. The findings need to be interpreted in the context of earlier work, including the SLÁN 1998 and 2002 surveys, the 1999 North/South Ireland Food Consumption Survey and the analysis of data from other surveys with diet and nutritional data, such as the Household Budget Survey. Furthermore, the findings should also be interpreted in the context of the conclusions of the *Review of the Population Nutrient Goals*, which the Department of Health and Children requested from the Nutrition Sub-Committee of the Food Safety Authority of Ireland.

While the results from SLÁN 2007 show some positive findings – notably the increase in fruit and vegetables consumption since 1998 – the findings with regard to other major nutritional indicators give cause for serious concern and will require a concerted response from policy-makers and the food sector in the coming years.

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APPENDICES

APPENDIX 1:
SLÁN 2007 – SAMPLING AND WEIGHTING

As discussed in Chapter 2 under 'Population and sampling', the sample for the SLÁN 2007 survey was selected from the GeoDirectory, which is a listing of all addresses in Ireland. The sample used was probabilistic and was selected using the ESRI's RANSAM program, which results in probability samples where each dwelling has a known probability of selection. RANSAM is a process for selecting samples in three stages. The first stage involved making a random selection of sampling points based on aggregates of townlands, using a minimum population criterion.[13] These form the primary sampling units (PSUs) or clusters. Following a sort by area characteristics[14] and region, 400 PSUs were systematically selected using a random starting point. Once the required number of PSUs had been selected, a systematic sample of addresses was drawn from within each, again using a random starting point. This resulted in 46 selected addresses per cluster. The third stage involved selecting a respondent at each address. Respondent selection within a household involved implementing a simple randomisation procedure, the so-called 'next birthday' rule.[15] To maintain the random nature of the sampling, no substitution of respondents within households was allowed.

The design is such that the sample selected is epsem (equal probability) in dwellings. When used to select a sample of individuals, the completed sample is biased in favour of individuals in smaller households as individual selection probability is inversely proportional to household size.[16] This is adjusted at the weighting stage of the analysis, using a 'design weight' (*see below*).

[13] The criterion was that each cluster has a minimum of 1,000 addresses.

[14] Area characteristics matched to the clusters from the SAPS ED-Level data were percentage of persons aged 65+, percentage of persons in professional or managerial occupations, and percentage urban.

[15] The interviewer first asked how many adults aged 18 and over lived at the address. If there was more than one, the adult with the next birthday was selected for interview.

[16] The relevant measure of household size for this purpose is number of persons aged 18 and over, rather than number of persons of any age.

WEIGHTING SLÁN 2007 – OVERALL SAMPLE DATA

The purpose of survey weighting is to compensate for any imbalances in the distribution of characteristics in the completed survey sample compared to the population of interest, whether such imbalances occur because of sampling error, from the nature of the sampling frame used, or to differential response rates within population sub-groups.

Weighting was a two-stage process:

1. Construction of a design weight to compensate for the over-representation of individuals in smaller households (a consequence of the sampling frame used).
2. Calibration of the sample distribution to population totals along a number of dimensions:[17]
    - age group (9 categories) by gender;
    - age by gender (2 categories) by marital status (4 categories);
    - gender by economic status (5 categories);
    - gender by level of education (4 categories);
    - occupational category (9 categories);
    - ethnicity (7 categories);
    - household size (5 categories);
    - geographic region (8 categories).

WEIGHTING SLÁN 2007 – PHYSICAL EXAMINATION DATA

As noted in Chapter 2, there was some tendency for those with lower levels of education and in lower socio-economic classes to be under-represented in the physical examination sub-study. To ensure that the physical examination results are representative of the population aged 45 and over, the data from the physical examination sub-sample were re-weighted. This was done by calibrating to the population aged 45 and over along the following dimensions:[18]

- age group (5 categories) by gender;
- age by gender (2 categories) by marital status (4 categories);
- gender by economic status (5 categories);
- gender by level of education (4 categories);
- occupational category (9 categories);
- ethnicity (7 categories);
- household size (5 categories);
- geographic region (8 categories).

SLÁN SURVEY COMPARISONS – WEIGHTING OF DATASETS

A key strategy in the SLÁN 2007 survey was to provide comparisons with previous SLÁN surveys (1998 and 2002). This required adopting similar weighting schemes for each dataset to ensure that any observed differences were not an artefact of the different approaches taken to sample weighting.

