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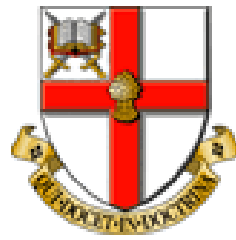
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Literature Review Knowledge and Attitudes towards Obesity

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Abstract

This paper reviews the literature which has measured individual's knowledge on the health risks associated with obesity, and individual's attitudes towards obese persons. This review primarily focuses on studies that recruited students, health care professionals, and the general population. The inclusion criteria was: students, health care professionals, general population, studies that used the Obesity Risk Knowledge (ORK-10) scale, studies that used the Attitudes Towards Obese Persons (ATOP) scale, and any other validated questionnaire which measured obesity risk knowledge (ORK), and attitudes towards obese persons. Results revealed high obesity risk knowledge among health care professionals, primarily dietitians and general practitioners, and low obesity risk knowledge amongst the general population. Negative attitudes towards obese persons were prevalent in most studies, and were evident in students, health care professionals and the general population. The variables gender and BMI yielded conflicting results among the selected studies. Education is needed to increase obesity risk knowledge among a number of health care professionals and the general population, this will aid preventative techniques towards overweight and obesity. In addition, educational tools to raise awareness and reduce weight related bias and stigma need to be implemented in employment and educational settings, amongst the general population and health care professionals.

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1.1 Introduction

The scale of obesity has reached epidemic levels, in the UK the prevalence of adult obesity has more than trebled in the last 25 years (1980-2005: from 7% to 23%) (Butland, Jebb, Kopelman, McPherson, Thomas, Mardell and Parry, 2007). Obesity is a multifactorial problem and can be due to a combination of factors: epigenetics, behaviour, the environment, technology, opportunities for physical activity, accessibility, availability, and cost (Butland et al. 2007). Extrapolation of the 1994-2004 Health Survey for England dataset has predicted that obesity rates may increase to 47% and 36% in males and females by 2025 (Butland et al. 2007). In addition it is predicted that by 2050 the percentage of men classified as healthy ($18.5\text{-}25\text{kg/m}^2$) will decline from approximately 30% (at present) to below 10%, and for females a decline from over 40% to approximately 15% (Butland et al. 2007). In order to help prevent the drastic increases in obesity prevalence it is important that individuals are educated on obesity risk knowledge. This will help individuals to make small sustainable changes to their lifestyle which will help them to reduce mortality and morbidity associated with being overweight and obese. One part of this review will focus on the literature that has measured obesity risk knowledge amongst the general population, students, and health care professionals. Another important aspect of obesity is the attitudes that individuals have towards obese persons. This is an important factor as being faced with negative attitudes and discrimination can impede a person's lifestyle, in terms of social, behavioural, and mental health. Therefore the second part of this review will focus on the literature which has measured individual's attitudes towards obese persons, including: the general population, students, and health care professionals.

1.2 Obesity Risk Knowledge Studies

1.2.1 Sample Size

The sample sizes of the studies are relatively small with the exception of: Bocquier, Verger, Basdevant, Andreotti, Baretge, Villani and Paraponaris (2005); Swift, Glazebrook and Macdonald (2006); Swift, Sheard and Rutherford (2007); and DeVille-Almond, Tahrani, Grant and Thomas (2010), see Table 1 for all knowledge studies. In addition several studies wishing to make comparisons of obesity risk knowledge between samples of participants (Swift et al. 2007; Redsell, Atkinson, Nathan, Siriwardena, Swift and Glazebrook, 2011; Ward & Amirabdollahian, 2011) failed to make reliable and valid comparisons due to some samples having a small number of participants within their groups. Small sample sizes are an important limitation as they limit generalizability, reliability and validity of results.

1.2.2 Generalizability

Another limitation visible amongst most studies is convenience and non-random sampling (Fisher, DeSalvo and Block, 2003; Swift et al. 2006; Swift et al. 2007; Swift, Glazebrook, Anness and Goddard, 2009; Redsell et al. 2011; Rutkowski & Connelly, 2011; Ward & Amirabdollahian, 2011). Convenience sampling was apparent as the participants in the studies were either from one or two areas, university institutions or job types. However Bocquier et al. (2005) randomly selected 600 General Practitioners (GP's) in South Eastern France. The sample represented the general population of 5435 private GP practices in that area as there were no significant differences between GP gender ($p=0.65$), GP age ($p=0.50$), and size of practice area

($p=0.13$). Also DeVille-Almond et al. (2010) randomly selected motorway service station sites from a number of areas, and randomly selected their study sample.

1.2.3 Measurement Technique

In terms of measurement technique, all the studies that used BMI as a variable in their research used self-reported height and weight measurements to calculate BMI (Block et al. 2003; Bocquier et al. 2005; Swift et al. 2006; Swift et al. 2009; Rutkowski & Connelly, 2011). The latter is a limitation as participants may underestimate or overestimate their measurements resulting in BMI calculations with a degree of inaccuracy (Beck, Schaefer, Nace, Steffen, Nigg, Brink and Browning, 2012; Stommel & Schoenborn, 2009). However this technique is used in most studies due to difficulty in accessing other methods, and cost restraints.

1.2.4 Knowledge and Age

The following studies compare and assess the results from the ORK-10 scale. Swift et al. (2006) validated a short scale (ORK-10) to measure individual's knowledge on the health risks associated with obesity. Results revealed a significant ($p<0.00$) difference in ORK-10 scores between 230 individuals with no obesity expertise, and 200 individuals with obesity expertise (mean and standard deviation (SD): 3.8 ± 1.8 vs. 8.6 ± 1.2). Hierarchical multiple regression analysis revealed that age and educational attainment (100% of experts attained an A level compared to 49.1% of non-experts) explained 29.9%, and expertise 41.9% of the difference in scores between the two groups. The study found that older people scored significantly ($p<0.05$) higher on the ORK-10 scale (mean age of 40).

Table 1: Studies: Obesity Risk Knowledge

Author	Date	Design	Subjects (n)	Location	Sample	Age (years)	BMI (kg/m ²)	Tool	Measurement Technique	Response Rate (%)	Overall result
Block et al.	2003	Cross sectional	87 Internal medicine residents	Tulane & Louisiana State University	Non-random & convenience	Mean age: 30; range: 25-44	Mean BMI: 23; range 17.8-34.3	Questionnaire measuring knowledge	Self-administered questionnaires & self-reported height & weight	43	Adequate obesity risk knowledge
Bocquier et al.	2005	Cross sectional	600 French General Practitioners	South East France	Random & non-convenience	<43yrs =158 43-52=305 >52=137	30% overweight 3% obese	Questionnaire measuring knowledge	Self-administered questionnaires & self-reported height & weight	55.8	Adequate obesity risk knowledge
Swift et al.	2006	Cross sectional	200 with obesity expertise 230 with no obesity expertise	'Association for the Study of Obesity' Department store & air freight service	Non-random & convenience	39.7±16.6 ^a 36.8±19.8 ^a	22.8±3.7 ^a 24.5±5.1 ^a	ORK-10	Self-administered questionnaires (no researcher present) & self-reported height & weight	31.5	9.0±2.0 ^a 8.6±1.2 ^b 4-10 ^c 4.0±2.0 ^a 3.8±1.8 ^b 0-8 ^c
Swift et al. ^d	2007	Cross sectional	162 u/g nurses ^e 38 MSc dietitians 389 medical students	Trainee HCP's ^f from University of Nottingham	Non-random & convenience	Does not state	Not measured	ORK-10	Self-administered questionnaires	30	6 vs. 5 ^{gh} 9 vs. 6 ^{gh} 7 vs. 5 ^{gh}
Swift et al.	2009	Longitudinal	66 adults attending an NHS weight management clinic	Nottingham	Non-random & convenience	45.5±11.4 ^{bi}	42.7±13.3 ^{ai}	ORK-10	Self-administered questionnaires (no researcher present) & self-reported height & weight	Does not state	4.0±2.8 ^a 4.2±1.8 ^b
DeVillem-Almond et al.	2010	Cross sectional	266 British male drivers	Motorway stations from NW Midlands, SW & SE	Random & non-convenience	52 (42-60) ^a	28.3 (25.6-31.2) ^a	Questionnaires regarding self-perception of adiposity & T2DM risk.	Self-administered (researcher present)	All that were asked volunteered (100%)	N/A

Table 1 Continued

Author	Date	Design	Subjects (n)	Location	Sample	Age (years)	BMI (kg/m ²)	Tool	Measurement Technique	Response Rate (%)	Overall result
Redsell et al.	2011	Cross sectional	8 Nursery nurses 27 Health visitors 29 RN ^j 52 GP's ^k	Two counties within East Midlands	Non-random	20-29yrs =7 30-39=21 40-49=46 50-59=36 60+=6	Not measured	ORK-10	Self-administered (postal survey, no research present)	34	5.5 (4.3-6.8) ^a 7 (5-8) ^a 8 (6-9) ^a 9 (8-9) ^a
Rutkowski & Connelly	2011	Cross sectional	94 adolescents 94 parents	Eight middle schools within South California	Non-random & convenience	12.8±1.0 ^b 44.1±5.2 ^b	19.4±2.7 ^b 24.1±4.9 ^b	ORK-10	Self-administered (researcher present) & self-reported height & weight	Does not state	4.7±1.6 ^b 0-10 ^c 5.5±1.8 ^b 0-10 ^c
Ward & Amirabdollahian	2011	Cross sectional	20 Health & Life Sciences Faculties 20 other Faculties ^l	Students from Coventry University	Non-random & convenience	Does not state	Does not state	ORK-10	Self-administered	Does not state	<20 years; 4.0±2.0 ^a >20 years; 6.0±4.0 ^a

^a median and interquartile range

^b mean and standard deviation (SD)

^c range

^d This sample consisted of a sample of students ranging from year 1-5 at University

^e 74 of the nursing students were MSc students, u/g= undergraduate

^f Health Care Professional

^g median

^h final year vs. first year students (score comparisons)

ⁱ based on 104 participants that had usable baseline data.

