

**Norm Effects on Eating Behaviour:
The Role of Social Identity**

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ABSTRACT

The main theme of the thesis was to examine the relationship between social influences and adults' eating behaviour, in particular how social identity affects the norm influence on eating behaviour. Chapter One describes the general background and evaluates the research literature. Chapter Two reports the results of a longitudinal investigation of the relationship between perceived eating norms and self-reported food consumption among a student population. Chapter Three presents a pair of online studies that tested whether social norms predict eating and whether there is an interaction between norm effects and social identity in both a community and student population. Chapter Four presents the results of two laboratory-based experiments that examined the moderating effect of social identity on the relationship between social norm messaging and healthy /unhealthy food consumption using a remote-confederate design. Chapter Five reports the results of a laboratory study that examined the effect of manipulating social identity on social norm enhancement of eating behaviour. Chapter Six reviews all findings, reflects on the importance of completed work, and concludes that social influences on eating are robust and social identity plays a moderating role. The findings have implications for the development of norm-identity based interventions in promoting healthier dietary habits.

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ETHICAL APPROVAL

The British Psychological Society (BPS) guidelines for human research ethics were adhered to in the design and conduct of the research studies that form this thesis. Ethical approval was granted by the Science, Technology, Engineering and Mathematics Ethical Review Committee at the University of Birmingham.

DISSEMINATION

The contents of this thesis have been presented in the following conferences: The British Feeding and Drinking Group (2015 and 2016), PSYPAG Annual Conference (2015), and The British Psychological Society (2016).

STATEMENT OF AUTHORSHIP

Chapter 2-5 contains material that has been prepared for publications in peer-reviewed journals. The authorship indicates collaborative work for each chapter. Authors involved in the design of the study: Dr Eric Robinson (Chapter 2), Dr Jason Michael Thomas (Chapter 2, Chapter 3 and Chapter 5), Prof. Suzanne Higgs (all Chapters). I collected and analysed data in all chapters under the supervision of Prof. Suzanne Higgs. This thesis does not contain any material which has been written or published by another person except where referenced above. This thesis is entirely my own work with edits/comments provided by Prof. Suzanne Higgs.

TABLE OF CONTENTS

Chapter 1 General introduction	1
1.1 <i>Prevalence of unhealthy eating habits</i>	<i>1</i>
1.2 <i>The importance of maintaining a healthy diet.....</i>	<i>2</i>
1.3 <i>Factors influencing eating behaviour</i>	<i>3</i>
1.4 <i>Social influence in food intake and selection</i>	<i>6</i>
1.5 <i>Moderators of normative effects on eating.....</i>	<i>25</i>
1.6 <i>Thesis motivation and hypothesis.....</i>	<i>35</i>
Chapter 2: Relationships between changes in perceived social norms and self-reported food and drink intake among university students across an academic year	38
2.1. <i>Background.....</i>	<i>38</i>
2.2. <i>Methods</i>	<i>43</i>
2.3. <i>Analysis Strategy.....</i>	<i>46</i>
2.4. <i>Results</i>	<i>47</i>
2.5. <i>Discussion</i>	<i>61</i>
2.6. <i>Conclusion.....</i>	<i>68</i>
Chapter 3: The effect of social norm messages on dietary intentions: the moderating effect of social identification	70
3.1. <i>Background.....</i>	<i>70</i>
<i>Study 1: The Effect of a Social Norm message and British identity on vegetable eating intentions</i>	<i>75</i>
3.2.1. <i>Method.....</i>	<i>76</i>
3.2.2. <i>Analysis Strategy.....</i>	<i>82</i>
3.2.3. <i>Results</i>	<i>84</i>

3.2.4. Interim summary.....	92
Study 2 Norm message and student identity on junk food eating intentions	93
3.3.1. Method.....	93
3.3.2. Analysis Strategy.....	96
3.3.3. Results	97
3.3.4. Interim summary.....	103
3.4. General discussion	103

Chapter 4: Modeling of food intake: the moderating effect of social identity ...107

4.1. Background.....	107
Study 1 Modelling of Cookie Intake	113
4.2.1. Method.....	113
4.2.2. Analysis Strategy.....	118
4.2.3. Results	119
4.2.4. Interim summary.....	126
Study 2 Modelling of vegetable intake.....	128
4.3.1. Method.....	128
4.3.2. Analysis Strategy.....	132
4.3.3. Results	132
4.3.4. Interim summary.....	139
4.4. General Discussion	140