[17] This involved using GROSS, a program using a minimum distance algorithm and iterative process to calibrate to external controls from national sources, such as the Quarterly National Household Survey (QNHS) or Census 2006.
[18] Again, the GROSS program was used with the totals from the weighted full sample of those aged over 45 years.

A number of options were considered, including:

1. Applying weighting schemes used in previous surveys to the 2007 data.

2. Choosing a weighting schema for all three years and applying this across all three surveys. At a minimum, this would include rebalancing for age, gender, education and marital status. Nationality was only available for the 2002 and 2007 surveys, and so it was impossible to include this factor in a general weighting regime for all three surveys.

3. Choosing a comparable weighting schema for all three years, but adding in design effects for specific years. This approach would yield more realistic weights and should provide estimates that are closer to the population in each year.

The third option was adopted since this strategy provided the closest match to the actual population figures in each period. There are some limitations in the application of strictly comparable weighting schema to data from all three SLÁN surveys, related to the measurement of the relevant variables in each survey and the availability of the population figures for each of the years.[19] In terms of previous SLÁN surveys, the weighting schema applied here will mainly address under-representation of those with lower levels of education and from manual social classes, compared with Census data, in the 1998 and 2002 SLÁN surveys. Overall, using a comparable weighting strategy for all three surveys minimises the extent to which observed differences in health-related behaviours or outcomes reflect differences in the extent to which the survey sample matched the population at the time.

[19] For example, the 1998 QNHS (as the population survey closest in time to SLÁN 1998) did not have a measure of education level of adults. Furthermore, information on country of origin for respondents was not asked in the 1998 SLÁN survey.

APPENDIX 2:
SOCIO-DEMOGRAPHIC PROFILE OF OVERALL SURVEY SAMPLE

Table A2-1 provides a profile of the overall survey sample, showing actual numbers of cases (N) and weighted percentage distributions. Census 2006 figures (for persons usually resident in the State) are included for comparison where available.

Table A2-1: Socio-demographic characteristics of respondents in SLÁN 2007

	N	Unweighted sample %	Weighted sample %	Census 2006 %
Gender				
Men	4,369	42	50	50
Women	5,995	58	50	50
Total	**10,364**	**100**	**100**	**100**
Age group				
18-29 years	1,907	18	25	26
30-44 years	3,310	32	31	30
45-64 years	3,178	31	29	29
65 and over	1,969	19	15	15
Total	**10,364**	**100**	**100**	**100**
Marital status				
Single/Never married	2,964	35	41	40
Married/Cohabiting	5,849	50	48	49
Separated/Divorced	639	6	4	5
Widowed	912	9	7	6
Total	**10,364**	**100**	**100**	**100**
Country of birth				
Ireland – Republic	8,820	85	83	85
Ireland – NI	116	1	1	1
Other UK	644	6	6	5
Other EU	376	4	5	4
Europe Non-EU	24	0	0	1
Africa	96	1	1	1
North America, South America and Canada	67	1	1	1
Other (including unknown)	221	2	3	2
Total	**10,364**	**100**	**100**	**100**
Ethnicity				
White or White Irish, Irish	9,333	90.0	87.0	87.0
Irish Traveller	31	0.3	0.4	0.4
Any other White background	634	6.1	8.0	8.0
Black or Black Irish; African	60	0.6	0.7	0.7
Any other Black background	19	0.2	0.1	0.1
Asian or Asian Irish; Chinese	32	0.3	0.4	0.4
Any other Asian background	62	0.6	0.9	0.9
Other, including mixed background	71	0.7	1.0	1.0
Unknown	122	1.2	1.5	1.5
Total	**10,364**	**100**	**100**	**100**

The profile of some other common socio-demographic characteristics could not readily be compared with Census 2006 figures.

In terms of education, approximately one-fifth (20%) of respondents had primary-level education only, 17% had incomplete second-level education, 27% had complete second-level education and over one-third (36%) had some form of third-level education.

Household social class was constructed for each respondent. Approximately one-third (31%) were in higher (professional and managerial) social classes (SC 1-2) while 38% were in non-manual and skilled manual categories (SC 3-4) and 16% were in semi-skilled and unskilled occupational categories (SC 5-6). 15% were unclassifiable on the basis of present or last occupation.[20]

The geographic distribution of the sample included 41% of respondents from rural (open country or village) settings, 35% from towns and cities other than Dublin, and 25% from Dublin city or county.

[20] Those not classified are mainly those who never worked (and no other member of the household is at work) and those where information on occupation was not provided.