^j RN= Registered Nurse (consisting of both practise and community nurses)

^k General Practitioner

^l other faculties: engineering and computing, art and design, business, environment and society, and lifelong learning

Possible reasons include: more experience in health related issues; an increase in health salience; and increased contact with health education messages (Swift et al. 2006). In addition no gender effect was apparent. Higher ORK-10 scores among older participants (mean and SD: 44.1 ± 5.2 years old) was also apparent in a cross sectional study of 94 adolescents and their parent dyads (Rutkowski & Connelly, 2011). Results from the ORK-10 scale revealed that obesity risk knowledge is significantly ($p < 0.00$) lower in adolescents compared to their parents (mean and SD: 4.7 ± 1.6 vs. 5.5 ± 1.8). Overall the ORK-10 scores were relatively low amongst all participants, the higher scores among parents may have been due to life experience which may have raised their awareness of these issues (Rutkowski & Connelly, 2011). Findings from the two previous studies are also similar to the findings from Ward and Amirabdollohian (2011), who administered the ORK-10 scale to 40 students at Coventry University. The researchers reported no significant difference in ORK-10 scores between: gender ($p = 0.2$), ethnicity ($p = 0.2$), discipline ($p = 0.3$), or faculty ($p = 0.2$). However students who were 20 years of age or above had significantly ($p = 0.03$) higher ORK-10 scores than students who were below the age of 20 years (median and range: 6 ± 4 vs. 4 ± 2). Overall it was evident that faculty type did not influence ORK-10 scores, however this non-significance may have been due to their small sample group.

1.2.5 Knowledge amongst Health Care Professionals

A cross sectional study used the ORK-10 scale to measure obesity risk knowledge amongst students studying health related courses at the University of Nottingham (Swift et al. 2007). Results revealed a significant ($p < 0.05$) difference in ORK in different years of study between all three groups. Higher ORK-10 scores were

prevalent in final year students in comparison to first year students (mean and SD: nurses [N]: 6 vs. 5; dietitians [D]: 9 vs. 6; medical students [MS]: 7 vs. 5). Regarding the participants in their final year, the trainee dietitians had significantly ($p < 0.01$) higher ORK-10 scores in comparison to trainee nurses (9 vs. 6) and medical students (9 vs. 7). However there was no significant ($p > 0.05$) difference in ORK-10 scores amongst first year students in each of the three groups (N: 5-6; D: 6; MS: 5), indicating that course content largely predicts ORK. However the validity of this study may be affected by the small number of participants in each year of study, particularly in the dietetic group which had a much lower number of participants than the other subjects (see Table 1). Similar findings were apparent in a study that measured ORK amongst 116 health care professionals (Redsell et al. 2011). Results revealed a significant ($p < 0.00$) difference in ORK-10 scores between groups of health care professionals (median and interquartile range [IR]: nursery nurse: 5.5 [4.3-6.8]; health visitors: 7 [5-8]; registered nurse (RN): 8 [6-9]; GP: 9 [8-9]). GP's had significantly higher ORK-10 scores in comparison to RN ($p = 0.01$), nursery nurses ($p < 0.00$), and health visitors ($p < 0.00$).

Strong knowledge on the health risks associated with obesity among medical students was also evident in a study conducted by Block et al. (2003). ORK was assessed in 87 internal medicine residents: 71% knew that obesity by itself is a risk factor for hyperlipidaemia; 85% knew that weight gain is usually associated with smoking cessation; 87% knew the weekly recommendation for physical activity; 92% knew that obesity by itself is a risk factor for hypertension; 97% knew that obesity by itself is a risk factor for type 2 diabetes mellitus, and 98% knew that obesity by itself is a risk factor for sleep apnoea (Block et al. 2003). Strong ORK amongst GP's was

also apparent in a cross sectional study conducted by Bocquier et al. (2005) which measured obesity knowledge in 600 French GP's in South Eastern France. The researchers reported that nearly all GP's knew most of the risks of obesity: hypertension, type II diabetes, sleep apnoea, increased surgical risks, phlebitis, and premature mortality. However 53% were unaware that obesity resulted in fertility risks, and 45.5% were unaware that obesity was a risk factor for some cancers. In addition 93.3% of GP's were unaware of the guidelines for obesity, 80% said they required more training in weight management, and 32.4% did not feel prepared to manage these patients. This indicates the need for more training in weight management for GP's.

1.2.6 Knowledge amongst the General Population

A UK prospective study measured ORK in 66 patients attending an NHS weight management clinic to see whether ORK was associated with greater weight losses (Swift et al, 2009). ORK-10 scores amongst the 66 participants were relatively low (mean and SD: 4.2 ± 1.8), which is surprising considering they have been patients at a weight management clinic for 18 months (mean duration). In addition, weight loss was not significantly ($p=0.31$) associated with ORK-10 scores. Similar findings are apparent in a cross sectional survey which assessed the awareness of obesity and type 2 diabetes among 266 British male drivers (DeVille-Almond et al. 2010). Participants were questioned regarding self-perception of adiposity and risk of type two diabetes mellitus (T2DM). Results revealed a significant ($p<0.00$) difference between estimated waist circumference (WC) measurements and actual WC ($94.3 \pm 10.2\text{cm}$ vs. $102.9 \pm 11.4\text{cm}$). Most participants who were at risk of T2DM did not realise that they were at risk, 74% ($n=125$) of overweight participants and 28% ($n=5$)

of obese participants did not realise that they were at risk of T2DM. In addition 71% of participants who were classed as having central obesity by a WC measurement thought that they were not at risk of T2DM. Self-perception of adiposity and risk of T2DM is poor in this population of British male drivers. It is vital that education is implemented to employment settings or through GP practices in order to reduce the risk of morbidity and mortality.

1.3 Attitudes towards Obesity Studies

Table 2 shows 15 studies which have been reviewed in order to assess the literature on attitudes towards obese persons.

1.3.1 Sample Size

Most of the studies had moderately adequate sample sizes (range: 99-1024 participants) (see Table 2). In addition several studies wishing to make comparisons of obesity risk knowledge between samples of participants failed to make reliable and valid comparisons due to some samples having a small number of participants within their groups (range: 24-52 participants: Allison, Basile and Yuker, 1991; Friedman, Reichmann, Costanzo, Zelli, Ashmore and Musante, 2005; Berryman, Dubale, Manchester and Mittelstaedt, 2006; Crerand, Wadden, Foster, Sarwer, Paster and Berkowitz, 2007). Therefore it is apparent that previous research measuring attitudes towards obesity are not too strong.

1.3.2 Generalizability

Another limitation which is widely visible amongst most studies is convenience and non-random sampling (Allison et al. 1991; Chen & Brown, 2005; Friedman et al.

2005; Gipson, Reese, Vieweg, Anum, Pandurangi, Olbrisch, Sood and Silverman, 2005; Greenleaf, Chambliss, Rhea, Martin and Morrow, 2006; Latner, Stunkard and Wilson, 2005; Lee & Ahn, 2007; Magliocca, Jaber, Alto and Magliocca, 2005; Neumark-Sztainer, Story and Harris, 1999; Poon & Tarrant, 2009; Vartanian, 2010). Random and non-convenience sampling is difficult to apply which explains its scarcity, so most studies use convenience and non-random sampling. Participants that volunteer in a study is a problem in all studies, as participants will always volunteer in a study they are interested in. Most studies in Table 2 used the ATOP scale (Allison et al. 1991), which is a reliable and valid 20-item scale which measures participant's attitudes towards obese persons (Allison et al. 1991; Crerand et al. 2007; Friedman et al. 2005; Gipson et al. 2005; Harvey, Summerbell, Kirk and Hills, 2002; Lee & Ahn, 2007; Neumark-Sztainer et al. 1999; Swami, Pietschnig, Stieger, Tov'ee and Voracek, 2010). However, Lee & Ahn (2007) and Neumark-Sztainer et al. (1999) used a modified version of the ATOP scale which explains their lower ATOP scores in comparison to other studies that used the original scale.

1.3.3 Measurement Technique

Many of the studies used self-reported height and weight measurements in order to calculate BMI (Allison et al. 1991; Chen & Brown, 2005; Crerand et al. 2007; Greenleaf et al. 2006; Harvey et al. 2002; Latner et al. 2005; Neumark-Sztainer et al. 1999; Poon & Tarrant, 2009; Puhl, Wharton and Heuer, 2009; Swami et al. 2010; Vartanian, 2010). Self-reported height and weight are a limitation as participants may underestimate or overestimate their measurements resulting in BMI calculations with a degree of inaccuracy (Beck et al. 2012; Stommel & Schoenborn, 2009).

Table 2: Studies: Attitudes towards Obese Persons*

Author	Date	Design	Subjects (n)	Location	Sample	Age (years)	BMI (kg/m ²)	Tool	Measurement technique	Response Rate (%)	Overall result
Allison et al.	1991	Cross sectional	169 NAAFA ^a 178 NAAFA 167 NAAFA 72 u/g ^b 52 graduates	USA (exact location is not stated)	Convenience & non-random	40 40 40 21 29	Does not state	ATOP scale	Self-administered & self-reported height & weight	40% for NAAFA	67.6±18.6 (0-120) 66.0±11.3 (28-96) 65.0±10.7 (31-90) 63.9±16.7 (23-96) 64.8±14.8 (32-104)
Neumark-Sztainer et al.	1999	Cross sectional	115 school staff (health related)	17 junior & senior schools in Minnesota	Convenience & non-random	41.1±10.1	27.6±3.3 ^c 25.5±4.9 ^d	ATOP scale (modified)	Self-administered (postal) & self-reported height & weight (no researcher present)	66%	42.4± 13.8
Harvey et al.	2002	Cross sectional	187 dietitians	Members of the British Dietetic Association	Non-convenient & randomly selected sample	36.9±7.7 ^e 38.0±7.8 ^f	22.3±2.3 22.8±2.7	ATOP scale	Self-administered (postal & hand out) & self-reported height & weight	Postal: 75.2% Conference: 42.6%	Overall: neutral to positive attitudes
Block et al.	2003	Cross sectional	87 Internal medicine residents	Tulane & Louisiana State University	Non-random & convenience	Mean age: 30; range: 25-44	Mean BMI: 23; range 17.8-34.3	Questionnaire measuring attitudes	Self-administered questionnaires & self-reported height & weight	43	Negative attitudes prevalent
Bocquier et al.	2005	Cross sectional	600 French General Practitioners	South East France	Random & non-convenience	<43yrs =158 43-52 =305 >52=137	30% overweight, 3% obese	Questionnaire measuring attitudes	Self-administered questionnaires & self-reported height & weight	55.8	Negative attitudes prevalent
Gipson et al.	2005	Cross sectional	96 ^c 95 ^d	Students at Virginia State university	Convenience & non-random	20.2±2.7 20.2±1.4	26.0±0.6 24.7±0.5	ATOP scale	Self-administered & researchers measured height & weight	9 exempt for not matching inclusion criteria	Overall ATOP score not available

Table 2 Continued.

