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Literature Review
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**A review of the literature describing the link between
poverty, food insecurity and obesity with specific reference to
Australia**

Dr Cate Burns
Centre for Physical Activity and Nutrition Research
School of Exercise and Nutrition Sciences, Deakin University

Website:
www.vichealth.vic.gov.au

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Dr Cate Burns

Dr Burns is a lecturer in Public Health and Social Nutrition in the School of Exercise and Nutrition Sciences. She is an active member of the Centre for Physical Activity and Nutrition Research. Her areas of research interest are; food insecurity, nutritional issues in vulnerable groups and obesity in low income families

cburns@deakin.edu.au

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Executive Summary

This report examines poverty, food insecurity and obesity and provides an overview of the evidence linking these three factors. Intuitively any relationship between poverty, food insecurity and obesity would appear an unlikely contradiction. How can someone have little money and therefore restricted food intake still be obese? However this review of the relevant literature in both peer-reviewed and government publications indicates a strong relationship between poverty and obesity. This is an important report for researchers, health professionals and policy makers to use in developing future research programmes, interventions and broad policies around obesity and healthy eating.

The current report finds that the risk of obesity is 20 to 40% higher in individuals who are food insecure. This is true for women only and is regardless of income, lifestyle behaviours or education and is observed consistently across US, Europe and in Australia. Extreme food insecurity attended by hunger is associated with thinness. As yet the association observed between food insecurity and obesity has not been explained. There are however several hypotheses which offer good bases for research. This research is imperative. National and international data indicate that those with the poorest social, economic and educational resources are at the greatest risk of obesity.

1. Poverty

1.1 Definitions and Prevalence Poverty

“Poverty is where people have unreasonably low living standards compared with others; cannot afford to buy necessities, such as a refrigerator for example; and experience real deprivation and hardship in everyday life” (McClelland 2000).

Our experience and understanding of poverty is usually through media coverage of living conditions in war torn or economically developing countries. These people who lack food and shelter for minimal needs are said to be living in absolute poverty. However, poverty is also experienced in the developed world. This poverty is considered relative. Though there are some Australians; homeless people and some indigenous communities known to experience absolute poverty (Saunders 1996). In Australia and other developed countries, most people are considered poor if their living standards fall below an overall community standard, and they are unable to participate fully in the ordinary activities of society.

This relative poverty can be measured in different ways. Commonly it is expressed in relation to a poverty line, a defined income which is updated regularly. A well-known measure of poverty in Australia is the Henderson Poverty Line. It estimates the income which families of different sizes need to cover essential needs. The Henderson Poverty Line represents a very basic living standard. The estimated prevalence of poverty varies according to the methodology used. The Commonwealth Government recently published the Report on Poverty and Hardship 2004 – “A hand up not a hand out” (Commonwealth 2004). This report clearly lays out the current estimates for poverty in Australia. These range from 3.7 million –4.1 million using the Henderson Poverty

Line (Harding and Szukalska 2000) to 1.5 million in a submission to the Senate enquiry by the Brotherhood of St Laurence in 2000. The Centre for Independent Studies estimates that some 5% of the population are in 'chronic poverty'. Analysis of the poverty trends using a range of poverty lines from 1990 to 2000 indicated that in all but one study poverty rates in Australia did not decrease over the decade, in spite of the nation's economic growth (Brotherhood of St Laurence 2002 (www.bsl.org.au)).

Even using a conservative estimate, more than a million and a half Australians are living below the poverty line at the beginning of the 21st Century (Commonwealth 2004). Around one in eight children in Australia live in poverty. Compared with most other industrialised countries, this rate is high (McClelland 2000). Relative poverty levels in Australia were around 13% to 16% during the late 1980s below the levels in the USA, similar to those in Canada and Ireland, and higher than the levels of western European countries. Poverty in Australia has increased from 10.2% to 16.7% between 1972 and 1990. Relative poverty is high among the following groups; single parent families, young people aged 15 to 24 years, unemployed people, immigrants from Oceania, the Americas and Asia, indigenous Australians and those families with children (Commonwealth 2004).

1.2 What level of household income constitutes poverty in Australia?

The average disposable household income in Australia in 2000-01 was \$495 per week net (ABS 2001). In low income households the average disposable weekly income in 2000-2001 was \$245, in middle income \$413 and in high income \$903. Wages and salaries were the principal sources of income for households with middle and high income levels, while government pensions and allowances dominated low income households (76%). Comparison of the government allowance payments (Centrelink) with the Henderson Poverty Line indicates (for most household categories) a significant short fall between allowance and basic need. Income support payments are often 20 to 30% below the poverty line (ACOSS 2000). "As the life circumstances of Australians change, due to such factors as marital breakdown, unemployment and ageing, many become dependent upon the Australian social security system. Being dependent upon government cash benefits is still the single key characteristic shared by those in poverty in Australia" (Harding and Szukalska 2000).

Unemployment is the major contributor to poverty. However, it is also possible to have a job and still be living in poverty. In these households a wage is earned but it amounts to only 30% in excess of the poverty line. It is estimated that one in five poor Australians are in paid work- they may be called the 'working poor' (Harding and Szukalska 2000). Many people in Australia also get trapped in the cycle of insecure low-paid casual jobs, followed by periods spent living on income support (McClelland 2002).

1.3 Poverty as a dynamic concept

Poverty has been established as a dynamic concept (Bane and Ellwood 1986, Walker and Ashworth 1994). Longitudinal data showed that poverty was not a static phenomenon, rather if we follow people over time, we find that some of the poor change places with the non-poor and that some experience repeated spells in poverty. This is not to suggest that all spells in poverty are brief. Duncan and colleagues (1984) found that poverty for some families is only a temporary condition,

beginning with a job loss or a divorce but ending with re-employment or remarriage. However for other families and households, poverty is persistent, the result of less tractable deficiencies in health, skills or resources. According to Duncan 1984 the crucial point is that the routes into and out of poverty differ.

2. Food Insecurity

2.2 Definition of Food Insecurity

Food insecurity is “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (American Dietetic Association 1998).

Hunger is defined as “The uneasy or painful sensation caused by a lack of food. The recurrent and involuntary lack of access to food. Hunger, over time may produce malnutrition’ (Hamilton 1997).