Chapter 5: The interactive effect of salient identity, dietary habits and social

norm on eating behaviour144

5.1. Background.....	144
5.2. Methods	146
5.3. Analysis Strategy.....	154
5.4. Results	156
5.5. Discussion	160
5.6. Conclusion.....	163

Chapter 6: General Discussion	164
6.1. <i>Review of Thesis Aims and Objectives</i>	<i>164</i>
6.2. <i>Overview of Findings</i>	<i>165</i>
6.3. <i>General Norms vs. Context-specific Norms and moderation by social identity</i>	<i>168</i>
6.4. <i>Broad Identity vs. Specific Identity.....</i>	<i>170</i>
6.5. <i>Healthy Eating vs. Unhealthy Eating.....</i>	<i>171</i>
6.6. <i>Injunctive versus descriptive norms</i>	<i>172</i>
6.7. <i>Strengths and Limitations.....</i>	<i>172</i>
6.8. <i>Future Work.....</i>	<i>174</i>
6.9. <i>Conclusion.....</i>	<i>176</i>
References.....	177
Appendices.....	214

List of Figures

Chapter 1

- Figure 1. 1. Social Identity Theory-Cognitive Process (adapted from ‘Social Identity Theory’ by Tajfel & Turner, 1979).....31
- Figure 1. 2. Outline of studies in the thesis.....37

Chapter 3

- Figure 3. 1. The interaction effect of condition (social norm vs. control) and centrality on vegetable eating intention (number).88
- Figure 3. 2. The interaction effect of condition (social norm vs. health) and centrality on vegetable eating intention (number)89
- Figure 3. 3. Mediation direct and indirect paths.90
- Figure 3. 4. The interaction effect of condition (social norm vs. control) and centrality on junk food intention.100

Chapter 4

- Figure 4. 1. Pictures shows a standard serving of cookies..... 115
- Figure 4. 2. The cookie intakes across conditions between low and high centrality levels.122
- Figure 4. 3. The interaction effect of condition and motivation on cookie intake..... 123
- Figure 4. 4. Pictures shows a standard serving of cucumber and red peppers..... 130
- Figure 4. 5. Vegetable intakes across conditions and centrality levels..... 136

Chapter 5

- Figure 5. 1 Picture shows a standard serving of food buffet..... 149
- Figure 5. 2. Flowchart of study procedure.153
- Figure 5. 3. Interaction between food type, condition and strategy.160

Chapter 6

- Figure 6. 1. Flowchart shows links between studies..... 168

List of Tables

Chapter 2

Table 2. 1. Demographic Characteristics of the sample at each time point.	47
Table 2. 2. Norm perception and self-reported servings of food intake between baseline, 3-months and 12-months across academic year.	50
Table 2. 3. Correlations between baseline food intake and self-reported follow-up food intake.	51
Table 2. 4. The association between perceived descriptive norm and food and drink consumption in university students at follow up at 3 months.	54
Table 2. 5. The association between perceived descriptive norm and food consumption in university students at follow up at 12 months.	57
Table 2. 6. Comparisons between completers and non-completers.	61

Chapter 3

Table 3. 1. Participants' characteristics across three conditions. (Mean/SD).	85
Table 3. 2. Multiple mediation analysis.	91
Table 3. 3. Participants' characteristics between social norm and control condition (Mean/SD).	98
Table 3. 4. Multiple mediation analysis.	102

Chapter 4

Table 4. 1. Participant characteristics in three conditions (Mean and SD).	120
Table 4. 2. Student identity scores (average scores) by conditions (ranged between 1 and 7).	121
Table 4. 3. Significance level for the main and interaction effects of cookie intakes.	125
Table 4. 4. Participant characteristics between high intake norm and control condition (Mean and SD).	134
Table 4. 5. Student identity scores between high intake norm and control condition.	135
Table 4. 6. Significance level for the main and interaction effects of vegetable intakes.	138

Chapter 5

Table 5. 1. Means (SD) for participants' characteristics between conditions.	156
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CHAPTER 1 GENERAL INTRODUCTION