Author	Date	Design	Subjects (n)	Location	Sample	Age (years)	BMI (kg/m ²)	Tool	Measurement technique	Response Rate (%)	Overall result
Friedman et al.	2005	Cross sectional	93 people 24 ^c 69 ^d	Self-referred weight loss facility	Convenience & non-random	53.6±12.5 51.8±12.7 54.2±12.5	42.3±8.7 42.1±7.9 42.4±10.0	ATOP scale	Self-administered. Nurse measured participants height and weight	5 refused to participate & 16 did not meet inclusion criteria	54.5±15.1 53.4±15.6 54.9±15.1
Chen & Brown	2005	Cross sectional	449 u/g ^b psychology students (173 ^c 276 ^d)	University of Washington	Convenience & non-random	19.2±1.5 (18-35)	22.9±3.7 (14.9-42.6)	Six Drawings	Self-administered & self-reported height & weight	Does not state	N/A
Latner et al.	2005	Cross sectional	348 students from various departments (56% ^d)	1 large state university	Convenience & non-random	20.6	23.3	Six drawings	Self-administered (researcher present) & self-reported height & weight	8 excluded due to incorrectly answered questions	N/A
Magliocca et al.	2005	Cross sectional	343 dental students 77 dental hygiene students	University of Michigan school of dentistry	Convenience & non-random	Not collected to increase anonymity and therefore reduce socially desirable answers		Assessing knowledge, beliefs & attitudes	Self-administered (researcher present).	Overall 91%	N/A
Greenleaf et al.	2006	Cross sectional	155 PE students ^c 119 PE students ^d	1 middle school (Southern USA)	Convenience	13.2±0.9 (11-16)	20.9±4.2 ^c 21.9±5.2 ^d	Adjective Checklist and Shared Activities Questionnaire	Self-administered & self-reported height & weight	Does not state	N/A
Crerand et al.	2007	Longitudinal	123 Obese women: 84 dieting group 39 non-dieting group	Recruited from newspaper advertisement	Non-convenient & women were randomly assigned to dieting or non-dieting group	44.2±10.0 44.3±9.9 43.9±10.2	35.9±4.5 36.2±4.5 35.5±4.3	ATOP scale	Self-administered & researcher measured height & weight.	55 excluded, did not fit inclusion criteria	62.8±15.0 61.0±16.2

Table 2 Continued.

Author	Date	Design	Subjects (n)	Location	Sample	Age (years)	BMI (kg/m ²)	Tool	Measurement technique	Response Rate (%)	Overall result
Lee & Ahn	2007	Cross sectional	260 Korean 5 th grade children (5 classes)	2 public elementary schools in Seoul	Convenience & non-random	10-12 years	107 ^g 108 ^h 45 ⁱ	Modified ATOP scale (10 Q's, score range: 10-50)	Self-administered (teacher present, not researcher) & self-reported height & weight	19 surveys excluded (response rate: 80%)	Boys 30.6±7.5 ^g 31.7±8.9 ^h 34.5±8.8 ⁱ Girls: 33.1±6.6 ^g 32.5±5.8 ^h 28.9±4.2 ⁱ
Poon & Tarrant	2009	Cross sectional	352 u/g ^b nurses 198 RN ^j	1 university in Hong Kong	Convenience & non-random	20.8±1.3 32.7±7.3	19.8±2.5 20.7±2.5	Fat phobia scale ATOAP scale	Self-administered (researcher present) & self-reported height & weight	2003-2004: 52%; 2005-2006: 81.8%	3.5±0.5 ^b 3.6±0.5 ^j 2.6±0.5 ^b 2.7±0.6 ^j
Puhl et al.	2009	Cross sectional	182 u/g ^b dietetic students	14 universities within USA	Convenience & sample randomly assigned to 1 of 4 patient profiles	23.1±5.4	22.5±3.2	Patient profile Fat phobia scale	Online survey (no researcher present) & self-reported height & weight	61.3%	N/A 3.7±0.5
Swami et al.	2010	Cross sectional ^k	504 ^c 520 ^d	General population in South Germany	Non-convenience & non-random	28.3±10.9	23.2±4.2	ATOP scale Fat phobia scale	Self-administered (researcher present) & self-reported height & weight	N/A	71.0±12.8 3.5±0.5
Vartanian	2010	Cross sectional: 3 studies	300 u/g ^b 125 u/g ^b 99 u/g ^b	private university (USA) private university (USA) public university (East Australia)	Convenience and non-random	19.2±1.3 19.5±3.8 19.2±1.4	23.5±3.8 23.9±3.8 21.1±3.2	Modified Anti-Fat Attitudes Scale	Self-administered & self-reported height & weight	Does not state	N/A

*all figures are based on mean and standard deviation (if applicable), and all figures in parenthesis indicate the range.

- ^a NAAFA= National Association to Advance Fat Acceptance
- ^b u/g= undergraduate
- ^c Male
- ^d Female
- ^e ATOP questions based on attitudes towards overweight persons
- ^f ATOP questions based on attitudes towards obese persons
- ^g Under weight
- ^h Normal weight
- ⁱ Overweight or obese weight
- ^j Registered Nurses
- ^k Sample recruited through a snowballing technique to produce a large sample

1.3.4 Attitudes towards Obese Persons among Students

One study measured attitudes towards obese persons in a convenience sample of 191 students attending Virginia State University (Gipson et al. 2005). Results from the ATOP scale revealed no significant difference in attitudes between gender and BMI categories (<25 and >25kg/m²) in all 20 items (Gipson et al. 2005). Similar findings were apparent from a study that assessed ATOP amongst 260 Korean fifth grade students (age 10-12 years old) from two public elementary schools located in Seoul (Lee & Ahn, 2007). Results revealed no significant difference in attitudes between boys and girls of different weight classifications (underweight, normal weight, overweight or obese). The scale score ranges from 10-50, higher scores indicating more positive attitudes towards obesity. From looking at Table 2 (results column) positive attitudes towards obese persons were apparent amongst 10-12 year olds, this suggests that negative attitudes may begin in older aged participants.

However the following studies found significant differences in attitudes when individuals were separated for gender and BMI categories. Greenleaf et al. (2006) assessed the extent of weight bias and stereotypes in 155 male, and 119 female physical education students from a middle school situated in Southern USA. Results from the Adjective checklist questionnaire (Siperstein, 1980) revealed that students associated the thin figure with significantly ($p<0.05$) more positive adjectives than the

fat figure, and significantly ($p < 0.05$) fewer negative adjectives for the thin figure than the fat figure. In addition a gender affect was apparent as the female students generally reported significantly ($p < 0.00$) more positive, and significantly ($p < 0.05$) fewer negative adjectives irrespective of figure size than males (Greenleaf et al. 2006). Results from the Shared Activities Questionnaire (Morgan, Walker, Bieberich and Bell, 1996) revealed that students were significantly more willing to participate in social ($p < 0.00$), academic ($p < 0.05$), and recreational ($p < 0.00$) activities with the thin figure than the fat figure. There is a stronger disinclination for students willing to participate in social and recreational activities with obese persons than academic activities. In addition a gender affect was apparent as women reported a significantly ($p < 0.00$) greater willingness to participate in activities regardless of size, in comparison to male students. Chen & Brown (2005) explored obesity stigma and adult preferences for sexual partners in a sample of 449 undergraduate psychology students studying at the University of Washington. A questionnaire was distributed to the students that consisted of a set of six drawings of each gender (healthy, armless, wheelchair, obese, mental illness, STD's) which they had to rank from 1-6: 1 -most prefer; 6- least prefer for a sexual partner (each drawing had a description below stating what the person in the drawing was suffering from). Overall the results revealed a significant ($p = 0.00$) difference in the ranks given for the healthy drawing and the obese drawing. The obese drawing was least preferred even when the results were separated for gender and BMI categories (< 25 and $> 25 \text{ kg/m}^2$). In addition males gave the obese drawing a significantly ($p = 0.01$) lower rank than females, and there was no significant difference in rank score for the obese drawing between each BMI category. Overall students least preferred to have an obese

sexual partner, even over a partner that was in a wheel chair, had a mental illness, had a history of STDs, and was armless (Chen & Brown, 2005).

Similar findings were evident in Latner et al. (2005), a study which explored stigmatization of obesity and various other disabilities among 348 college students enrolled at a large state university. The students completed a questionnaire which consisted of six drawings of males or females depending on their gender (healthy, crutches, wheelchair, missing hand, facial disfigurement, obese). The students were asked to rank the drawings by circling the drawing they liked the best, 2nd best, 3rd best, and etc. until all six drawings were ranked. Results revealed that students preferred the healthy drawing the best, facial disfigurement second, crutches third, wheelchair fourth, obese fifth, and missing hand sixth. A gender affect was apparent as male students were significantly ($p < 0.00$) less favourable towards the obese drawing than female students. In addition white participants showed significantly ($p < 0.00$) more stigmatization than all three ethnic (African-American, Asian, and Hispanic) groups combined. However this study found no significant differences in students from different BMI categories. Overall the study found that obese persons are highly stigmatized, not only by thinner counterparts but by peers who are also overweight or obese.

Many of the studies have focused on perceptions of control to be a determinant of attitudes towards obese people, however Vartanian (2010) discussed three studies that focused on favourability, control and disgust as determinants of attitudes in university students (see Table 2 for study details). Results from the three studies revealed that the strongest predictor of attitudes was disgust, and that it facilitated the relationship between perceived control and attitudes (Vartanian, 2010). The three studies revealed mixed findings regarding age and BMI as predictors of attitudes.

Study one found that younger individuals and individuals with a lower BMI had significantly more negative attitudes towards obese people ($p=0.03$ and $p=0.01$). Conversely studies two and three found that age and BMI were not significant predictors of attitudes towards obese people (Vartanian, 2010). However the latter may be due to narrow age and BMI ranges in the study sample. In addition, Allison et al. (1991) distributed the ATOP scale to 514 members of the National Association to Advance Fat Acceptance (NAAFA), 72 undergraduate and 52 postgraduate psychology students. Overall there were no significant differences in attitudes towards obese persons between NAAFA members (split into three groups) (mean and SD: 67.6 ± 18.6 ; 66.0 ± 11.3 ; 65.0 ± 10.7), undergraduate students (63.9 ± 16.7), and postgraduate students (64.8 ± 14.8). The researchers did not state how and why they split the NAAFA members into three groups, however this may have been due to their large sample in comparison to the two student groups.