There is a continuum of experience involving food insecurity with or without hunger according to the severity and consequences of the food scarcity situation. Food insecurity consists mainly of anxiety about having enough food to eat or running out of food and having no money to purchase more (Klein 1996). Adults who believe they are food insecure may try to avoid hunger by cutting the size of meals, skipping meals, or even going without food for one or more days. However, when food is extremely limited, the means to avoid hunger are ineffective and cause severe personal hunger and hunger that spreads to the family and children (Klein 1996).

2.3 Prevalence of food insecurity

Food insecurity can be measured by various survey tools that range in complexity from a single question to multi-item questionnaires. The standard single item question to determine individual and household food security is “In the past 12 months, have you or anyone in your household run out of food and not had enough money to purchase more?” (Booth and Smith 2001)

More complex questionnaires for example the Radimer/ Cornell and CCHIP measures (Frongillo, 1999) cover;

- anxiety that budget may be insufficient
- the experience of running out of food, without money to obtain more
- perceptions about inadequacy of quality or quantity of food eaten
- adjustments to normal food use
- instances of reduced intakes by adults in household
- instances of reduced intakes by children in household

US data from 1995 food insecurity survey Centre for Nutrition Policy and Promotion (CNPP 1996) indicates that 7.8% of US households were food insecure, 3.3% experienced food insecurity with moderate hunger and 0.8% suffered from severe hunger.

A single item question used in both the 1995 Australian National Nutrition Survey (NNS) and the Australian Bureau of Statistics Population Survey Monitor provides the only Australian population prevalence estimate of food security. Respondents aged 16 years and over were asked “In the last 12 months were there any times that you ran out of food and couldn’t afford to buy

more?" Of the total sample 5% were screened as food insecure. However the risk was much higher in specific groups; unemployed (23%), single parent households (23%), second lowest income quintile (20%), rental households (20%), young people (15%). With respect to young people, for those in 16-18 years bracket 8% males, 5% females were food insecure, while in the 19-24 year old bracket the prevalence of food insecurity was 9% males and 12% females. (Moon, Meyer, Grau 1999)

Other measures which have been used to assess the prevalence of food security problems are the number of emergency feeding sites and their rates of use. In 1993, Second Harvest, the largest hunger relief organisation in the United States distributed surplus food to 41,487 member agencies that operated 69,294 food programs, including 26,936 food pantries that provided groceries to needy families and 4,104 soup kitchens that serve prepared meals to those in need (Van Amburg Group 1993). It is estimated that 26 million American used the food programs of Second Harvest.

The extent of emergency food relief in Australia is demonstrated by Victoria Relief and The Salvation Army providing more than \$12 million worth of emergency relief in 2003. Last year, Victorian Relief contributed to the provision of 1 million meals while The Salvation Army met the needs of more than 125,000 contacts for emergency aid, with another 20% of contacts going unmet (Victorian Relief 2004). It should be noted that although use of emergency food sources may be indicators of food insecurity in a community, failure to use such sources may indicate a lack of emergency food sources in a community rather than the absence of food insecurity.

On average Australian household weekly expenditure on food and non-alcoholic beverages amounts to 18.2% income. The mean absolute weekly food expenditure is \$127. The lowest income bracket spend proportionally more of their disposable income on food (20%), than those in top income bracket (17%). As a bench mark for food cost a recent Healthy Food Access study indicate that the average weekly cost of a basket of food to provide a nutritionally adequate intake for a family of 6 is \$180 (Burns et In Press).

2.4 The relationship between poverty and food insecurity

Although most persons living in poverty are at risk of food insecurity, it cannot be assumed that they are, in fact, food insecure. In addition, for many reasons, including factors such as ill health, disability, sudden job loss, and high living expenses, persons above the poverty line cannot be assumed to be food secure. The relationship between poverty, food insecurity and hunger is a complex one. There is no one-to-one correspondence between income-based measures of poverty and food insecurity.

In the US only 13.1% of those in poverty are affected by hunger (Rose, 1999). Of the food insecure households (65%) showed no evidence of hunger, 28% reported moderate hunger, 6.9% reported severe hunger (Carlson 1999). The risk of food insecurity in low-income families is associated with single-parent families, not having health insurance, and having a family head with < 12 years of schooling. The Community Childhood Hunger Identification Project (CCHIP) conducts surveys of low-income families with children younger than 12 years throughout the United States. Their data indicates that 70% of families experienced hunger or were at risk of hunger (Community Childhood Hunger Identification Project 1995).

The Monitoring Food Habits and Food Security Study: Australia 1995-1996 (Coles-Rutishauser, Penm 1996) reported those in the lowest quintile of household income (0-\$14,000pa) 12% of individuals reported having run out of food at some time in the last 12 months, and had insufficient money to buy more. In this study the percent of individuals who were food insecure decreased steadily with increasing quintile of household income from 14% (\$14,000-\$25,000) to less than 3% (> \$60,000). The National Nutrition Survey 1995 (NNS95) indicates that 51% of those who were food insecure received a government pension or benefit as the main source of income, 63% had an income less than \$30,000 per annum (National mean \$45000), 36% were in the lowest level of equivalent income (1st quintile) (Wood et al., 2000).

Therefore the terms poverty and food insecurity may not necessarily be synonymous but there is a strong overlap. Therefore for the purposes of this review we will define food insecurity on the basis of income relative to the poverty line (< or = 130% Henderson Poverty Line) or in response to a standard and valid food insecurity measurement tool.

3. Obesity

3.3 Definition of obesity

Obesity can be defined simply as a disease in which excess body fat has accumulated to an extent that health may be adversely affected (WHO 1997). Body Mass Index (BMI), an index of weight for height, is the standard measure for classifying overweight and obesity in adults. The WHO classification is based primarily on the association between BMI and mortality. A BMI of 30 or more is now widely accepted as denoting the classification of obesity.

Adiposity can also be represented in terms of fat distribution. Abdominal fat mass has been shown to be indicative of health risk. WHR (Waist Hip Ratio) has become accepted as the clinical method of identifying individuals with abdominal fat accumulation. Waist circumference is a more convenient and simple measurement which is unrelated to height and correlates closely with BMI and WHR (Lean 1995).

For the purposes of this review obesity will be defined in terms of BMI, WHR and waist circumference.