APPENDIX 3:
CROSS-TABULATION OF SELF-REPORTED AND MEASURED BMI FOR SUB-SAMPLES IN SLÁN 2007

Research based on self-reported data is prone to misclassification bias. In SLÁN 2007, respondents changed BMI categories when self-reported and measured BMI were compared. This was almost always in the direction that measured data was higher than self-reported. The mean absolute difference in BMI units among respondents aged 18-44 was 1.0 for men and 1.5 for women. For the older sub-sample (aged 45+), the mean absolute difference was higher among both men (1.5) and women (2.1).

RESPONDENTS AGED 18-44 YEARS

Overall, 22% of respondents were misclassified when comparing self-reported BMI data to measured BMI data (*see Table A3-1*). Almost one-quarter of men (23%) and 14% of women who were classified as healthy weight based on self-reported data were, in fact, overweight based on measured data. Women (28%) were more likely than men (14%) to be misclassified as overweight rather than obese when self-reported and measured data were compared.

Table A3-1: Cross-tabulation of self-reported and measured BMI for respondents aged 18-44, by gender*

	Self-reported BMI				
Measured BMI	**Underweight % (N)**	**Healthy % (N)**	**Overweight % (N)**	**Obese % (N)**	**Total N**
Men					
Underweight	71 (10)	0 (0)	0 (0)	0 (0)	10
Healthy	29 (4)	77 (187)	8 (15)	0 (0)	206
Overweight	0 (0)	23 (56)	78 (142)	18 (11)	209
Obese	0 (0)	0 (1)	14 (26)	82 (51)	78
Total	100 (14)	100 (244)	100 (183)	100 (62)	503
Women					
Underweight	40 (4)	1 (4)	0 (0)	0 (0)	8
Healthy	60 (6)	83 (247)	8 (8)	0 (0)	261
Overweight	0 (0)	14 (42)	64 (63)	11 (6)	111
Obese	0 (0)	2 (5)	28 (27)	89 (48)	80
Total	100 (10)	100 (298)	100 (183)	100 (54)	460

* Although data were collected from 967 respondents for the younger sub-sample, the total N in this table does not add up to this figure due to missing and/or invalid data.

RESPONDENTS AGED 45 YEARS AND OVER

Respondents aged 45 and over were more likely than younger respondents (aged 18-44) to be misclassified when comparing self-reported BMI data to measured BMI data. Overall, one-third of respondents (33%) were misclassified into an incorrect BMI category (*see Table A3-2*). About one-third of men (34%) and 38% of women who were classified as healthy weight based on self-reported data were actually overweight based on measured data. Women (36%) were more likely than men (28%) to be misclassified as overweight rather than obese based on self-reported data.

Table A3-2: Cross-tabulation of self-reported and measured BMI for respondents aged 45 and over, by gender*

	Self-reported BMI				
Measured BMI	**Underweight % (N)**	**Healthy % (N)**	**Overweight % (N)**	**Obese % (N)**	**Total N**
Men					
Underweight	33 (1)	0 (0)	0 (0)	0 (0)	1
Healthy	67 (2)	62 (101)	4 (11)	0 (0)	114
Overweight	0 (0)	34 (55)	68 (204)	17 (17)	276
Obese	0 (0)	4 (6)	28 (86)	83 (83)	175
Total	100 (3)	100 (162)	100 (301)	100 (100)	566
Women					
Underweight	86 (6)	0 (1)	0 (0)	0 (0)	7
Healthy	14 (1)	57 (140)	5 (11)	3 (3)	155
Overweight	0 (0)	38 (92)	59 (132)	2 (2)	226
Obese	0 (0)	5 (12)	36 (81)	95 (97)	190
Total	100 (7)	100 (245)	100 (224)	100 (102)	578

* Although data were collected from 1,207 respondents for the older sub-sample, the total N in this table does not add up to this figure due to missing and/or invalid data.

APPENDIX 4:
ADDITIONAL DATA ON MEAN DAILY INTAKE OF NUTRIENTS

Table A4-1: Comparison of mean daily intake of key nutrients, by year (1998, 2002 and 2007)