1.3.5 Attitudes towards Obese Persons among Health Care Professionals

A cross sectional study measured attitudes towards obese persons, and attitudes towards the management of obese patients between 352 undergraduate student nurses and 198 registered nurses (Poon & Tarrant, 2009). Participants completed the Fat Phobia (FP) Scale (Bacon, Scheltema and Robinson, 2001) and the Attitudes Toward Obese Adult Patients (ATOAP) Scale (Bagley, Conklin, Isherwood, Pechiulis and Watson, 1989). FP scores revealed that both groups of nurses held negative attitudes towards obese persons, however registered nurses scored significantly ($p<0.00$) higher (more negative) than student nurses. The ATOAP scale revealed mostly neutral scores, however registered nurses scored significantly ($p=0.02$) higher than student nurses. In addition there was no significant difference in attitudes between gender and BMI categories. In relation to the previous study (Poon &

Tarrant, 2009) Harvey et al. (2002) also revealed neutral findings amongst health care professionals, however this study used the ATOP scale. Harvey et al. (2002) distributed two versions (1. assess attitudes towards overweight persons; 2. assess attitudes towards obese persons) of the ATOP scale to assess attitudes in 187 dietitians. The researchers reported neutral to positive attitudes towards overweight and obese persons. However negative answers were evident towards obese persons in relation to: self-esteem, sexual attractiveness, and health.

Poon and Tarrant (2009) found no significant differences in FP scores between different BMI categories, this was also evident in 188 undergraduate dietetic students from 14 universities located throughout America (Puhl et al. 2009). The students were randomly assigned to review one of four patient profiles (non-obese male [n=49], non-obese female [n=51], obese male [n=44], obese female [n=38]). Evaluations from the patient profiles revealed that in comparison to non-obese patients, obese patients were: less likely to comply with treatment recommendations ($p=0.02$); were perceived as having a poorer diet quality ($p=0.03$), and were perceived as having a poorer health status ($p=0.00$). This indicates that stereotypical assumptions were apparent amongst these dietetic students as all nutritional and health information were identical for the four patient profiles (except for their weight, BMI and body fat percentage). The FP score revealed a moderate level of fat phobia among the dietetic students (mean and SD: 3.7 ± 0.51). There was a vast percentage of agreement to the negative adjectives on the FP scale indicating strong negative attitudes, and there was no significant association between the student's body weight and their FP scores.

Negative attitudes towards obese persons were also evident in a cross sectional survey which assessed attitudes towards obesity among 420 dental students from

the University of Michigan school of Dentistry (Magliocca et al. 2005). Results from the attitudes questionnaire revealed that negative attitudes towards obese people are prevalent among dental students, and this could affect how they approach and treat obese patients. The figure in parenthesis indicates the percentage of participants that agreed with the following statements: 'I have negative reactions towards the appearance of obese patients' (31%); 'It is difficult for me to feel empathy for an obese patient' (66%); 'I feel uncomfortable when examining an obese patient' (68%); 'overweight people tend to be lazier than normal weight people' (40%); 'overweight people lack will power and lack motivation in comparison to normal weight people' (47%) (Magliocca et al. 2005). It is evident that negative attitudes towards obese persons are even evident in health care professionals that do not treat patients for their obesity, but for other health issues.

Block et al. (2003) assessed attitudes towards the treatment of obesity among 87 internal medicine residents. Negative attitudes were prevalent: only 30% said they had success in treating obese patients; 31% considered treating obese patients as futile; and 92% stated behavioural factors as a primary cause of obesity. There was no significant correlation ($p=0.5$) between knowledge and attitude summary measures, indicating that great knowledge did not result in improved attitudes. However residents who felt qualified enough to treat obese patients (44%) had more confidence and success in treating patients, and were less likely to report the treatment as futile ($p<0.00$). Also Bocquier et al. (2005) assessed negative attitudes among 600 French GP's. Negative attitudes were prevalent: 30.8% of GP's thought obese people were lazier and more self-indulgent than normal weight people, and 28.6% agreed with this statement when it regarded overweight people. Many GP's (45%) were setting strict weight loss goals of >15%, unrealistic goals will set the

patient up for failure and will demotivate them when they cannot reach it. This explains why 57.2% of GP's agreed that only a small proportion of obese people lose and maintain weight loss. Many GP's perceived behavioural factors to be the principal culprit of obesity, however 60.7% rarely suggested the use of a food diary to help change their behaviour, and 36.2% rarely felt prepared to provide weight management advice for overweight and obese patients (Bocquier et al. 2005). This study reveals that GP's have negative attitudes towards obese patients, however they are not providing the right support for their patients to help them to lose weight.

1.3.6 Attitudes towards Obese Persons among the General Population

The previous studies have found that negative attitudes towards obese persons are apparent amongst health care professionals, this could be due to having a bad experience with an obese patient, or due to the negative connotations associated with the term 'obesity' that has manifested from society. It is apparent from the following study that education on weight bias and discrimination can increase positive attitudes towards obese individuals. Crerand et al. (2007) assessed attitudes towards obesity between 123 obese women. The dieting group (n=84) learnt how to modify their behaviour through the LEARN program for weight control. The non-dieting group (n=39) learnt how to adopt new eating patterns, and were given information on weight related bias and discrimination. The non-dieting group had a significantly ($p<0.00$) greater increase in ATOP scores than the dieting group at week 20 and week 40 of the intervention (mean and SD: week 20: 9.8 ± 12.1 vs. 0.9 ± 11.7 ; week 40: 11.2 ± 16.1 vs. 2.4 ± 11.8). No decrease in ATOP scores was apparent amongst the dieters, this may be because their BMI still classed them as overweight or obese even though they had lost weight. This study indicates that information on weight related bias can improve attitudes towards obesity. It

increases awareness and proves that losing weight does not indicate an increase in negative attitudes. A study explored weight stigmatization and attitudes towards obesity in 93 individuals seeking help at a self-referred weight loss facility (Friedman et al, 2005). In comparison to previous findings, this study reported relatively lower ATOP scores indicating stronger anti-fat attitudes amongst overweight/obese individuals (mean and SD for men: 53.42 ± 15.60 ; women: 54.90 ± 15.09 ; overall: 54.52 ± 15.14 (Friedman et al. 2005). In addition a very high proportion of the study participants had experienced weight stigmatization in an array of situations, this may explain their strong anti-fat attitudes: 97.9% received nasty comments from family; 96.8% experienced physical barriers; 89.1% received inappropriate comments from doctors and from others; 86.0% had loved ones embarrassed by their size; 78.3% had others making negative assumptions; 33.3% had experienced job discrimination; and 4.3% had been attacked. However, Swami et al. (2010) administered the ATOP and FP scale to 1024 individuals situated in South Germany, the mean BMI ($23.2 \pm 4.2 \text{ kg/m}^2$) indicated that the majority of participants were classed as 'normal weight' (WHO, 2006). This study revealed positive attitudes (ATOP mean and SD: 70.95 ± 12.80) and a neutral FP score (mean and SD: 3.51 ± 0.54). Results from the previous studies indicate that overweight and obese have strong anti-fat attitudes, this may be because they are more critical and judgemental of their own weight (due to past experience of stigma).

Receiving negative attitudes towards your weight can be damaging particularly at a young age, the latter can result in many mental health problems in the future such as depression, anxiety and eating disorders (NOO, 2011). The ATOP scale was completed by 115 school staff (health related) from 17 junior and senior high schools within the urban school district of St. Paul, Minnesota. Among the school staff: 66%

agreed that “most obese persons are more self-conscious than other people”; 57% agreed that “most obese people feel that they are not as good as other people”; and 47% agreed that “most non-obese people would not want to marry anyone who is obese”. However lower percentages were apparent with the following negative statements: “obese workers cannot be as successful as other workers” (17.5% agreed), “severely obese people are usually untidy” (20.2% agreed), and that “most obese people have different personalities than non-obese people” (20.9% agreed). In addition the study found no significant ($p=0.49$) correlations between BMI and ATOP scores. Even though many school staff did not associate obesity with a number of statements unrelated to weight (personality, tidiness, work success), negative responses were still prevalent, and were considerably high for other statements.

A major limitation of the attitude studies is that they do not reveal individual’s actual actions and behaviour towards obese people. Even if individuals have negative attitudes towards obese individuals, they may not act discriminative towards them. In addition the methodologies of the previous studies are subject to socially desirable answers. Particularly amongst health care professionals who may feel that it would be politically incorrect to state their true attitudes.

1.4 Conclusion

Overall in relation to the knowledge studies it is evident that higher obesity risk knowledge is apparent in: older individuals; individuals with higher educational attainment; and health care professionals, particularly dietitians, GP’s and medical residents. It was identified that nurses, nursery nurses and health visitors require extra education and training on obesity risk knowledge, in order to help deal with the

increasing numbers of overweight and obese individuals. In addition it was revealed that many health care professionals feel unprepared to educate patients on weight management practices, therefore it should be implemented that all health care professionals receive a copy of the NICE guidelines for obesity and extra training if required. The studies that measured gender and ethnicity found no significant differences in obesity risk knowledge. In addition obesity risk knowledge amongst the general population was found to be relatively poor. This identifies the need for health care professionals, environmental and employment settings, to provide their patients or employees with educational tools on obesity risk knowledge as an aid to prevent and reduce the extent of the obesity epidemic (i.e. discussions with patients, posters in waiting rooms, posters in employment settings and highly visited areas in order to increase awareness). Overall in relation to the attitude studies it was evident that negative attitudes towards obese persons were prevalent amongst: students; health care professionals; all BMI categories; and the general population. Indicating that negative attitudes begin and manifest from society, and not just health related disciplines or careers. Significant differences in attitudes between gender and different BMI categories revealed conflicting results among the studies. However it was apparent from many studies that males were significantly less favourable towards obese individuals than females, and that obese persons were least preferred as a friend and sexual partner. Education on weight bias was found to be a significant predictor of improved attitudes towards obese persons, this should be implemented into school curriculums, health care professionals and at university level in order to help reduce the stigma associated with being overweight and obese. Future studies should try to employ an adequate sample number and wide range of BMI measurements in each of their groups in order to confidently assess significant

differences and correlations, in relation to knowledge and attitude. Attitudes do not necessarily predict actions, therefore it would be important for future studies to measure attitudes towards obese persons, and whether this differs from their actual actions. There are gaps in the research regarding knowledge and attitudes, it would be valuable for a future research paper to measure knowledge and attitudes towards obese persons among students studying different subjects, to identify whether university students require education on obesity risk knowledge, and reducing weight bias and discrimination. Young people are the future, so it is vital that prevention is made priority, and education is implemented to those who require it.