3.4 The prevalence of obesity in Australia

In Australia, differentials in overweight and obesity for adults for 1989-2001 (AIHW 2003) showed that the prevalence of obesity increased considerably over this time period (9.5% to 16.7%), a much greater rise than that for the overweight but not obese group (30.5% to 34.4%).

Men were more likely than women to be overweight (5 8.9% vs 43.2%). However, women were just as likely as men to be obese (17.4% vs 16.0% respectively). Women in the most disadvantaged socioeconomic group had nearly double the rate of obesity (22.6%) in relation to those in the most advantaged group (12.1%). Men in the most disadvantaged group were also more likely to be obese than those in the most advantaged group (19.5%, 12.7% respectively).

4. The PARADOX –The relationship between Obesity, Poverty and Food Insecurity

4.1 The paradox

Hunger and food insecurity could be called Australia's "hidden crisis". At the same time and apparently paradoxically obesity is on the increase and has been declared an epidemic. National data indicates that obesity is most prevalent amongst those at highest risk of food insecurity. The co-existence of obesity and food insecurity sounds contradictory. Whereas links between food insecurity and low diet quality might be expected, the association between food insecurity and overweight is something of a paradox. How can those with insufficient resources to purchase adequate food be overweight and even obese? This paradox is only now beginning to be understood. Much of the research around the issue comes from the US and Canada though in Australia we do have some data.

4.2 Obesity, Poverty and Food Insecurity – The paradox in the US

In the US as in Europe the rates of obesity and Type 2 diabetes follow a socioeconomic gradient, such that the burden of disease falls most heavily on people with limited resources, racial-ethnic minorities, and the poor (US Dept of Health and Human Services, Healthy People 2010). Among women, higher obesity rates tend to be associated with low incomes and low educational levels. The association of obesity with low socio-economic status (SES) among men is less consistent (Drewnowski and Specter, 2004). Although obesity rates have increased steadily in both sexes, at all ages, in all races and at all educational levels, the highest rates occur among the most disadvantaged groups (Mokdad 2001).

Food security and obesity also appear to be linked. Several studies have investigated whether poverty and food insecurity of families are linked with obesity ((Townsend et al., 2001), (Dietz, 1995), (Frongillo et al., 1997) , (Olson, 1999), (Alaimo et al., 2001). The consistent finding is that white women in families that are resource-constrained as measured by poverty, food insecurity or both – are more likely to be obese. The trend in these studies was that although mild or moderate food insecurity is associated with a higher risk of obesity, severe food insecurity is associated with a lower risk. Poverty and food insecurity were not shown to be associated with obesity in men.

U.S data from the 1995-1999 Behavioural Risk Factor Surveillance Study (BRFSS) an ongoing random-digit-dialed telephone survey was analysed to determine the relationship between food insecurity and obesity (MMWR 2003). This indicated 7% of those sampled were food insecure (In the past 30 days, have you been concerned about having enough food for you or your family?), 18.7% were classified as obese. Persons who reported concern about food security were 29% more likely to be obese than those who did not report such concerns

In a study of 193 women aged 20 to 39 years with children living at home Kendall (1995) using the Radimer/Cornell hunger and food insecurity items, found 26% households were food insecure, 17% had adults who were experiencing food insecurity and 10% had hungry children in them (Table 2). BMI was significantly higher for women in the household food insecure group compared with food secure group (28.2 vs 25.6 kg/m²). In addition, 37% of the women in the household food-insecure group had a BMI > 30 (obese) compared with 26% of women in the food-secure households.

Kendall 1996, in a multiple linear regression model, controlling for all known influences on body weight *including income household* showed that food security was positively related to BMI. This is a significant finding namely that the effect of food security on obesity is *over and above the effect of income level*. In this study (Kendall 1996) on average the women in the food-insecure households were 2 BMI units heavier than women in households that were food secure. It should be noted that 2 BMI units within the range of the group means in this sample (25-28 kg/m²) is a difference of clinical and public health significance. The Kendall study (1996) indicates another important point which is that food insecurity (household level) is related to an anthropometric measure of nutritional status. In this study those who were food insecure but not at an extreme level appear to have higher BMIs and thus at greater risk of poor health outcomes. Although this hypothesis is intriguing, it must be confirmed with prospective studies controlling for additional confounding factors such as smoking and physical activity.

Jeffrey and French 1996 carried out a study of 20 to 45 year old women aimed at understanding demographic differences in obesity prevalence. They found that in a full multivariate model, including variables for demographic characteristics, diet and exercise behaviours, weight concerns and weight loss practices, did not appreciably reduce the magnitude of the overall association between income group and BMI. Thus they concluded that economic deprivation contributes to the high rates of obesity among women of lower socioeconomic status in ways not accounted for by the many demographic and lifestyle variables in their statistical model. Their finding that meal skipping was nearly twice as high in the income group that made <\$10,000 per year than it was in higher income groups could possibly implicate food insecurity as a factor.

Townsend 2001 (Townsend et al., 2001) in an analysis of the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSF 11) using 4 item food security scale found that overweight (BMI > 27.3kg/m² for women and 27.8kg/m² for men) was related to overweight status for women (n=4509), but not for men (n=4970). Excluding the 11 severely insecure women, the prevalence of overweight among women increased as food insecurity increased, from 34% for those who were food secure, to 41% for those who were mildly food insecure to 52% for those who were moderately food insecure. Food insecurity remained a significant predictor of overweight status, after adjustment for potential confounding demographic; poverty, education ethnicity, age and lifestyle variables; dietary intake, physical activity and sedentary behaviour. In a logistic regression analysis, mildly food insecure women were 30% more likely to be overweight than those who were food secure. Severe food insecurity in adjusted analysis was not predictive of overweight. Interestingly women who were recipients of food stamps i.e. government food relief were almost 40% more likely to be overweight.

Gibson (2003) studied Food Stamp Programme participation and obesity, overcoming the limitations of other cross-sectional studies by using data from 1985 to 1996 waves of the National Longitudinal Survey of Youth 1979. Both concurrent and long-term Food Stamp Programme participation were associated with increased absolute risk of obesity of about 2 to 4.5 percentage points. The study used longitudinal data, but had no data on food security.