	YEAR OF SLÁN SURVEY														
	1998					2002					2007				
	Mean	SD	Percentiles			Mean	SD	Percentiles			Mean	SD	Percentiles		
			10th	50th	90th			10th	50th	90th			10th	50th	90th
Protein (g)	101.1	39.9	57.8	95.6	150.8	103.9	36.4	61.0	99.6	152.0	105.4	43.6	60.7	97.9	158.5
Carbohydrate (g)	288.8	128.7	147.1	266.2	464.0	286.5	122.0	148.4	265.6	446.0	273.8	116.7	151.0	252.4	423.7
Fat (g)	96.0	48.3	43.5	86.9	159.9	96.9	43.9	46.3	89.6	154.4	92.4	45.2	44.4	83.1	153.6
Fibre (g)	25.0	11.8	12.0	22.9	40.6	25.6	11.8	12.0	23.8	40.5	26.7	12.1	13.7	24.5	41.5
Vitamin B6 (mg)	3.1	1.3	1.7	2.8	4.7	3.2	1.2	1.8	3.0	4.7	3.2	1.2	1.9	3.0	4.8
Vitamin B12 (µg)	6.1	4.4	2.4	5.1	10.7	5.9	3.9	2.2	5.0	10.3	6.7	5.4	2.6	5.3	11.7
Vitamin C (mg)	123.6	87.4	37.4	103.8	229.8	151.4	100.9	46.0	127.8	290.8	165.4	110.0	56.2	141.4	297.0
Vitamin D (µg)	3.5	2.2	1.3	3.0	6.2	3.4	2.0	1.4	3.1	5.8	3.6	2.3	1.4	3.1	6.4
Vitamin E (mg)	9.0	5.3	3.6	7.8	16.0	9.9	5.5	4.1	8.8	16.7	9.0	4.9	4.0	8.0	15.4
Folate (µg)	337.5	147.4	183.5	311.3	525.5	368.5	153.2	196.0	349.1	569.8	354.0	149.5	198.0	329.2	535.6
Calcium (mg)	932.9	418.4	455.9	880.8	1478.4	1004.2	517.1	439.1	917.8	1654.6	973.0	467.6	485.5	881.2	1601.7
Iron (mg)	13.0	6.3	6.8	11.7	20.9	13.4	6.1	7.2	12.3	21.0	13.3	6.3	7.2	12.0	21.2
Zinc (mg)	11.7	5.2	6.3	10.9	17.8	12.0	4.7	6.5	11.4	17.8	12.4	5.6	6.8	11.4	19.0
Potassium (mg)	3863.0	1518.8	2266.2	3585.9	5810.5	4075.1	1444.8	2442.0	3939.6	5947.7	4142.5	1540.4	2462.1	3895.1	6147.0
Salt (g)	8.3	3.8	4.2	7.6	13.1	8.2	5.9	3.6	7.2	13.2	8.4	3.8	4.4	7.6	13.1

Table A4-2: Comparison of mean daily intake of vitamins and minerals, by year (1998, 2002 and 2007)

	YEAR OF SLÁN SURVEY														
	1998					2002					2007				
	Mean	SD	Percentiles			Mean	SD	Percentiles			Mean	SD	Percentiles		
			10th	50th	90th			10th	50th	90th			10th	50th	90th
Vitamins															
Vitamin A (µg)	708.7	826.7	166.7	478.2	1459.0	662.8	707.4	138.8	470.1	1408.1	723.9	1010.0	157.4	438.4	1478.9
Thiamine (mg)	2.0	0.9	1.1	1.9	3.1	2.1	0.9	1.2	2.0	3.2	2.1	0.9	1.2	1.9	3.1
Riboflavin (mg)	2.0	0.9	1.1	1.9	3.0	2.3	1.0	1.2	2.2	3.5	2.1	1.0	1.1	1.9	3.3
Niacin (mg)	25.2	11.2	13.4	23.3	38.7	25.1	10.2	13.4	24.4	37.7	26.3	11.6	14.5	24.3	40.4
Carotene (µg)	2642.4	2116.3	670.9	2432.7	5091.2	2937.1	2088.3	813.6	2652.0	5535.3	3552.4	2464.1	1166.5	3119.3	6104.1
Minerals															
Phosphorous (mg)	1575.5	595.9	913.9	1497.5	2356.1	1654.5	599.0	955.1	1575.8	2460.7	1638.9	634.6	953.3	1527.8	2488.7
Selenium (µg)	60.1	27.9	29.9	55.2	97.7	59.0	25.5	29.7	55.2	95.0	60.5	27.7	31.0	55.8	95.5
Magnesium (mg)	331.6	131.8	191.0	311.0	508.6	353.4	129.7	202.5	333.5	533.1	352.7	136.1	204.4	331.5	530.7
Copper (mg)	1.4	0.8	0.7	1.2	2.3	1.4	0.7	0.7	1.3	2.3	1.4	0.9	0.7	1.2	2.3
Chloride (mg)	5376.5	2499.8	2756.8	4945.7	8418.0	5180.5	2127.2	2709.4	4862.1	8088.6	5279.0	2402.3	2775.5	4834.7	8323.4
Manganese (mg)	3.6	1.7	1.9	3.3	5.7	3.7	1.6	1.8	3.5	5.7	3.8	1.7	2.0	3.5	5.9
Iodine (µg)	182.0	87.9	88.1	170.2	288.9	185.7	91.9	83.4	172.2	296.1	172.1	83.2	85.7	157.6	274.5
Arsenic (mg)	0.04	0.05	0.01	0.03	0.1	0.05	0.05	0.01	0.03	0.1	0.1	0.1	0.01	0.04	0.1
Cadmium (mg)	0.03	0.02	0.01	0.02	0.04	0.03	0.01	0.01	0.02	0.04	0.03	0.01	0.01	0.02	0.04
Tin (mg)	1.3	1.4	0.1	0.9	3.1	1.3	1.5	0.1	0.9	2.8	1.4	1.6	0.1	0.9	3.1
Mercury (mg)	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.2	0.01	0.01	0.01	0.02
Lead (mg)	0.01	0.003	0.005	0.008	0.01	0.01	0.003	0.005	0.01	0.01	0.01	0.004	0.01	0.01	0.01