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Research Paper

Knowledge and Attitudes

of Obesity in University

Students'

Word Count: 4338

Key Words: Overweight, Obese, Risk, Stigmatisation

Rational for Publication

If this paper were to be published, the present study would fit the requirements of the journal *Obesity*. A large proportion of studies that have measured obesity risk knowledge and attitudes towards obese persons have been published by the journal *Obesity*. This journal includes research into the treatment of obesity (i.e. increasing knowledge/ education), focuses on public health and covers aspects of obesity and behaviour epidemiology. The present study would add to current research in this area and would assist in raising the importance of increasing obesity risk knowledge and reducing negative attitudes towards obese persons, which may help to reduce stigmatization and discrimination that obese persons face.

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Abstract

Background: Many strategies to alleviate the high levels of obesity are concerned with prevention. Therefore it is vital that young persons, and future health care professionals are knowledgeable regarding the health risks of obesity, to reduce future levels of obesity related comorbidity and mortality. In addition negative attitudes towards obese persons are highly prevalent within the general population and amongst health care professionals who deal and manage with obese patients. This can result in stigmatisation and discrimination in societal, employment and educational settings. This study explores students' knowledge on the health risks associated with obesity and their attitudes towards obese people.

Methods: Two valid and reliable questionnaires: Obesity Risk Knowledge Scale (ORK-10), and Attitudes Toward Obese Persons Scale (ATOP); were distributed to 138 students' at the University of Chester. Students' were from four different disciplines: nutrition and dietetics; nursing; history; and mathematics.

Results: Nutrition and dietetic students' (n=32) revealed significantly ($p=0.00$) higher ORK-10 scores than nursing (n=36), history (n=27) and mathematic students' (n=27). ATOP scores from all disciplines revealed positive attitudes towards obese persons, however negative responses were prevalent.

Conclusion: Future dietitians will be equipped in managing obese patients, however the lower levels of knowledge by nurses needs to increase as these health care professionals (HCP's) will regularly be in contact with overweight and obese patients. Knowledge amongst students' studying non-health related degrees needs to increase in order to prevent future risk of disease, and to raise awareness. Negative attitudes towards obese persons are prevalent in students' studying health related (future health care professionals) and non-health related disciplines.

Introduction

At present most strategies to alleviate the current obesity epidemic are concerned with prevention, for this to succeed it is vital that individuals are knowledgeable regarding prevention and the health risks of obesity as it may influence them to make healthier choices to their lifestyle (Peberdy, 2000). As well as obesity risk knowledge amongst the general population, it is vital that health care professionals are knowledgeable so they can educate and raise awareness to patients particularly if they are overweight or obese. The increases in obesity prevalence have resulted in greater stigmatisation towards overweight and obese individuals. Studies have found that obese individuals have experienced the following: verbal abuse; teasing; bullying; discrimination in educational, work, healthcare, and public settings; feel their friends and family are embarrassed of them; and fear of being humiliated in public (Lewis, Thomas, Blood, Castle, Hyde and Komesaroff, 2011; Puhl, Moss-Racusin and Schwartz, 2008). It has been reported that obesity stigma has implications on: an individual's emotional health and well-being (psychosocial dysfunction), health behaviours, and social participation. (Lewis et al. 2011). Most individuals blame themselves for the stigma they receive which can degrade mental functioning (low confidence, low body/self-esteem, anxiety and depression). Society has constructed this ideal of thinness, which has been influenced by the media, weight loss industry, fashion industry, government policy, academia, and medical professions (Lewis et al. 2011). This thin ideal has contributed to the stigma of overweight and obese persons as they are not classed as 'normal' members of society, this has resulted in them having a devalued social identity (Puhl et al. 2008). Negative attitudes have been reported by the general population (Neumark-Sztainer, Story and Harris, 1999), students' (Chen & Brown, 2005; Greenleaf, Chambliss,

Rhea, Martin and Morrow, 2006; Latner, Stunkard and Wilson, 2005; Vartanian, 2010), and health care professionals (Block, DeSalvo and Fisher, 2003; Bocquier, Verger, Basdevant, Andreotti, Baretge, Villani and Paraponaris, 2005; Friedman et al. 2005; Magliocca, Jabero, Alto and Magliocca, 2005; Poon & Tarrant, 2009; Puhl, Wharton and Heuer, 2009). It is vital that anti-stigma policies are put in place to reduce the implications it has on the obese individual, 40.6% of obese individuals in a study by Puhl et al. (2008) stated that 'education about the causes of obesity and weight stigma may help to decrease negative attitudes. The present study aims to assess students' knowledge on the health risks associated with obesity and their attitudes towards obese persons.

Aims/hypothesis

Aim:

To measure students' knowledge on the health risks associated with obesity and their attitudes towards obese people. To determine whether there is a difference in knowledge and attitudes towards obesity in students' studying different undergraduate degree courses.

Hypotheses

1. There will be a significant difference in knowledge on the health risks associated with obesity between students' studying different undergraduate degree courses.
2. There will be a significant difference in attitudes towards obese persons between students' studying different undergraduate degree courses.

3. There will be a significant relationship between knowledge on the health risks associated with obesity and body mass index (BMI).
4. There will be a significant relationship between attitudes towards obese persons and BMI.

Methods

Participants

A convenience sample of 138 students' was recruited from the University of Chester. The inclusion criteria were students' in their second and third year studying BSc nutrition and dietetics; BSc nursing; BA history and BSc mathematics. The students' were approached in lectures during March 2012. No incentives were given to students' for participating in the study. Participants had a mean age of 27.07 ± 9.76 years (range: 17-68 years), and a mean BMI of $23.36 \pm 3.85\text{kg/m}^2$ (range: 17.2-36.6 kg/m^2). There was an uneven distribution between genders, there were 17.2% males and 82.8% females. The final study sample included 122 students' (nutrition and dietetics=32; nursing=36; history=27; mathematics=27), 16 questionnaires had to be excluded due to missing data: i.e. unanswered questions and questions answered incorrectly.

Measures

Participants completed self-administered questionnaires to assess knowledge on the health risks associated with obesity and attitudes towards obese persons. The questionnaire format can be seen in Appendix 1.

Demographics

Students' were asked to provide information regarding what degree course they were enrolled on, their age, gender, height, and weight. Height and weight measurements were used to calculate BMI.

Obesity Risk Knowledge Scale

The Obesity Risk Knowledge (ORK-10) scale is a reliable and valid scale designed by Swift, Glazebrook and Macdonald (2006). This 10-item instrument was distributed to students' in order to assess their knowledge on the health risks associated with obesity. The students' were given ten statements regarding health risks associated with obesity, they had to circle whether they thought the statement was true or false. If they got the statement correct they would get one point, if they were incorrect they would get zero points. The latter also applied if the students' circled the 'don't know' option. The score range for this scale ranged from 0-10, higher scores indicate greater knowledge and awareness of the health risks associated with obesity. After the students' had completed the questionnaires, they were given an answer sheet for the ORK-10 scale (see Appendix 2). This answer sheet aimed to: raise awareness and insight into the health risks associated obesity; increase the knowledge of students' studying health and non-health related disciplines; and to clear up any incorrect or non-evidence based health messages which the general population are bombarded with daily.

Attitudes Toward Obese Persons scale

Attitudes towards obese individuals among students' were assessed with the Attitudes Toward Obese Persons (ATOP) scale, a 20-item scale developed by

Allison, Basile and Yuker (1991). The scale is based on a six-point Likert scale (ranging from: -3= I strongly disagree to +3 = I strongly agree), participants have to indicate the extent to which they agree or disagree with twenty statements regarding obese people. Higher scores on the ATOP scale indicate positive attitudes towards obese people. The lowest score that can be obtained is 0, and the highest is 120, therefore any score above the midpoint (score of 60) indicates that the individual has positive attitudes towards obese persons (Harvey, Summerbell, Kirk and Hills, 2002). Scoring instructions for both scales can be seen in Appendix 3.

Ethical Considerations

This study received ethical approval from the Faculty of Applied Sciences Research Ethics Committee (FREC) at the University of Chester in March 2012 (FREC reference: 642/12/MG/CS). Prior to completing the questionnaire participants were given, and asked to read the participant information sheet (see Appendix 4).

Students' were considered to have consented to participating in the research study if they had completed and returned the questionnaires to the researcher.

Statistical Analysis

SPSS (version 20.0) was used to conduct all data analyses. All questionnaires with missing values were excluded from data analysis (n=16). All data will be presented as mean and standard deviation (SD). All data failed to achieve normality, so non-parametric analyses were conducted. The Kruskal-Wallis ANOVA and post hoc analysis (multiple Mann Whitney U tests) measured the difference in obesity risk knowledge amongst the four groups of students', and the difference in attitudes towards obese persons between the four student groups. Bonferroni's adjustment was used as multiple Mann Whitney U tests were conducted, the significance was

set as $p < 0.008$ rather than $p < 0.05$. The Spearman's Rank Correlation tested for associations between knowledge score and BMI, and the association between attitude score and BMI. A p value less than $p < 0.05$ was considered statistically significant.

Results

Participant characteristics are presented in Table 1. The four disciplines reported a mean age (SD) of: 27.31 ± 8.02 years for nutrition and dietetics; 30.42 ± 9.16 years for nursing; 24.19 ± 10.65 years for mathematics; and 25.22 ± 10.60 years for history students'. Overall the mean age of all the participants was 27.07 ± 9.76 years (range: 19-68 years), and the mean BMI was reported as $23.36 \pm 3.85 \text{kg/m}^2$ (range: $17.2\text{-}36.6 \text{kg/m}^2$). In relation to gender, female students' were overrepresented compared to male students' (101 [82.8%] vs. 21 [17.2%]). All disciplines reported a mean BMI that was in the normal range (healthy/desirable) which is classified by WHO (2006) as $18.5\text{-}24.9 \text{kg/m}^2$. The four disciplines reported a mean BMI (SD) of: $22.08 \pm 3.27 \text{kg/m}^2$ for nutrition and dietetics; $23.93 \pm 4.56 \text{kg/m}^2$ for nursing; $23.08 \pm 2.75 \text{kg/m}^2$ for history; and $24.38 \pm 4.13 \text{kg/m}^2$ for mathematic students'. BMI classifications produced by WHO (2006) were used to categorise the students' into BMI categories. It is surprising to see that the two health related disciplines have obese students' (nutrition and dietetics=1, nursing=5), whereas the two non-health related disciplines have no obese students'. However students' in the mathematics and history group did have a high proportion of students' who were overweight in relation to their group size (>50% of students' were overweight in the mathematic and history class).