Adams (2003) (Adams et al., 2003) analysed this relationship between food security and obesity from a telephone survey of 8169 women in the California Women's Health Survey. Food insecurity was evaluated by use of four questions adapted from the U.S. Household Food Security

Module. Food insecurity without hunger affected 13.9% of the population and food insecurity with hunger 4.3%. Almost one fifth (18.8%) of the population were obese (BMI > 30). Obesity was more prevalent in food insecure (31.0%) than in food secure women (16.2%). Food insecurity without hunger was associated with 36% increased risk of obesity in whites and a 47% increased risk in others. Food insecurity with hunger was associated with increased risk of obesity for Asians, Blacks and Hispanics (OR=2.81) but not for non-Hispanic Whites (OR=0.82). All these analyses were adjusted for income level, age, education, general health status and walking. Thus food insecurity was shown to be associated with increased likelihood of obesity irrespective of income and education and the risk is greatest in nonwhite i.e. this effect is amplified in some ethnic groups. Interestingly in this study the effect of food insecurity with and without hunger remained significant, even after controlling for poverty status, suggesting that food insecurity is not simply a proxy for income.

4.3 Obesity, Poverty and Food Insecurity — The paradox in the UK and Europe

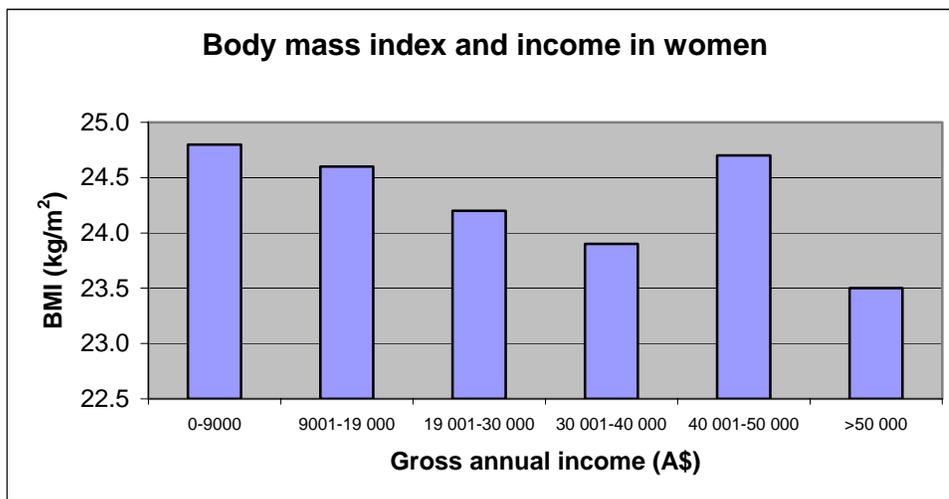
In a Finnish study (Sarlio-Lahteenkorva and Lahelma 2001) of 25 to 64 year old men and women the association between economic disadvantage, food insecurity and self-reported body weight. The respondents were classified by their body mass index (BMI) (calculated from self-reported weight and height) into four groups: thin, normal, overweight and obese. Food security was assessed by five separate items concerning economic fears and experiences related to sufficient supply of food during the past 12 months (Edmonton Food Policy Council 1992), and a combined scale in which those with affirmative responses to four to five items were classified as hungry. Multivariate logistic regression was undertaken using both the BMI grouping and indicators of economic disadvantage as independent variables to predict food insecurity controlling for recent unemployment, educational attainment and sex. Low household income, recent unemployment and economic problems in childhood were all predictors of food insecurity. Data suggested that deviant body weight (thin or obese) was associated with food insecurity. Thin people were the most likely to be hungry and showed most food insecurity in five separate items. Only thinness was associated with hunger. Those who experienced extreme hunger were twice as likely to be thin as those who did not. On the other hand obese people reported more buying cheaper food due to economic problems (20% more likely) and fears or experiences of running out of money to buy food (40% more likely) than did normal weight subjects.

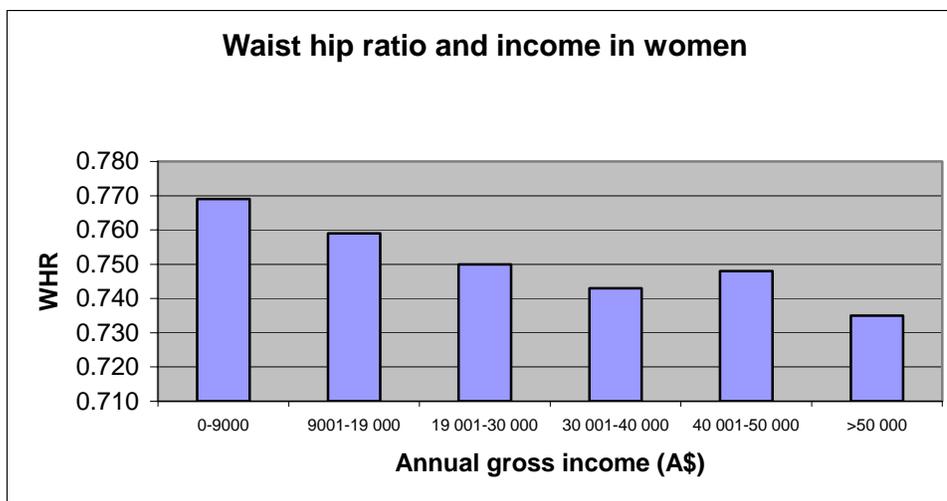
This study was interesting in that it showed that in addition to material quantity and quality, food security includes psychological and socio-cultural dimensions (Feichtinger 1997, Radimer 1992). The authors comment that food insecurity is not limited to those with inadequate nutrient and energy supplies. Food insecurity exists when people lack choice, fear running out of food, or are forced to make major changes in their preferred eating habits due to economic constraints. This has been noted in other descriptive European studies (Demos 2002, Watson 2002). This study indicates that economic disadvantage, both immediate (recent unemployment) and even in the distant past (childhood), is associated with food insecurity. These experiences include those of childhood which has resonance in the theory of Barker which posits that poor nutrition in utero is predictive of childhood and adult disease. The Duchess of Windsor was reputed to have said that you can never be “Too thin, or Too rich”. However, in the current study extreme food insecurity associated with thinness i.e. it is possible in modern times to be both too thin and too poor. Even in a developed welfare state, such as Finland, some people are hit by circumstances in which they are forced to reduce their intake of food due to economic problems.