1.1 Prevalence of unhealthy eating habits

Globally, dietary patterns have changed rapidly over recent decades (Popkin, 2006; Popkin et al., 2012). The availability of high calorie-dense unhealthy foods has increased and their price has decreased (Popkin, 2007; Rosenheck, 2008; Thow, 2009). In contrast, the purchase and consumption of healthy foods such as fruit and vegetables has decreased, which has contributed to a rise in unhealthy dietary patterns, especially among young people (Guenther et al., 2006; HSE, 2014; Nielsen & Popkin, 2004; Paeratakul et al., 2003; Popkin, 2010), which constitutes a challenge to public health. The low frequency of consumption of fruit and vegetables, alongside reduced rates of physical activity has led to a rising burden of chronic diseases such as stroke, diabetes, cancer and cardiovascular disease (WHO, 2002). It has been reported that food related ill health accounts for 10% of morbidity and mortality in the UK, which costs the NHS about £6 billion every year (Rayner & Scarborough, 2005). Obesity, which is also associated with unhealthy dietary patterns and social and economic inequalities, has also become a major issue in developed countries (WHO, 2004). In 2014, more than 1.9 billion adults aged 18 years or above were categorized as overweight and 600 million of those adults were classified as obese (WHO, 2014). Around a quarter of adults in England were classified as obese (HSE, 2014).

1.2 The importance of maintaining a healthy diet

Fruit and vegetables provide a good source of vitamins, minerals and fibre, which have a wide range of health benefits. For instance, consuming enough fruit and vegetables has been found to be a possible way to reduce the risk of throat, lung and stomach cancers (Benetou et al., 2008; World Cancer Research, 2007). The World Health Organisation (WHO) suggests that consumption of 400g of fruit and vegetables a day can also reduce the likelihood of heart disease and stroke (WHO, 2003). Other evidence suggests that consuming 7 portions of fruit and vegetables a day is linked to a reduction of cardiovascular disease mortality (Oyebode et al., 2014). It has been further suggested that a diet containing plenty of fruit and vegetables, in combination with a diet low in fat intake, can reduce the risk of type 2 diabetes in the long term (Bazzano et al., 2008). The UK National Health System (NHS) developed a guideline of '5 A DAY', which was based on the WHO recommendation, to encourage people to eat at least 5 portions of fruit and vegetables every day (Public Health England, 2016).

Despite the potential benefits of consuming a diet plentiful in fruits and vegetables, a HSE 2013 report found that the number of adults consuming 5 portions of fruit and vegetable has fallen since 2006. Only 25% of men and 28% of women reached the target consumption in 2013 (HSE, 2013). Young adults aged between 16 and 24 reported the lowest number of servings of fruit and vegetables and were considered as the group least likely to meet the '5 A DAY' guideline (HSE, 2013). On average, adults aged 19 to 64 years consumed only 4.1 portions of fruit and vegetables per day. No

more than 30% of adults currently meet the recommended amount of fruit and vegetable intake (NDNS, 2014). The reason for the gap between recommended and actual fruit and vegetable intake has been linked to income and education status, gender and age, nutritional knowledge, accessibility and availability of fruit and vegetables, individual preference, social factors, psychological factors, attitudes beliefs and perceived barriers (EUFIC, 2012). Therefore, attempts to promote healthy eating behaviour might benefit from increased attention of relevant psychological determinants.

1.3 Factors influencing eating behaviour

Eating behaviours are influenced by a variety of internal and external factors. One internal factor is the sensory response to foods (Eertmans et al., 2001). For instance, flavour perception including the taste, smell and perception of the appearance of food contributes to the sensory-specific component of satiety and the process of food intake and selection (McCrickerd & Forde, 2016; Rolls et al., 1982). Taste and smell preferences play an important role in eating behaviour, which is developed through experience and influenced by people's attitudes and beliefs (Clarke, 1998). Rolls et al. (1982) indicated that changes in the sensory properties of food such as flavour and shape lead to changes in the pleasantness of foods eaten and thus determine the amount of food consumed. In one study, participants were offered sandwiches with different fillings and yogurt with different flavours. It was reported that males ate more if the food was presented with more fillings or flavours compared to when there was only a

single filling or flavour (Rolls et al., 1981). Overeating might occur if a wide variety of foods is available. Other studies also showed sensory food components interact with each other to affect food perception (Eertmans et al., 2001). For example, interactions between smell and taste (Frank & Byram, 1988; Prescott et al., 2004; Small & Prescott, 2005), interactions between food texture and taste (Green, 1993; Stieger, 2011; Tournier et al., 2007), interactions between colour and taste (Alley & Alley, 1998; Hyman, 1983; Strugnell, 1997) were found to be associated with flavour perception.