Table 1: Participant Characteristics

	Nutrition and Dietetics (n=32)	Nursing (n=36)	History (n=27)	Mathematics (n=27)
Age	27.31 ± 8.02	30.42 ± 9.16	25.22 ± 10.60	24.19 ± 10.65
Gender^a n= (%)	1 M (3.1) 31 F (96.9)	36 F (100)	11 M (40.7) 16 F (59.3)	9 M (33.3) 18 F (66.7)
BMI	22.08 ± 3.27	23.93 ± 4.56	23.08 ± 2.75	24.38 ± 4.13
BMI Category^b n= (%)	1 u/w (3.1) 29 n/w (90.6) 1 o/w (3.1) 1 obese (3.1)	2 u/w (5.6) 23 n/w (63.9) 6 o/w (16.7) 5 obese (13.9)	18 n/w (66.7) 9 o/w (33.3)	14 n/w (51.9) 10 o/w (37.0) 3 obese (11.1)

^aM= male, F=female

^bu/w= underweight, n/w= normal weight, o/w= overweight.

Figures for age and BMI are based on mean and standard deviation.

It was not feasible to find a large sample of students' from each discipline in second and third year that were just single honour students', so most students' (studying history and mathematics) were dual honour students'. In the nursing students', there was a mixture of: learning disability nurse (n=1); adult nurses (n=22); children's nurse (n=1); nursing in general (did not state speciality) (n=7); and mental health nursing (n=4). In addition third year classes were relatively small due to student module choices, therefore this study had to employ postgraduate students' (BSc nutrition and dietetics: 21 undergraduate students'; 11 postgraduate students'), and second year students' (BA history: 17 second year students'; 10 third year students').

However the non-parametric Mann Whitney U test reported no significant differences in BMI (p=0.51), BMI categories (p=0.66), age (p=0.33), and ORK-10 score (p=0.12), between undergraduate and postgraduate nutrition and dietetic students'. However there was a significant (p=0.02) difference in ATOP scores between undergraduate and postgraduate students' (77.52 ± 11.45 vs. 64.82 ± 14.70). However both student groups reported positive attitudes, so both groups were combined as one group as

nutrition and dietetic students'. Regarding the second year and third year history students', the Mann Whitney U test reported no significant differences in BMI ($p=0.08$), BMI categories ($p=0.26$), age ($p=0.83$), ORK-10 score ($p=0.16$), and ATOP score ($p=0.65$). Therefore both of these student groups were merged as one group as history students'.

There was a significant difference in obesity risk knowledge between students' studying different disciplines.

The Kruskal Wallis ANOVA revealed a significant ($p=0.00$) difference in obesity risk knowledge between students' studying: nutrition and dietetics, nursing, history, and mathematics (see Table 2). A Mann Whitney U post hoc analysis revealed that nutrition and dietetic students' had significantly ($p=0.00$) greater obesity risk knowledge than nursing (mean and SD: 9.06 ± 1.31 vs. 6.94 ± 1.17), history (9.06 ± 1.31 vs. 5.15 ± 1.58), and mathematic students' (9.06 ± 1.31 vs. 5.78 ± 1.34). In addition nursing students' had significantly ($p=0.00$) greater obesity risk knowledge than history (6.94 ± 1.17 vs. 5.15 ± 1.58), and mathematic students' (6.94 ± 1.17 vs. 5.78 ± 1.34). However there was no significant ($p=0.17$) difference in obesity risk knowledge between the two non-health related disciplines: history and mathematics (5.15 ± 1.58 and 5.78 ± 1.34).

Table 2: Student results from the ORK-10 scale

	Nutrition and dietetics (n=32)	Nursing (n=36)	History (n=27)	Mathematics (n=27)	P value
ORK-10 score*	9.06 ± 1.31	6.94 ± 1.17	5.15 ± 1.58	5.78 ± 1.34	0.00

**All results are based on mean and standard deviation, ORK-10 scoring ranges from 1-10 (1=low obesity risk knowledge; 10=high obesity risk knowledge)*

There was a significant difference in attitudes towards obese persons between students' studying different disciplines

The Kruskal Wallis ANOVA revealed a significant ($p=0.00$) difference in attitudes towards obese persons between nutrition and dietetic, nursing, history and mathematic students' (see Table 3). A Mann Whitney U post hoc analysis revealed that nursing students' had significantly ($p=0.00$) more positive attitudes towards obese persons than history students' (78.83 ± 16.36 vs. 65.00 ± 19.27). In addition there were no significant differences in attitude scores between nutrition and dietetic and history students' ($p=0.06$), nutrition and dietetic and mathematic students' ($p=0.25$), nutrition and dietetic and nursing students' ($p=0.11$), history and mathematic students' ($p=0.23$), and mathematic and nursing students' ($p=0.01$).

Table 3: Student results from the ATOP scale

	Nutrition and Dietetic (n=32)	Nursing (n=36)	History (n=27)	Mathematic (n=27)	P value
ATOP Score*	73.16 ± 13.85	78.83 ± 16.36	65.00 ± 19.27	70.11 ± 10.22	0.00

**All results are based on mean and standard deviation, ATOP scale score ranges from 0-120, a score of >60 indicate attitudes at the positive end of the scale (midpoint).*

There was a significant relationship between knowledge and BMI

The Spearman's rho revealed a very low negative correlation between ORK-10 score and BMI ($r=0.19$ / correlation coefficient: -38.8%). This significant relationship ($p=0.03$) suggests that individuals with higher BMI's have higher obesity risk knowledge. However caution should be taken when generalizing this result as the correlation was very low in strength, which questions its validity.

There was no significant relationship between attitudes and BMI

The Spearman's rho revealed a very low positive correlation between attitudes towards obese persons and BMI ($r=0.09$ / correlation coefficient: 0.84%). However the correlation was not significant ($p=0.31$) indicating that BMI has no influence on an individual's attitude towards obese persons.

Summary of answers from the ORK-10 scale

Kruskal Wallis ANOVA revealed a significant difference in answers between the four student groups in the following questions: 'a person with a 'beer-belly' shaped stomach has an increased risk of getting diabetes' ($p=0.00$); 'obesity increases the risk of getting bowel cancer' ($p=0.00$); 'an obese person who gets diabetes needs to lose at least 40% of their bodyweight for clear health benefits' ($p=0.00$); 'obesity increases the risk of getting breast cancer after the menopause' ($p=0.00$); 'obesity is more of a risk to health for people from South Asia (e.g. India and Pakistan) than it is for white Europeans' ($p=0.00$); 'there is no major health benefit if an obese person who gets diabetes loses weight' ($p=0.02$); 'it is better for a person's health to have fat around the hips and thighs than around the stomach' ($p=0.00$); 'obesity increases the risk of getting a food allergy' ($p=0.00$). There was no significant difference in answers between the four student groups in the following two questions: 'obese people can expect to live as long as non-obese people' ($p=0.56$); and 'obesity does not increase the risk of developing high blood pressure' ($p=0.48$) (see Appendix 5).

Summary of answers from the ATOP scale

Kruskal Wallis ANOVA revealed a significant difference in answers between the four student groups in the following statements: 'obese people are happy as non-obese

people' ($p=0.05$); 'severely obese people are usually untidy' ($p=0.02$); 'obese people are just as self-confident as other people' ($p=0.00$); 'obese people should not expect to lead normal lives' ($p=0.01$) (see Appendix 6).

Discussion

The aim of the study was to measure students' knowledge on the health risks associated with obesity and their attitudes towards obese people, and to determine whether there is a difference in knowledge and attitudes towards obesity in students' studying different undergraduate degree courses. The study revealed significantly higher levels of obesity risk knowledge among nutrition and dietetic students' compared to nursing, history, and mathematic students'. High levels of knowledge amongst trainee dietitians and trainee health care professionals were similar to previous findings by Swift, Sheard and Rutherford (2007) and Block et al. (2003). However findings from Ward and Amirabdollahian (2011) found no significant difference in obesity risk knowledge in students' belonging to a health and life sciences faculty and students' belonging to non-health related faculties. The non-significance in that study may be due to the small sample size ($n=40$), and the fact that students' were from a diverse range of disciplines.

Scores from the ORK-10 scale suggests that dietitians of the future will be prepared to manage overweight and obese patients, as well as educating and assisting other health care professionals on obesity risk knowledge. Nursing students' scored significantly higher than history and mathematic students', however their ORK-10 score is still relatively low for a future health care professional. Similar findings of low ORK-10 scores amongst nurses were reported by Swift et al. (2007), and Redsell,

Atkinson, Nathan, Siriwardena, Swift and Glazebrook (2011). These results suggest that additional education on obesity risk knowledge needs to be implemented in the nursing curriculum. Whether situated in a GP surgery, or the hospital, nurses will always be dealing with overweight and obese patients, especially in this current epidemic. Therefore it is vital that nurses are fully educated on obesity risk to help with information and queries from patients.

As expected students' studying non-health related disciplines had relatively low obesity risk knowledge scores, similar scores were reported in Rutkowski & Connelly (2011), and Ward & Amirabdollahian (2011). However these scores were not as low as those reported in the general population in Swift, Glazebrook, Anness and Goddard (2009), and Swift et al. (2006). Due to the low number of males in the present study, it is vital that future studies focusing on student populations employ a substantial number of male participants, as DeVille-Almond, Tahrani, Grant and Thomas (2010) found relatively low obesity and diabetes risk knowledge amongst a male sample. It is vital that education on overweight and obesity is implemented in popular environments, or within university institutions to raise awareness on the health risks associated with being obese. It is important to target this population as universities are not educating students' in health and disease. This may help to reduce the number of young adults growing up to be older obese adults, and therefore reduce the extent of obesity related comorbidities. In addition it will reduce the impact that the obesity epidemic will have upon society and its' economy.

ATOP scores overall revealed positive attitudes towards obese persons amongst all students' (nutrition and dietetics, nursing, history, and mathematics). Positive attitudes amongst dietitians were also apparent in Harvey et al, (2002). ATOP scores for the history students' were similar to those reported by Allison et al. (1991) in their

sample of psychology students', as well as Swami, Pietschnig, Stieger, Tov'ee and Voracek (2010) who reported similar ATOP scores as the mathematic students' in this study. Even though the student scores indicated positive attitudes, negative responses were prevalent, and can be seen in Table 5. For example, a high percentage of students' in all four disciplines disagreed to the following statements: 'obese people are often less aggressive than non-obese people'; 'very few obese people are ashamed of their weight'; 'most obese people resent normal weight people'; 'obese people are just as healthy as non-obese people'; and 'obese people are just as sexually attractive as non-obese people'. Similar findings of negative attitudes towards obese persons were evident in the following studies which measured students' attitudes: Chen & Brown, 2005; Greenleaf et al. 2006; Latner et al. 2005; Magliocca et al. 2005; Poon and Tarrant, 2009; Puhl et al. 2009).