In the UK, (Wardle et al., 2002) using data in 15061 men and women from the 1996 Health Survey for England calculated the risk for obesity by education, occupation and 2 markers of economic status; receipt of benefits and housing status (owns or rents). This study found that after adjusting for age, marital status and ethnicity, for both men and women, the adjusted risk of obesity was 40% higher in those in receipt of benefits. The receipt of benefits is a high risk for food insecurity. These results would indicate that a group likely to be food insecure were more likely to be obese. With respect to housing status for women only there was a 20% higher risk of obesity after adjustment for those who rent. The authors note that the effect of poverty (as indicated by receipt of benefit) on obesity appears to function independently of the effects of education and occupational status.

4.4 Obesity, Poverty and Food Insecurity - The paradox in Australia

Waist-to-hip ratio and BMI data from the Risk Factor Prevalence Study conducted in 1989 indicates marked socio-economic gradients(Boyle et al., 1993). Income was not associated with consistent (or statistically significant) differences in WHR or BMI among men. For women income was much more strongly associated with mean WHR and mean BMI, with those on an income of \$9000 or less having a significantly higher mean WHR than other income groups ($p < 0.003$ for all comparisons). (See Figures below).





Ball et al., 2002) used an analysis of the National Health and Nutrition surveys in a total of 8667 randomly-selected adults (4167 men, 4500 women) to determine the relationship between objective height, weight and body fat distribution and a range of sociodemographic indicators. For men who were not in labour force, for whom the main income source was a government pension and who received a pension WHR was significantly higher. For women who were not in the labour force, for whom the main income source was a government pension or who received a pension both WHR and BMI were significantly higher than women in more socially advantaged income categories. Men in the lowest employment bracket were 20% less likely to be overweight. However, women in the lowest employment bracket were 40% more likely to be overweight and 200% more likely to have abdominal adiposity.

Recently the AusDiab survey (Cameron et al., 2003) was carried out to measure the prevalence of obesity in Australian adults and to examine the associations of obesity with socio-economic and lifestyle factors. In this study 20,347 subjects aged > 25 years completed a household interview, of these 11,247 attended the physical examination. The prevalence of overweight and obesity and abdominal obesity was almost 60% defined either by BMI or WHR. The prevalence of obesity was 2.5 times higher than in 1980. With respect to income, for men the risk of obesity as determined by BMI and WHR was elevated over an income of \$ 200-399 per week with a 20-30% increase in obesity risk relative to men in the top income bracket. However men with an income of \$ 0-199 per week, indicative of being below or on the poverty line, were 30-50% less likely to be obese either by BMI or WHR. For women the trend was the reverse with women in the lowest income bracket 20-60% more likely to be obese as determined by either BMI or WHR.

In one of the only direct studies of food insecurity in Australia, Radimer et al. 1997 (Radimer et al., 1997) looked at food insecurity in Queensland collecting data from 10451 people interviewed by computer-assisted telephone interviewing technique. Two questions were used to measure household and individual food insecurity;

1. In the last 12 months were there times that your household ran out of food and there wasn't money to buy any more food?
2. In the last 12 months, has anyone in your household eaten less than they should because you couldn't afford enough food?

The overall prevalence of food insecurity were 9.7% for household and 6.4% for individual with 11.3% for at least one type of food insecurity. For prevalence was significantly higher for women than men, for younger than older respondents and for urban than rural areas ($p < 0.0001$ for all comparisons). Both household and per capita income were strongly associated with household food insecurity. For per capita income \$7500 was generally the threshold at which prevalence of

food insecurity dropped. In multivariate analysis, both men and women with household income less than \$7500 were 3 times more likely to suffer household and individual food insecurity. Those who were unemployed were twice as likely to be food insecure. With respect to body weight, in this study those who experienced either household or individual food insecurity were more likely to be obese (BMI >30) and underweight (BMI < 20).

This pattern relative to body weight, with the greatest numbers of both underweight and obese being among the food insecure has been found in several Australian studies. Radimer 1997 showed the pattern with her study in Queensland and it has been demonstrated by Wood et al. 2000 in an analysis of the National Nutrition Survey. In the latter survey food and nutrient intake was assessed by interview of 10901 Australians, food security was determined by single question "In the last 12 months, were there any times that you ran out of food and you couldn't afford to buy more?". Wood 2000 reports that the prevalence of underweight (BMI <18.5kgm²) was 4.1% in the food insecure, 1.5% in food secure, for overweight (BMI <25 to <30) in food insecure was 26.8% vs 38.2% for food secure while for obesity (BMI 30+) in food insecure 22.1% vs 18.9% for food secure.

4.5. Limitations to reviewed studies

Most of the studies of the relationship between food security and obesity have been cross-sectional design, any inferences regarding cause and effect must be made with caution and should be considered preliminary. A causal relationship between food insecurity and obesity has not been established. However it should be noted that there are numerous studies that indicate the diets of food insecure or food insufficient women have been shown to include fewer fruits and vegetables (Olson, 1999), and to be deficient in a variety of nutrients ((Rose, 1999), (Dixon et al., 2001) compared with those who are food secure i.e. there are documented changes in energy and nutrient intake as a result of food insecurity.

Future research using longitudinal data should directly examine how change is associated dynamically with other factors using multiple time points. For example, how does transition from not participating to participating in a food relief programme or governmental benefit relate to subsequent weight gain or to transition from a non-obese to obese state? Using multiple years of data and a dynamic analytic approaches, these transitions can be examined in detail (Frongillo, 2003).

There are issues of validity, specificity and sensitivity associated with the type and complexity of the food insecurity tool used in any particular studies. The more complex tools are well described and validated (Frongillo, 1999). Single item questions will obviously not have the specificity and sensitivity to detect relative degrees of food insecurity and hunger. However for the purposes of monitoring such questions are sufficiently reliable.

All data self-reported, introducing a variety of social response biases. Problems with measurement of food security including that food-insecure women may be fearful of answering honestly because honest responses might be perceived as justification for removal of their children from their care.

Undersampling of at risk populations is apparent in all health and lifestyle studies. As Turrell (2003) comments study designs have not been sensitive to the difficulties associated with

recruiting a socio-economically representative sample. The upshot of this is that studies produced biased estimates (underestimates) of socio-economic differences in lifestyle and diet.