Table A4-3: Mean daily intake of vitamins, by gender, age and social class (2007)

	Gender		Age group (years)				Social class		
Vitamins	**Men**	**Women**	**18-29**	**30-44**	**45-64**	**65+**	**SC 1-2**	**SC 3-4**	**SC 5-6**
Vitamin A (µg)	777.1	672.3	788.5	871.9	651.8	819.4	610.3	715.1	926.6
Thiamine (mg)	2.1	2.0	2.3	2.1	2.0	2.1	2.0	2.1	2.1
Riboflavin (mg)	2.2	1.9	2.5	2.3	2.0	2.0	2.0	2.1	2.2
Niacin (mg)	27.4	25.3	30.5	28.7	25.0	24.1	25.8	26.6	26.6
Carotene (µg)	3259.9	3832.1	2992.1	3292.9	3322.9	3540.6	3607.8	3572.5	3312.3

Table A4-4: Mean daily intake of minerals, by gender, age and social class (2007)

	Gender		Age group (years)				Social class		
Minerals	**Men**	**Women**	**18-29**	**30-44**	**45-64**	**65+**	**SC 1-2**	**SC 3-4**	**SC 5-6**
Phosphorous (mg)	1727.0	1552.6	1794.2	1698.0	1534.5	1457.3	1588.7	1659.7	1672.8
Selenium (µg)	62.8	58.1	62.7	61.1	59.1	58.0	58.6	60.7	62.7
Magnesium (mg)	363.1	342.2	366.4	366.4	342.1	320.3	351.5	354.5	350.9
Copper (mg)	1.5	1.4	1.5	1.5	1.4	1.3	1.4	1.4	1.5
Chloride (mg)	5540.3	5021.9	5536.7	5276.7	5050.2	5289.7	4923.9	5321.9	5668.4
Manganese (mg)	3.8	3.8	3.4	3.8	4.0	3.9	3.8	3.8	3.8
Iodine (µg)	181.8	162.6	186.3	175.6	161.8	161.0	167.9	173.2	177.8
Arsenic (mg)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cadmium (mg)	0.03	0.02	0.02	0.02	0.03	0.03	0.02	0.03	0.03
Tin (mg)	1.4	1.3	1.5	1.4	1.3	1.2	1.2	1.4	1.4
Mercury (mg)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Lead (mg)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

APPENDIX 5:
COMPARISON OF MEAN DAILY INTAKE OF KEY NUTRIENTS WITH IRISH DIETARY RECOMMENDATIONS

Table A5-1: Comparison of mean nutrient intake levels with Irish dietary recommendations*