The difference in attitudes amongst students' can be due to the different methods used to measure attitudes towards obese persons. Nevertheless negative attitudes towards obese persons may be due to the negative connotations associated with obesity in society, these stereotypical assumptions result in negative attitudes and discrimination amongst individuals who are overweight and obese. Therefore it is vital that education on reducing weight related bias is implemented amongst individuals from all weight categories, as negative attitudes have also been reported amongst overweight and obese individuals, not just their thinner counterparts (Latner et al. 2005).

The relationship between knowledge and BMI has not been measured by many studies, particularly with the use of the ORK-10 scale. This study however found a significant relationship between knowledge score and BMI, the strength of the correlation however was very low, and this may be due to the relatively small sample

size in each discipline and the narrow range of BMI measures. Therefore future studies should try to employ participants with a wide range of BMI measures. This study reported no significant relationship between attitude scores and BMI, this is similar to past and current literature which demonstrates conflicting results regarding this relationship. Similar findings to this study were apparent in: Gipson, Reese, Vieweg, Anum, Pandurangi, Olbrisch, Sood and Silverman (2005); Latner et al. (2005); Lee and Ahn (2007); Poon and Tarrant (2009); and Vartanian (2010). However the following studies found a significant relationship between attitudes and BMI: Chen and Brown (2005) and Vartanian (2010) (Vartanian: sample 1 out of 3 was significant). The non-significant relationship between attitude score and BMI in the present study and in the studies previously mentioned may be due to the studies research design and methodologies. This can be due to: a homogenous sample, small sample sizes, a low range of participants belonging to different BMI categories, and socially desirable answers. Most of the students' in this study were female (82.2%), and this may impede the generalizability of results when comparing them against a male population, as many studies have shown that male participants have more negative attitudes towards obese persons than females (Chen & Brown, 2005; Greenleaf et al. 2006; Latner et al. 2005).

Conclusion

The ORK-10 scale has revealed that future dietitians will be equipped in managing obese patients, and that nurses require additional education on the risks of obesity as most will be in regularly contact with overweight and obese patients. Obesity risk knowledge amongst students' studying non-health related disciplines was considerably low and needs to increase in order to raise awareness and prevent future risk of disease. This could be done by implementing health workshops within university settings, or portable drop in centres where students' can raise their queries. This could be conducted by health care professionals themselves, or through posters and leaflets to help raise awareness of the risks of being overweight and obese, and the benefits of making healthy lifestyle changes to prevent the risk of disease. The overall ATOP score for each discipline demonstrated positive attitudes towards obese persons, and some of the ATOP scores reported in this study were relatively higher than scores reported in previous studies (Allison et al. 1991; Crerand, Wadden, Foster, Sarwer, Paster and Berkowitz, 2007; Friedman, Reichmann, Costanzo, Zelli, Ashmore and Musante, 2005; Neumark-Sztainer et al. 1991; Swami et al. 2010). The present study overall reported positive attitudes towards obese persons, however when each answer from the ATOP scale was analysed separately, negative attitudes and stereotypical assumptions towards obese persons were evident amongst all four disciplines. Overall negative attitudes and assumptions were evident in all student answers indicating that negative attitudes do not solely begin in health related disciplines, they are prevalent throughout the student population. It would be beneficial if universities implemented education on reducing weight related stigma and discrimination as previous research has shown favourable outcomes (Crerand et al. 2007).

Strengths

1. High response rate
2. No students' refused to participate in the study, this reduces the risk of selection and response bias.
3. The use of valid and reliable instruments (ORK-10 and ATOP scales) to assess knowledge of the health risks associated with obesity and attitudes towards obese persons.
4. The study used a range of health related (future health care professionals) and non-health related disciplines which have not been focused on in past and current literature.

Limitations

1. The study used non-random and convenience sampling methods (one institution), this is subject to selection bias and response bias. In addition caution must be taken when generalizing the results to a larger population.
2. The study had a relatively small number of participants who were overweight (21.3% of sample) or obese (7.4%) in comparison to normal weight (68.9%) individuals, so caution must be taken when determining the results.
3. Self-reported height and weight measurements were used to calculate BMI which is subject to underestimation. In addition due to the sensitivity of the topic participants may feel too embarrassed to write down their true weight, which was the principal reason for the excluded questionnaires (n=16).
4. Assessing attitudes towards obese persons is subject to socially desirable answers and participants may feel that they cannot report their true attitudes.

Recommendations for Future Research

For future research it would be beneficial if studies focusing on obesity risk knowledge amongst students' had an age and gender matched control group consisting of individuals with no higher educational attainment. From this it would be recognised whether individuals with no educational attainment within this age group require additional support in obesity risk knowledge. In addition the present study did not focus on ethnicity as a factor which may influence the level of knowledge and attitudes towards obese persons. It would be beneficial if all future studies gathered information on student's ethnic identity to explore whether different ethnic groups require additional support in obesity risk knowledge, and whether certain ethnic groups hold more negative attitudes towards obese persons. The latter was assessed in a study by Latner et al. (2005) which found white participants to hold significantly more negative attitudes than African-American, Asian and Hispanic groups. In addition it is evident that the present study and most studies measuring attitudes towards obese persons are subject to socially desirable answers due to the nature and feasibility of the study design. Future studies should try and employ the Implicit Association Test as it may reduce the risk of socially desirable answers.

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Appendix 1

Demographic Questions

What degree course are you enrolled on?

What is your age?

What is your sex?

What is your height (please state the unit of measurement. (I.e. feet, inches)?

What is your weight (please state the unit of measurement. (I.e. pounds, stones, kilograms)?

ORK-10: Obesity Risk Knowledge scale

Please circle the answers that you think are correct, if you are unsure of the answers please circle don't know.

1. **A person with a 'beer-belly' shaped stomach has an increased risk of getting diabetes.**
True
Don't know
False
2. **Obesity increases the risk of getting bowel cancer.**
True
Don't know
False
3. **An obese person who gets diabetes needs to lose at least 40% of their bodyweight for clear health benefits.**
True
Don't know
False
4. **Obese people can expect to live as long as non-obese people**
True
Don't know
False
5. **Obesity increases the risk of getting breast cancer after the menopause**
True
Don't know
False
6. **Obesity is more of a risk to health for people from South Asia (e.g. India and Pakistan) than it is for white Europeans.**
True
Don't know
False
7. **There is no major health benefit if an obese person who gets diabetes loses weight**
True
Don't know
False
8. **Obesity does not increase the risk of developing high blood pressure**
True
Don't know
False
9. **It is better for a person's health to have fat around the hips and thighs than around the stomach**
True
Don't know
False
10. **Obesity increases the risk of getting a food allergy**
True
Don't know
False

Attitudes Toward Obese Persons Scale

Please mark each statement below in the left margin, according to how much you agree or disagree with it. Please do not leave any blank. Use the numbers on the following scale to indicate your response. Be sure to place a minus or plus sign (- or +) beside the number that you choose to show whether you agree or disagree.

-3 I strongly disagree	-2 I moderately disagree	-1 I slightly disagree	+1 I slightly agree	+2 I moderately agree	+3 I strongly agree
-----------------------------------------	-------------------------------------------	-----------------------------------------	--------------------------------------	----------------------------------------	--------------------------------------

1. _____ Obese people are as happy as nonobese people.
2. _____ Most obese people feel that they are not as good as other people.
3. _____ Most obese people are more self-conscious than other people.
4. _____ Obese workers cannot be as successful as other workers.
5. _____ Most nonobese people would not want to marry anyone who is obese.
6. _____ Severely obese people are usually untidy.
7. _____ Obese people are usually sociable.
8. _____ Most obese people are not dissatisfied with themselves.
9. _____ Obese people are just as self-confident as other people.
10. _____ Most people feel uncomfortable when they associate with obese people.
11. _____ Obese people are often less aggressive than nonobese people.
12. _____ Most obese people have different personalities than nonobese people
13. _____ Very few obese people are ashamed of their weight.
14. _____ Most obese people resent normal weight people.
15. _____ Obese people are more emotional than nonobese people.
16. _____ Obese people should not expect to lead normal lives.
17. _____ Obese people are just as healthy as nonobese people.
18. _____ Obese people are just as sexually attractive as nonobese people.
19. _____ Obese people tend to have family problems.
20. _____ One of the worst things that could happen to a person would be for him/her to become obese

Appendix 2

ORK-10: Obesity Risk Knowledge scale: **Answer Sheet**

1. **A person with a 'beer-belly' shaped stomach has an increased risk of getting diabetes.**
 True
 Don't know
 False
2. **Obesity increases the risk of getting bowel cancer.**
 True
 Don't know
 False
3. **An obese person who gets diabetes needs to lose at least 40% of their bodyweight for clear health benefits.**
 True
 Don't know
 False
4. **Obese people can expect to live as long as non-obese people**
 True
 Don't know
 False
5. **Obesity increases the risk of getting breast cancer after the menopause**
 True
 Don't know
 False
6. **Obesity is more of a risk to health for people from South Asia (e.g. India and Pakistan) than it is for white Europeans.**
 True
 Don't know
 False
7. **There is no major health benefit if an obese person who gets diabetes loses weight**
 True
 Don't know
 False
8. **Obesity does not increase the risk of developing high blood pressure**
 True
 Don't know
 False
9. **It is better for a person's health to have fat around the hips and thighs than around the stomach**
 True
 Don't know
 False
10. **Obesity increases the risk of getting a food allergy**
 True
 Don't know
 False

Appendix 3

Scoring Instructions for the Obesity Risk Knowledge (ORK-10) Scale

Each question that is answered correctly on the ORK-10 scale is equal to one point.

As there are ten questions on the questionnaire, the minimum score that can be achieved is zero and the maximum score that can be achieved is 10. If participants get the question wrong, or they select the 'don't know' option they are given zero points for that question (Swift et al. 2006).

Scoring instructions for the Attitudes Toward Obese Persons (ATOP) scale

Step 1: Multiply the response to the following items by -1 (i.e., reverse the direction of scoring): Item 2 through Item 6, Item 10 through Item 12, Item 14 through Item 16, Item 19 and Item 20

Step 2: Add up the responses to all items.