Summary – The relationship between Food insecurity and Obesity

The risk of obesity is 20 to 40% higher in individuals who are food insecure. This is true for women only and is regardless of income, lifestyle behaviours or education and is observed consistently across US, Europe and in Australia. Extreme food insecurity attended by hunger is associated with thinness.

5. Why? Likely explanations

5.1 Cheap foods are energy dense, high in fat and sugar and highly palatable

Basiotis (1992) hypothesized and confirmed a behavioural model in which household members faced with diminishing incomes first consumed less expensive foods to maintain energy intakes at a lower cost. In this study at a certain income level participants stated that they had “enough but not the kind of food we want to eat”. Only when incomes diminished still further did households reduce dietary energy to below daily requirements, this resulted in overt deprivation. The association between poverty and obesity is mediated at least in part by the low cost of energy dense foods which may in turn promote overconsumption (Drewnowski 2004). The explanation is that energy density (MJ/kg) and energy costs (\$/MJ) are inversely linked, such that the selection of energy-dense foods by food insecure or low-income consumers may represent a deliberate strategy to save money. Persons attempting to limit food costs will first select less expensive but more energy dense foods to maintain energy needs. As food costs diminish further dietary energy density rises, the total energy intakes may actually increase (Drewnowski 2004).

People consume a constant volume of food i.e. stomach's capacity does not vary greatly, so total energy intake is determined not by volume but by the energy density of the food consumed. The energy density of a food is essentially a function of water content. Foods with a high water content for example fruits and vegetables have a low energy density. Foods containing little water for example butter or chocolate have a high energy density. These energy-dense foods are known to be more palatable largely because they are high in fat and sugar for which humans have a taste preference (Drewnowski 2004). Developments in agriculture and food technology have made energy-dense foods accessible to consumers at a very low cost. For example the energy cost of potato chips is about 20 cents (US) /MJ (1200kcal/\$), whereas that of fresh carrots is 95 cents US/MJ (250kcal/\$). The energy cost of soft drinks is 30 cents/MJ (875 kcal/\$) whereas that of orange juice from concentrate was 143 cents/MJ (170 kcal/\$). Fats and oils, sugar, refined grains, potatoes and legumes represent some of the lowest-cost options and provide dietary energy at a minimal cost. These foods account for between 30-50% of the energy content of the Western diet. Cheap and tasty energy dense foods - this is a very obesogenic combination. The inverse relation between energy density and energy costs would indicate that “obesity-promoting’ foods simply offer the most dietary energy at the lowest cost. They are more satiating for less expense. Given the differential in energy costs between energy-dense and energy dilute foods, the advice to replace fat and sweets with fresh fruits and vegetables may have adverse economic consequences for low income consumers (Drewnowski 2004). In fact studies show that limited economic resources have a detrimental effect not so much on dietary energy, but rather on overall quality, and energy density (Basiotis 2002).

Drewnowski 2004 has proposed an economic hypothesis for the increasing prevalence of obesity in low income groups. He points out that there has been little emphasis on the *low economic costs* of becoming obese. At world market prices, the cost of refined sugar is about 10centsUS/500g. This means that close to 80000 kJ can be purchased for \$1US. Drewnowski postulates that it is high energy intakes, *worldwide*, driven by the very low cost and reinforced by the positive hedonic properties of energy dense foods that is “fueling” the obesity epidemic. This effect is exacerbated in among the poor.

5.1.2 Is healthy food more expensive and less readily available to low-income consumers?

To achieve a healthy diet it may be necessary to spend more money. There have been numerous studies mapping food availability and cost relative to social advantage of a neighbourhood (Ellaway 2000, Donkin 2000, Cummins 2002, Kaufman 1997, Dibsall 2004). The majority of these studies found that low-income households may face higher food prices but this is not a consistent finding (Dibstall 2004, Cummins 2002). In Australia, poor food access is more a product of distance from major regional centers with poor food availability and high cost in more remote rural areas (Lee 2002).

US studies indicate total energy intakes or percentage energy from fat varies little with income. In contrast a greater dietary variety and higher consumption of vegetables and fruits were associated with higher education and higher income levels (Kendall 1996). This has also been shown in Australia (Crotty 1992). However, as yet there is no firm data either from US or elsewhere to allow us to link dietary and economic parameters causally. Drewnowski 2004 comments further studies on diet quality in relation to diet costs represents a major research need.

5.2 Poor education and lifestyle behaviours – “The poor behaving badly”

The food insecurity/overweight relationship could be attributable to knowledge about maintaining a normal body weight and health awareness and/or beliefs. This hypothesis posits that the effect of socioeconomic variables on diet quality and health behaviours can be attributed to a higher educational level or a greater awareness of health issues among higher-income respondents i.e. the poor do not are ignorant and therefore “behave badly”.

With respect to socio-cultural factors, it has been demonstrated both overseas (Roos 1999, Martikainen 2003) and in Australia (Turrell 2002, Giskes 2002, Mishra 2002) that those with fewer economic resources are less likely to be compliant with recommendations for healthy eating and exercise. Dietary distinctions between social strata may now be changing (Turrell et al., 2002). Murphy and Bayer 1997 based on recent national nutrition surveys in the United States did not find large differences in dietary quality across income categories. In the UK Dowler and Calvert 1995 found that in spite of poverty lone-parent families in London aimed to shop for and cook “healthy” “fresh” foods to achieve better diets for themselves and their children. This was true even where the parents smoked. In Australia (Crotty et al., 1992) also found that low-income families are concerned about health and nutrition and manage to consume a nutritionally sound diet under difficult circumstances. (Turrell, 1996) has found that the food skills of low-income groups, *not on welfare*, were comparable with high-income families. A study of food insecurity and nutritional adequacy (Tarasuk and Beaton 1999) conducted in Toronto revealed that women who reported hunger in their households during the past 30 days also reported systematically lower intakes of

energy and a number of nutrients. Estimated prevalence of inadequacy in excess of 15% were noted for Vitamin A, folate, iron and magnesium. It would appear with extreme food insecurity involving hunger that energy and nutrient intakes may be compromised but that low income families at risk of food insecurity may eat diets that are nutritionally adequate and consistent with dietary recommendations. The relationship however between food insecurity and the energy density of the diet is not known. This is the critical issue with respect to obesity.