Nutrients	Mean intake SLÁN 2007	Lowest threshold intake (LTI)	Average requirement (AR)	Recommended dietary allowance (RDA)**
Vitamin A (µg)	777.1 (672.2)	300 (250)	500 (400)	700 (600)
Thiamin (mg)	2.1 (2.0)	0.6 (0.4)	0.8 (0.6)	1.1 (0.9)
Riboflavin (mg)	2.1	0.6	1.3	1.6
Niacin (mg)	27.4 (25.3)	11 (9)	15 (11)	18 (14)
Vitamin B6 (mg)	3.2	–	1.3 (1.0)	1.5 (1.1)
Folate (µg)	353.8	160	230	300
Vitamin B12 (µg)	6.7	0.6	1.0	1.4
Vitamin C (mg)	165.3	32	46	60
Vitamin D (µg)	3.6	–	–	0-10
Calcium (mg)	972.4	430	615	800
Phosphorus (mg)	1638.0	300	400	550
Potassium (mg)	4140.7	1600	–	3100
Iron (mg)	13.6 (13.1)	5.4 (7.5)	7.7 (10.8)	10 (14)
Zinc (mg)	13.1 (11.7)	5 (4)	7.5 (5.5)	9.5 (7)
Copper (mg)	1.4	0.6	0.8	1.1
Selenium (µg)	60.4	20	40	55
Iodine (µg)	172.0	70	100	130

* Adapted from *Recommended Dietary Allowances for Ireland*, Food Safety Authority of Ireland (FSAI, 1999). FSAI recommendations are currently in the process of being established for β carotene and other carotenoids, vitamin E, manganese, magnesium, sodium and chloride.

** If the recommended daily intake value is gender-specific, intake for women is given in parentheses.

Table A5-2: Adult protein recommended dietary allowance (RDA), by gender, age and activity level*

MEN			
Age group	**Activity level**	**Weight (kg)**	**RDA (g/day)**
19-34	Sedentary	70	63
	Moderately active	70	72
	Very active	70	84
35-64	Sedentary	70	60
	Moderately active	70	69
	Very active	70	84
65-74	Moderately active	70	60
75+	Moderately active	70	54
WOMEN			
Age group	**Activity level**	**Weight (kg)**	**RDA (g/day)**
19-54	Most levels	55	54
	Very active	55	62
55-74	Moderately active	55	47
75+	Moderately active	55	42
Pregnancy**	Moderately active	–	60
Lactation***	Moderately active	–	69

* Adapted from *Recommended Dietary Allowances for Ireland*, Food Safety Authority of Ireland (FSAI, 1999).

** Second half of pregnancy.

*** First 6 months of lactation.

APPENDIX 6:
MAXIMUM POPULATION COMPLIANCE WITH MACRONUTRIENT GUIDELINES

Population-based and individual-based targets for recommended nutrient intake levels are distinctly different. While individual-based targets rely on a cut-off point (those who meet the requirement and those who do not), population-based targets create a frequency distribution around a mean population goal and thus all individuals who fall within this distribution would be considered as complying with the recommended nutrient intake. In SLÁN 2007, methods described by Harrington *et al* (2001) were applied to determine the maximum percentage of the overall population complying with nutrient intake recommendations (*see Table A6-1*).

Table A6-1: Maximum percentage of respondents complying with recommended dietary allowance (RDA) guidelines, by gender and age

	MEN Age group (years)				WOMEN Age group (years)			
Percentage contribution to food	**18-29**	**30-44**	**45-64**	**65+**	**18-29**	**30-44**	**45-64**	**65+**
Carbohydrates (≥55%)	21	34	48	54	41	46	54	58
Protein (≤15%)	33	31	24	26	40	36	28	26
Fat (≤35%)	60	79	100	100	87	96	100	100

APPENDIX 7:
COMPLIANCE WITH MULTIPLE FOOD PYRAMID SHELVES

Table A7-1: Compliance with multiple Food Pyramid shelves, by gender, age and social class

Food Pyramid shelves	Gender % (N)		Age group (years) % (N)				Social class % (N)		
	Men	Women	18-29	30-44	45-64	65+	SC 1-2	SC 3-4	SC 5-6
No shelves	12 (505)	8 (372)	12 (260)	10 (277)	8 (216)	9 (124)	9 (255)	10 (354)	11 (158)
1 shelf	36 (1,592)	34 (1,541)	38 (842)	35 (970)	33 (887)	33 (434)	32 (942)	35 (1,211)	38 (567)
2 shelves	38 (1,670)	41 (1,871)	38 (854)	40 (1,107)	39 (1,052)	40 (527)	41 (1,194)	39 (1,324)	37 (546)
3 shelves	13 (593)	16 (717)	11 (246)	14 (386)	18 (466)	16 (212)	16 (461)	14 (491)	13 (199)
4 shelves	1 (61)	2 (102)	1 (34)	1 (45)	2 (61)	2 (24)	2 (56)	2 (64)	1 (23)

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Published by The Stationery Office, Dublin

To be purchased from the
Government Publications Sales Office
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or through any bookseller

Printed by Brunswick Press Ltd, Dublin 12