Step 3: Add 60 to the value obtained in Step 2. This value is the ATOP score. Higher numbers indicate more positive attitudes (Allison & Baskin, 2009).

Appendix 4:



Participant information sheet

Knowledge and Attitudes towards Obesity between University Students’.

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the study?

This research is being conducted on third year students’ at the University of Chester who are studying single honour undergraduate degree courses in: Nutrition and Dietetics, Nursing, History and Mathematics. The purpose of the research is to determine students’ knowledge on the health risks associated with obesity, and their attitudes towards obese people. The research will also determine whether there is a difference in knowledge and attitudes in students’ studying different degrees. The research will also be measuring any correlation within the data to see if BMI has any influence on knowledge of the health risks associated with obesity and attitudes towards obese people.

Why have I been chosen?

You have been chosen because you are a third year student at the University of Chester and you are studying one of the following four single honour undergraduate degree programmes: Nutrition and Dietetics, Nursing, History and Mathematics.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep, by completing the following questionnaires you are consenting to taking part in this research. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect you in any way.

What will happen to me if I take part?

You will be asked to complete five questions about yourself, and two questionnaires. The questions about your self will include: what are you studying? What is your age? What is your gender? What is your height? What is your weight?. The two questionnaires that you will be asked to complete are the Obesity Risk Knowledge Scale and the Attitudes Toward Obese Persons Scale. The former consists of ten questions regarding the health risks

associated with obesity and the latter consists of twenty questions which will measure your attitudes towards people who are obese. No-one will be identifiable in the final report, and all answers will be dealt with in confidence.

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks in taking part in the study.

What are the possible benefits of taking part?

By taking part, knowledge of the health risks associated with obesity and attitudes towards obesity can be measured, the data will identify whether health education needs to be targeted at university students' to make students' more aware of the health risks associated with obesity and the benefits of a healthy lifestyle. By measuring student's attitudes towards obesity, the data will identify the extent of negative attitudes which will determine whether education on reducing weight bias is needed to reduce the barriers that obese individuals face.

What if something goes wrong?

If you wish to complain or have any concerns about any aspect of the way you have been approached or treated during the course of this study, please contact Professor Sarah Andrew, Dean of the Faculty of Applied Sciences, University of Chester, Parkgate Road, Chester, CH1 4BJ, 01244 513055.

Will my taking part in the study be kept confidential?

All information which is collected about you during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information.

What will happen to the results of the research study?

The results will be written up into a dissertation for my final project of my MSc. Individuals who participate will not be identified in any subsequent report or publication.

Who is organising the research?

The research is conducted as part of a MSc in Weight Management within the Department of Clinical Sciences at the University of Chester. The study is organised with supervision from the department, by Melissa Giglia, an MSc student.

Who may I contact for further information?

If you would like more information about the research before you decide whether or not you would be willing to take part, please contact:

Melissa Giglia:

Department of Clinical Sciences: 01244 513431

Thank you for your interest in this research.

Appendix 5: Answers from the ORK-10 scale from all four student groups

Questions from the ORK-10 scale	Nutrition and Dietetics (n=32)		Nursing (n=36)		History (n=27)		Mathematics (n=27)	
	Correct %	Incorrect %	Correct %	Incorrect %	Correct %	Incorrect %	Correct %	Incorrect %
A person with a 'beer-belly' shaped stomach has an increased risk of getting diabetes ^a	93.8	6.2	94.4	5.6	63.0	37.0	66.7	33.3
Obesity increases the risk of getting bowel cancer ^b	93.8	6.2	91.7	8.3	59.3	40.7	63.0	37.0
An obese person who gets diabetes needs to lose at least 40% of their bodyweight for clear health benefits ^c	84.4	15.6	47.2	52.8	25.9	74.1	37.0	63.0
Obese people can expect to live as long as non-obese people	96.9	3.1	91.7	8.3	96.3	3.7	88.9	11.1
Obesity increases the risk of getting breast cancer after the menopause ^d	81.2	18.8	38.9	61.1	14.8	85.2	18.5	81.5
Obesity is more of a risk to health for people from South Asia (e.g. India and Pakistan) than it is for white Europeans ^e	87.5	12.5	5.6	94.4	7.4	92.6	18.5	81.5
There is no major health benefit if an obese person who gets diabetes loses weight ^f	90.6	9.4	97.2	2.8	77.8	22.2	74.1	25.9
Obesity does not increase the risk of developing high blood pressure	93.8	6.2	97.2	2.8	92.6	7.4	100	N/A
It is better for a person's health to have fat around the hips and thighs than around the stomach ^g	90.6	9.4	61.1	38.9	33.3	66.7	59.3	40.7
Obesity increases the risk of getting a food allergy ^h	93.8	6.2	69.4	30.6	44.4	55.6	55.6	44.4

^a Mann Whitney U test revealed a significant difference in answers between: nutrition and dietetic and history students' (93.8% vs. 63.0% correct, $p=0.04$); nutrition and dietetic and mathematic students' (93.8% vs. 66.7% correct, $p=0.00$); history and nursing students' (63.0% vs. 94.4% correct, $p=0.00$); mathematic and nursing students' (66.7% vs. 94.4%, $p=0.00$).

^b Significant difference in answers between nutrition and dietetic and history students' (93.8% vs. 59.3% correct, $p=0.00$); nutrition and dietetic and mathematic students' (93.8% vs. 63.0% correct, $p=0.00$); history and nursing students' (59.3% vs. 91.7% correct, $p=0.00$); mathematic and nursing students' (63.0% vs. 91.7% correct, $p=0.00$).

^c Significant difference in answers between nutrition and dietetic and history students' (84.4% vs. 25.9% correct, $p=0.00$); nutrition and dietetic and mathematic students' (84.4% vs. 37.0% correct, $p=0.00$); nutrition and dietetic and nursing students' (84.4% vs. 47.2% correct, $p=0.00$).

^d Significant difference in answers between nutrition and dietetic and history students' (81.2% vs. 14.8% correct, $p=0.00$); nutrition and dietetic and mathematic students' (81.2% vs. 18.5% correct, $p=0.00$); nutrition and dietetic and nursing students' (81.2% vs. 38.9% correct, $p=0.00$).

^e Significant difference in answers between nutrition and dietetic and history students' (87.5% vs. 7.4% correct, $p=0.00$); nutrition and dietetic and mathematic students' (87.5% vs. 18.5%, $p=0.00$); nutrition and dietetic and nursing students' (87.5% vs. 5.6% correct, $p=0.00$).

^f Significant difference in answers between mathematic and nursing students' (74.1% vs. 97.2% correct, $p=0.00$).

^g Significant difference in answers between nutrition and dietetic and history students' (90.6% vs. 33.3% correct, $p=0.00$); nutrition and dietetic and mathematic students' (90.6% vs. 59.3% correct, $p=0.00$); nutrition and dietetic and nursing students' (90.6% vs. 61.1% correct, $p=0.00$).

^h Significant difference in answers between nutrition and dietetic and history students' (93.8% vs. 44.4% correct, $p=0.00$); nutrition and dietetic and mathematic students' (93.8% vs. 55.6% correct, $p=0.00$).

Appendix 6: Answers from the ATOP scale from all four student groups

	Nutrition and Dietetics (n=32)		Nursing (n=36)		History (n=27)		Mathematics (n=27)	
Questions from the ATOP scale	Agree %	Disagree %	Agree %	Disagree %	Agree %	Disagree %	Agree %	Disagree %
Obese people are as happy as non-obese people	37.5	62.5	66.7	33.3	44.4	55.6	63.0	37.0
Most obese people feel that they are not as good as other people	59.4	40.6	44.4	55.6	66.7	33.3	63.0	37.0
Most obese people are more self-conscious than other people	78.1	21.9	69.4	30.6	63.0	37.0	92.6	7.4
Obese workers cannot be as successful as other workers	18.8	81.3	25.0	75.0	37.0	63.0	22.2	77.8
Most non-obese people would not want to marry anyone who is obese	28.1	71.9	30.6	69.4	44.4	55.6	55.6	44.4
Severely obese people are usually untidy ^a	6.3	93.8	13.9	86.1	29.6	70.4	33.3	66.7
Obese people are usually sociable	62.5	37.5	80.6	19.4	51.9	48.1	74.1	25.9
Most obese people are not dissatisfied with themselves	21.9	78.1	41.7	58.3	22.2	77.8	29.6	70.4
Obese people are just as self-confident as other people ^b	59.4	40.6	75.0	25.0	29.6	70.4	33.3	66.7

	Nutrition and Dietetics (n=32)		Nursing (n=36)		History (n=27)		Mathematics (n=27)	
Questions from the ATOP scale	Agree %	Disagree %	Agree %	Disagree %	Agree %	Disagree %	Agree %	Disagree %
Obese people are often less aggressive than non-obese people	6.3	93.8	22.2	77.8	18.5	81.5	33.3	66.7
Most obese people have different personalities than non-obese people	6.3	93.8	11.1	88.9	25.9	74.1	18.5	81.5
Very few obese people are ashamed of their weight	18.8	81.3	33.3	66.7	37.0	63.0	18.5	81.5
Most obese people resent normal weight people	31.3	68.8	25.0	75.0	33.3	66.7	25.9	74.1
Obese people are more emotional than non-obese people	18.8	81.3	16.7	83.3	14.8	85.2	7.4	92.6
Obese people should not expect to lead normal lives ^c	6.3	93.8	13.9	86.1	25.9	74.1	N/A	100
Obese people are just as healthy as non-obese people	6.3	93.8	16.7	83.3	7.4	92.6	11.1	88.9
Obese people are just as sexually attractive as non-obese people	28.1	71.9	55.6	44.4	33.3	66.7	40.7	59.3
Obese people tend to have family problems	25.0	75.0	11.1	88.9	25.9	74.1	3.7	96.3
One of the worst things that could happen to a person would be for him to become obese	31.3	68.8	33.3	66.7	22.2	77.8	22.2	77.8

^a Mann Whitney U test revealed a significant difference in answers between nutrition and dietetic and mathematic students' (6.3 vs. 33.3% disagreed, $p=0.00$).

^b Significant difference in answers between: history and nursing students' (70.4 vs. 25.0% disagreed, $p=0.00$), and mathematic and nursing students' (66.7 vs. 25.0% disagreed, $p=0.00$).

^c Significant difference between history and mathematic students' (74.1 vs. 100% disagreed, $p=0.00$).