Furthermore the consensus is that nutrition knowledge alone does not necessarily head to a healthy diet (Berg 2003, Patterson 1996, Tempper 1997, Parmenter 2000). Kennedy and Ling 1997 evaluated a community based nutrition education programme targeted at low-income groups in UK. They found that “even using more contemporary methods of nutrition education, people with limited resources are still less likely to adopt recommended dietary changes. The main barriers preventing them from adopting healthy eating advice was not ignorance but the *sum* effect of the following factors *and their interrelationship*: socio-cultural norms; lack of resources; financial instability; limited access to and availability of affordable healthy food and lack of choice. This would indicate broader political, economic and social factors must be incorporated into any model of eating behaviour in low-income families.

There is a poor understanding of the factors that contribute to unhealthy behaviours in low-income groups. Martikainen 2003 found that material hardship and perceived control over health were only weakly related to poor health behaviour. The latter authors point to contextual influences namely socio-demographic characteristics (for example marital status) and broad ‘cultural’ traditions (for example ethnicity) as playing a more important role in determining health-related behaviour. Devine and colleagues (2003) in a qualitative study of choice in low or moderate income families showed the complexity of the interaction between personal perceptions, availability of resources, family roles and job characteristics. These data indicate that social determinants of food choice may be more complex and subtle than simply distinction based on class or income.

5.3. Poor food and physical activity environment

It is now understood, though not fully, that both neighbourhood socio-economic environment and individual educational status may be associated with self-reported poor health and poor health behaviours (Malmstrom, Sundquist, Johansson 1999). As mentioned previously it has been found that those living on a low income or in a socially disadvantaged area may face higher food prices (Ellaway 2000, Donkin 2000, Kaufman 1997). It should be noted that this is not a consistent finding (Cummins 2002). What is apparent however that environmental approaches have made snacks, soft drinks and fast foods widely available. Reidpath et al. 2001 found that low-income areas have 3 times the density of fast food outlets per head population data. Furthermore, the phenomenon of “supersizing” i.e. offering larger food portions for little increase in price for foods eaten outside the home provides inexpensive extra energy at lower unit cost (Cameron-Smith, Bilsborough and Crowe 2002).

There are few reports linking food availability with the actual consumption. (Morland et al., 2002) found an association between the presence of a supermarket and healthy diet in Black Americans, however they found no association between healthy diet and the presence of fast food restaurants. We need to better understand the relationship between food availability and consumption,

particularly for energy dense snacks and fast foods which are more readily available in low income areas.

5.4. Different cultural norms around weight, health and diet

It is possible that lifestyle behaviours such as food and exercise are driven by class based differences in cultural norms around weight, health and diet. Different classes may value these things differently and have quite distinct normative behaviours which may not be consistent with health recommendations but be appropriate for that class or “tribe” of people. Bourdieu (1987) states “tastes in food depend on the idea that each class has of the body and of the effects of food on the body, that is, on its strength, health and beauty, come of may be important for one class and another for another”. There is little literature on cultural food and weight norms with respect to low income, poverty and resource deprivation. In one study, Baughcum 2000 found in a study of 622 mothers with children 23 to 60 months of age, obesity was more common in among the low education mothers and their children tended to be more overweight. However 79% of mothers failed to perceive their overweight as overweight . Among the 99 mothers with overweight children, low maternal education was associated with a failure to perceive their children as overweight after adjusting for low family income, maternal obesity, age, smoking, children’s age , race and gender. While further research is needed to understand this maternal misperception. For example, mothers may recognize that their child is overweight but may actively choose not to acknowledge or address it. This study would suggest class/socio-economic dependent norms for weight and may have different cultural beliefs around food and exercise.

5.5. Biological explanations

There is some evidence that low socioeconomic status leads to psychosocial stress promoting abdominal obesity through psychoneuroendocrinological pathways (Bjorntorp2001).

5.6. Feast and famine/ Binge eating associated with periodic hunger

It has been postulated that food insecurity can result in periodic food deprivation which constitutes a stress that may be linked with disordered eating behaviours and obesity. Studies of stress-induced eating have not been conclusive however they have consistently found that “restrained” eating predicts a vulnerability to stress induced eating (Greeno and Wing, 1994). This restraint model has been used in the eating disorder literature and may have an application in linking stress, overeating and obesity in food insecure individuals.

Within month (pension cycle) variability in resources leading to periodic over consumption. Dietz (1995) published a case study of a 7-year-old obese girl for whom food shortages that occurred at regular intervals in each month before her mother received the welfare cheque appears to be a contributing factor in her obesity. Dietz states “This brief discussion suggests that either food choices or physiological adaptations in response to episodic food shortages could cause increased body fat. However, confirmation of this hypothesis requires the demonstration of obesity associated with food insufficiency in larger cross-sectional and prospective studies”.

Hamelin 2002 (Hamelin et al., 2002) undertook a study to understand food insecurity from the perspective of household who experienced it. Group interviews and personal interviews with 98 low-income households in Quebec elicited the meaning of “enough food” for the households and the range of manifestations of food insecurity. These manifestations were of two types; (1) its core

characteristics: a lack of food encompassing the shortage of food, the unsuitability of both food and diet and a preoccupation with continuity in access to enough food; and a lack of control of households over their food situation; and (2) a related set of potential reactions; socio-familial disturbances, hunger and physical impairment, and psychological suffering. The psychological suffering included being constrained to go against held norms and values, loss of dignity and stress. This study underlines the monotony of the diet, describes the feeling of alienation, differentiates between a lack of food and the reactions that it engenders, and emphasizes the dynamic nature of the experience. Kendall 1996 (Kendall et al., 1996) in a dietary study of 193 low income women found significant increases in indicators of disordered eating patterns to be associated with worsening food insecurity status.