In addition, hunger and satiety signals, which are controlled by the central nervous system, influence food choices and amounts eaten (de Castro and Elmore, 1988; Gibson and Desmond, 1999; Hill et al., 1984; Hill and Blundell, 1986; Lozano et al., 1999; Pliner et al., 1990; Rolls, 1993). Moreover, psychological factors also contribute to the choice of food. There is a two-way interaction between mood and our choice of food. Positive mood cues enhance a health goal, thus leading to a greater preference for healthy foods (Gardner et al., 2014). In addition, restriction of certain kinds of food can increase the desire for those foods (Nederkoorn et al., 2000). Self-efficacy (Kreausukon et al., 2012) and self-esteem (Schafer et al., 1999) are also strong predictors of fruit and vegetable intake in adults. Furthermore, a longitudinal naturalistic study showed that chronic stress is strongly correlated with changes in food selection and increased levels of energy consumption because of increases in cortisol secretion (Roberts, 2008).

What people choose to eat and how much they eat is not determined solely by

psychological or nutritional needs, and a variety of factors should be considered. External factors are those that people are usually unaware of, but affect eating behaviour nevertheless, such as portion size, food variety, cultural influences, social influences, and the physical environment (Eertmans et al., 2001; Herman et al., 2003; Rozin, 1996; Vartanian et al., 2008; Wansink et al., 2009). Cultural differences affect habitual food consumption. Culture refers to a shared set of values, beliefs and history: the ideas, customs, and social behaviour of a particular people or society. For example, pork and beef are not considered as clean meat to be consumed in Hindu and Buddhist religions. As a result, 90% of Hindus and Buddhists refuse to eat those kind of meats (Dindyal & Dindyal, 2003). Moreover, migrants are reported to adapt the food habits of local cultures when they move to a new country. For example, South Asian females settled in Great Britain increased energy and fat intake and reduced consumption of carbohydrates, which was associated with an increased body mass index and higher incidence of heart disease and type 2 diabetes (Holmboe-Ottesen & Wandel, 2012).

External cues often work together to affect food intake and choice by interfering with existing consumption norms (Wansink et al., 2009). External cues such as social factors may exert an influence on eating behaviour through social facilitation (de Castro, 1991; de Castro and Brewer, 1992; Redd and de Castro, 1992). The eating behaviour of dining partners' strongly affects how much a person chooses to eat in a real life setting (Pliner & Chaiken, 1990). Even when a person is alone, food intake and choice can still be influenced by social factors such as the attitudes and beliefs about other people's eating

behaviour. In laboratory settings, people are indirectly influenced by the behaviour of others even when they are not physically present (Cruwys, 2015). For example, previous research compared the manipulation of specific factors (the presence and behaviour of others) on the amount of food that individual consumed and it was reported that individuals' intake was strongly influenced by the behaviour of others, although taste rating and hunger were seen as more important factors to influence food intake (Vartanian et al., 2008). Therefore, the extent to which social factors influence human eating behaviour and whether people are aware of such an influence is worth examining.

In a summary, both internal and external factors influence people's eating behaviour (Herman et al., 2005). External factors are associated directly or indirectly with social influences, which play an additional role in eating behaviour (Rozin, 1996). Of those external factors, social influence appears to be one of the strongest influence on eating behaviour.

1.4 Social influences on food intake and selection

1.4.1. Theoretical models

Many social influences on eating are underpinned by norms. An Inhibitory Norm Model of Social Influence on Eating has been proposed, which suggests that people eat as much as they can in the presence of palatable food without being seen as eating

excessively (Vartanian et al., 2003). People are motivated to maximize their intake without eating more than their companions eat. The fact is that people look to others to determine the appropriate eating norm for that situation. On the one hand, a so called ‘avoid–excess’ norm guides people to eat a lot in a situation in which others are eating a lot, but ensures that the amounts eaten are not more than the intake of others. On the other hand, a ‘minimal-eating’ norm limits food intake to less than the amount eaten by others while also eating as much as possible. Eating minimally is more likely to lead to positive judgments from people’s companion or social group (Basow & Kobrynowicz, 1993; Bock & Kanarek, 1995; Chaiken & Pliner, 1987; Martins et al., 2004; Pliner & Chaiken, 1990). In addition, minimal eating may convey certain characteristics. For example, women who eat healthy food and small amounts are regarded as more feminine, while those who eat unhealthy food and large amounts are regarded as more masculine and less sexually attractive (Vartanian et al., 2007).