In an American study, Townsend (Townsend et al., 2001) suggests that one possible explanation for the high prevalence of overweight among food stamp recipients involves a food acquisition cycle (Wilde 2000). Abundant food supplies may be available the first 3 weeks of the month, followed by 1 week without food stamps or money when food selection is limited. Then, when money and food stamps are restored at the first of the food stamp month, food—insecure families may overeat highly palatable and rich foods. This cycle may synchronise with food stamp distribution, suggesting a “food stamp cycle” hypothesis. Furthermore, this behaviour is reminiscent of binge eating, also known as disinhibition (Polivy, 1996). Binge eating can result in weight gain (Polivy 1996). Thus overeating by food insecure families when palatable food is plentiful i.e. when food stamps or money for food is available, followed by a short period of involuntary food restriction, followed by overeating, could be pattern that results in gradual weight gain over time.

Although the “food stamp cycle” hypothesis has yet to be tested, a limited number of human and animal studies provide evidence for it. These studies show that food deprivation in humans (Polivy 1994, Keys 1950) and animals (Kochan 1997, Brownell 1986) and food restriction in children (Fisher 1999, Cutting 1999) produce a tendency toward binge eating behaviour when a plentiful food supply is available. For example Keys and his colleagues (Keys 1950) induced a group of normal-weight volunteers (World War II conscientious objectors) to starve themselves down to about 74% of their initial weight by following a calorie-reduced diet. When food was later made available in unlimited quantities and the men returned to their initial weights, they exhibited a persistent tendency to binge, gorging at meals to the limit of their physical capacity.

Therefore, while the eating pattern literature supports the idea that food deprivation can result in overeating. Polivy (1996) found that food restriction and deprivation, whether voluntary or involuntary, result in a variety of cognitive, emotional and behavioural changes such as preoccupation with food and eating. Although it is tempting to compare regular episodic cutback in food intake by women in food insecure households to the so called “yo-yo” dieting and suggest that these women have an increased efficiency in their use of dietary energy, the present state of knowledge does not strongly support this potential mechanism (National Task Force on the Prevention of Obesity 1994).

6. Summation and Comment

In Australia, overweight and obesity affects more than half the population. The levels of overweight and obesity have increased rapidly in the last 20 years. The problem is of enormous health, social and economic concern. The financial burden incurred by obesity may be as high as \$1.3 billion per year and rising. Excess weight is now more common among lower socio-economic and socially disadvantaged groups, particularly among women. Thus far obesity has been resistant to long term treatment and prevention. Action however must be taken. The literature would suggest that we need to develop interventions directed not only at education, but also food policy and the food and physical activity environment to improve the availability of cheap, healthy food, opportunities for exercise and encourage societal change. The literature also indicates consistently that there is a strong socio-economic gradient associated with risk behaviours and chronic conditions including obesity. Poor people are fatter and sicker than rich people. Poor people are at greater risk of unhealthy habits. As yet this is not fully understood. However, this health inequality must be addressed if chronic disease is to be properly addressed in Australia and other developed countries.

At the same time as obesity is on the increase in Australia, economic indicators show no significant change in the level of inequity. In spite of the nation's economic growth all measures of poverty indicate that poverty in Australia has not decreased. Poverty is strongly associated with food insecurity and hunger. Even using the most cautious estimate, more than a million and a half Australians are living below the poverty line at the start of the 21st Century.

Therefore at the same time as hunger and food insecurity is emerging as a "hidden crisis", apparently paradoxically obesity is on the increase. National data indicates that obesity is most prevalent amongst those at highest risk of food insecurity. The co-existence of obesity and food insecurity sounds contradictory. We expect food insecure individuals to have a poor diet in terms of nutrient deficiency, but the association between food insecurity and obesity is something of a paradox. How can those with insufficient resources to purchase adequate food be obese? Obesity suggests an excessive intake of food. In fact the paradox can be substantiated. It exists but why, is not fully understood. It is imperative that we explore this. The current review indicates that those with the poorest social, economic and educational resources are at greatest risk of developing obesity and its attendant co-morbidities. Socially disadvantaged individuals, families and communities need to make informed decisions about how to proceed with this metabolic time bomb.

The current literature review found that the risk of obesity is 20 to 40% higher in individuals who are food insecure. This is true for women only and is regardless of income, lifestyle behaviours or education. The association between obesity and food insecurity is observed consistently across US, Europe and in Australia. Extreme food insecurity attended by hunger is associated with thinness.

The broad question that needs to be tackled is;
"How is poverty and food insecurity related to obesity?"

There are essentially 3 hypotheses offered to explain the link between food insecurity and obesity

- 1) Economic hypothesis posited by Drewnowski 2004 which points out that it is *very cheap* to become obese. At world market prices, fats and sugar are cheap energy dense foods. This encourages high consumption and high energy intakes which are reinforced by the positive

hedonic properties “tastiness” of these energy dense foods.

- 2) Food stamp/ government pension cycle hypothesis offered by Townsend and others which suggests that the end of the cycle of pension income or food relief can cause food insecurity i.e periodic food deprivation that constitutes a stress which causes overeating in otherwise “restrained” individuals (usually women). This hypothesis has a theoretical framework in the eating disorder literature and can be substantiated by both animal and human studies of starvation.
- 3) The anthropological hypothesis is that the so called “bad behaviours” i.e. poor diet, poor exercise and weight control are the product of cultural differences between poor or food insecure people and the middle or upper class who are attempting to educate or improve them. This implies that poor diet or physical activity habits are not so much “bad” behaviours but different behaviours normative to particular classes or sub-classes of people.

Proceeding with this issue should involve testing each or all of these hypotheses. These are the type of research questions that could be posed;

1).What is the association between food cost and availability and consumption specifically for foods prepared outside of the home, soft drinks and snack foods ? What is the impact of income, social class and food insecurity on this association? This study would involve may be observing changes in consumption after instituting interventions to alter the cost of healthy and unhealthy foods within socially disadvantaged neighbourhoods.

2) How can government support and policies be best designed to alleviate poverty and food insecurity, an important policy goal given that these forms of deprivation are associated with serious physical and mental health, academic and psychological problems, particularly in children (Alaimo 2001).

3) What are the psychological and physiological changes related to experiences of stress, hunger and food intake across the pension cycle for food insecure Australian women? This would be a cohort study. It is important that we get longitudinal data around the issue of pension cycle and possible binge eating. This binge eating is likely to be a strong contributor to obesity in food insecure women.

4) What are the normative beliefs around food, weight and health for those at risk of food insecurity? These studies would involve collaboration with an anthropologist familiar with low income populations. Strangely such studies which could be termed nutritional anthropology have not as yet been undertaken in this area.

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