Herman et al. (2003) reviewed how food intake is affected by the presence of others including social facilitation (people tend to eat more if they are eating in groups than eating alone), modelling (people tend to match the amount of food intake to what they perceive models eat), and impression management (people tend to eat less if they believe they are observed or evaluated by someone else than eating alone).

First, social facilitation studies provide evidence that the presence of others increases personal intake. Berry et al. (1985) found that undergraduate male and female

participants ate more ice cream in the presence of a group of three or four than when they ate alone. A series of studies from de Castro and his colleagues (Bellisle et al., 1999; de Castro & de Castro, 1989; de Castro, 1990; de Castro et al., 1990; de Castro, 1991; Redd & de Castro, 1992) and diary studies from Patel and Schlundt (2001) found that people ate around 30% to 50% more when they ate with others rather than eating alone. Moreover, laboratory studies investigated how both group sizes and the relationship of eating companions contribute to social facilitation (Clendenen et al., 1994). Evidence suggests that participants paired with others in groups ate more than subjects who ate alone (Klesges et al., 1984). People tend to eat more when surrounded by friends than with strangers (Anderson, 2013; Salvy et al., 2007; Salvy et al., 2009), suggesting that the power of social facilitation of eating might be stronger among friends, partners and relatives than among strangers (de Castro, 1994; Herman et al., 2003). Possible explanations for social facilitation of eating is that the presence of other people increases social interaction, which leads to longer durations of meals, and therefore greater amount of intakes, which is known as the time-extension hypothesis (de Castro, 1990). Herman and Polivy (1984) then proposed a boundary model which suggested that people spend less time eating and eat less because eating alone is less pleasurable than eating with others (Herman et al., 2003). More recently, Herman (2015) proposed a 'feast' hypothesis which argues that anticipation of a group meal leads people to regard a meal as a feast, which results in them providing excess food to themselves and dinners in the group. Hence, both an extended meal time and anticipating more food when socializing may increase intake.

Second, the results of modelling studies suggest that people adjust their own eating behaviour to be similar to that of a model (Conger et al., 1980; de Luca & Spigelman, 1979; Feeney et al., 2011; Goldman et al., 1991; Hermans et al., 2009; Hermans et al., 2010; Vartanian et al., 2013). It has been argued that models do not have to be present in order to trigger the modelling effects on eating (Bevelander et al., 2013; Feeney et al., 2011; Florack et al., 2013; Hermans et al., 2012; Leone et al., 2007; Pliner & Mann, 2004; Robinson et al., 2013; Romero et al., 2009; Roth et al., 2001; Vartanian et al., 2013). Nisbett and Storms (1974) first interpreted 'social cues' to explain such a modelling effect but did not explain it in further detail. The theory of normative eating suggests that the food intake of others determines an appropriate norm of how much one can or should eat within an upper limit, especially in the absence of clear guidelines (Herman et al., 2003). Although modelling may facilitate or suppress eating, researchers have suggested that precise matching of food eaten might not be expected (Herman et al., 2003). The extent to which people match models is still unclear. For instance, people may hold a misperceived view of how much their model eat in ambiguous situations (Polivy et al., 1986), or people may reject matching to the model if the model is not considered as somehow comparable (Herman et al., 2003) or people may not conform to the norm if the model is seen as a non-valid indicator of appropriate food intake (Nisbett & Storms, 1974). Even though the underpinning mechanisms of modelling should be further explored, there is consistent evidence that modelling of eating behaviour occurs.

Third, impression management theory suggests that people adjust their eating to convey a desired impression on others (Herman et al., 2003; Leary & Kowalski, 1990; Leary et al., 1994; Schlenker, 1975; Vartanian et al., 2007; Vartanian, 2015). The results of studies on impression management through eating indicate that noneating observers may suppress people's food intake because they wish to convey a good impression in front of others (Mori et al., 1987; Pliner & Chaiken, 1990). That is because that being evaluated may make people feel uncomfortable and they may want to complete eating as quickly as they can, to avoid feeling embarrassed (Herma et al., 2003). Mori et al. (1987) found female subjects try to eat less if they are paired with a desirable partner of the opposite sex, due to the fact that females may be concerned about whether their feminine identity is threatened or not. Pliner and Chaiken (1990) replicated Mori et al.'s (1987) study and reported that both male and female subjects eat less in the presence of an attractive partner of the opposite sex, suggesting that behaving in a socially desirable manner motivates eating for males as well as females. Furthermore, Vartanian (2015) reported that people eat less than they normally do if they believe that eating a small amount can create a particular favourable impression of themselves. More specifically, Herman et al. (2003) also argued that people may eat a small amount around strangers to create a positive impression.

In summary, people's food intake is profoundly affected by their eating companions. Social influence on eating can be explained according to multiple theoretical

perspectives. Social facilitation describes how the presence of other diners (e.g. eating partners but not noneating observers) can increase food intake in certain circumstances. Modelling describes how people's eating behaviour can be affected by the estimation of how others behave. People are likely to eat a little when their companion eats a little, while eating more when their companion eats more. Lastly, impression management describes the inhibitory effects of others (e.g. strangers and noneating evaluators) on personal eating behaviour to create a favourable image of themselves to others. These effects are largely underpinned by social norms.

1.4.2. Types of Social Norm

Descriptive norm vs. Injunctive norm

According to 'A Focus Theory of Normative Conduct', people follow two types of social norms to make their own decisions (Cialdini et al., 1990). Descriptive social norms refer to how other people actually behave while injunctive norms refer to what behaviours are approved by others (Aronson et al., 2010). Descriptive norms influence individuals' actions by providing accurate information as a clear guidance on how to behave (Cialdini et al., 1990; Cialdini, 2008). Based on the "Social Proof Principle" (Cialdini, 1988; 2008), the way that most other people are behaving must be the appropriate or the most effective way to behave. There is a growing body of literature demonstrating the strong influence of descriptive social norms on dietary choice. For instance, it has been reported that participants are more likely to choose healthy snack

if they are led to believe that previous participants made that choice (Burger et al., 2010). More recently it has been reported that a social normative message about the junk food preferences of others can motivate individuals to reduce their own high calorie snack food intake (Robinson et al., 2013) and social normative messages about consumption of fruits and vegetables can encourage healthy dietary choices (Robinson et al., 2013; Stok et al., 2014).

There is limited research concerning the effect of injunctive norms on eating behaviour (Lally et al., 2011; Robinson et al., 2014; Stok et al., 2014). Injunctive norms motivate behaviours by indicating moral rules in a social group (Cialdini et al., 1990). Yun & Silk (2011) found that injunctive norms are related to the intention to do exercise and the intention to have a healthy diet. However, other authors found that injunctive norms reduced the intention to eat healthy (Stok et al., 2014). It was also found that positive injunctive norms (other fellow students approve of eating healthily) reduced intentions to eat healthily only when a negative descriptive norm (other fellow students do not eat healthily) was made salient (Staunton et al., 2014). In all, studies have found little evidence related to the impact of injunctive norms on dietary behaviour (Lally et al., 2011; Mollen et al., 2013; Robinson et al., 2013; Stok et al., 2014). The lack of effect of injunctive norms on eating behaviours is probably related to the fact that most people are aware of how they should eat already. It may also be that injunctive norms affect eating behaviour through concerns about social approval (Cialdini & Trost, 1998; Jacobson et al., 2011). Therefore, comparing injunctive norms and descriptive norms,

descriptive are more effective in influencing eating behaviour (Mollen et al., 2013).

Perceived norm vs. actual norm

Research has suggested that people rely on what they think others do and believe more than what others actually do or believe (Tankard & Paluck, 2015). In other words, peer influences are clearer when taking consideration of perceived norms rather than actual norms (Perkins & Berkowitz, 1986; Perkins, 2002). The gap between perceived and actual norms is referred to as norm misperception. It has further been proposed that individuals sometimes misperceive how other group members think and act and this influences their behaviour (Berkowitz et al., 2004; Perkins & Wechsler, 1996). Overestimation of problem behaviours may result in an increase in problem behaviours, while underestimation of problem behaviour may reduce the engagement in problem behaviours (Prinstein & Wang, 2005). Therefore, social norm interventions have been developed that aim to correct misperceived social norms, particularly focusing on peer influence (Berkowitz & Perkins, 1986).

1.4.3. Social norm approaches to behaviour change

The importance of social influence on health-related behaviours has been emphasised. Perkins was the first to suggest that social norms are an important external influence on consumption of alcohol (Berkowitz & Perkins 1986) and this led to the development of a social norms approach to behaviour change more generally. Social norms provide an

acceptable or typical way to behave in a particular social group (Hogg & Reid, 2006). They reflect the appropriateness of a certain behaviour that individuals within a social group are expected to conform. People tend to follow other people's behaviour as a guide for their own behaviour (Malle, 1999). For example, social norms have been found to be significant predictors of physical activity (Ball et al., 2010; Emmons et al., 2007).

The influence of social norms on health-promoting behaviours has been incorporated into different theories such as Theory of Planned Behaviour (TPB) (Ajzen, 1985) and Social Cognitive Theory (SCT) (Bandura, 2001). The TPB has been used to explain health behaviours and it is often used as a basis of health-related interventions (Armitage & Conner, 2001). The TPB suggests that intentions predict behaviour and intentions in turn are based on attitudes toward the behaviour, subjective norms and perceived behavioural control. To be more specific, attitudes refer to positive or negative evaluations of particular behaviour performance in a social group. If people show positive attitudes about the group, then they are likely to follow the corresponding group behaviour (Ajzen & Fishbein, 1980). Subjective norms indicate the salient belief about whether most people approve or disapprove of the behaviour and relate to perceived social pressure from important others (Ajzen, 1991). Subjective norms are located within the broader construct of social norms and usually conceptualised as normative beliefs (Ajzen & Fishbein, 1972). In addition, SCT conceptualizes self-efficacy as people's perception of their ability to perform a given behaviour. It has been

reported that self-efficacy for performing a behaviour increases when people are confident in performing like others in a social group (Stok et al., 2014). Previous evidence suggests that intentions, together with attitudes, subjective norms and perceived behavioural control successfully predict dietary behaviour (McEachan et al., 2011).

1.4.4. Research Evidence and Issues

Norm message on eating

The social norms approach has been applied in a series of studies of eating behaviour. Many studies have examined social influences on dietary behaviours: how our eating behaviour is formed and shaped in terms of what and how much your companion eats. A preliminary investigation showed that intentions to eat fruit and vegetables could be increased by presenting normative information (Croker et al., 2009). However, this effect was only observed in men and not in women. It was suggested that women may already have high intentions to consume healthy foods. In addition, how both social norm-based and health-based messages affect actual unhealthy food consumption has been investigated in the laboratory based studies. Messages that contain information about the junk food intake of others or the health benefits of reducing junk food intake as opposed to messages containing information of non-food related information resulted in a significantly lower amount of high calorie snack food consumption (Robinson et al., 2013). Later, evidence from a laboratory study conducted by Robinson

and his colleagues (2014) showed that the exposure of a descriptive social norm message lead to a significantly higher vegetable and fruit intake and less high energy dense snack food intake compared to the exposure of a health-related message. Moreover, the significant effect of the social norm message on healthy food intake was only observed among low but not high usual consumers of fruit and vegetables. However, there was no effect of injunctive norm message on food intake (Robinson et al., 2014).

The influence of social norm information on food selections among young adults has also been examined in field-experiments. Those studies went beyond the laboratory environment to provide greater ecological validity. Mollen and colleagues (2013) reported that healthy descriptive social norms led to selection of more healthy foods, compared to unhealthy descriptive norms or control messages. More recently, the use of social norms on increasing vegetable selection in a regular meal in a workplace has been investigated (Thomas et al., 2017). It was found that posters which containing social norm based messages about vegetable purchases of other diners increased purchase of meals with vegetables. However, the underlying mechanisms of such an eating behaviour change is still unclear. Overall, social norm based interventions have shown promise in changing dietary behaviours. Further research is still required to understand how interventions might work and for whom they might work.

Researchers have also been interested in whether perceptions of eating and drinking

behaviour of other peers are associated with food consumption. Pelletier et al. (2014) reported a strong association between young adults' dietary behaviour and their perceptions of normative behaviours of family, friends and significant others. Longitudinal studies have conducted and showed that perceived norms about how other people eat predict subsequent food consumption among young adult samples (Jones & Robinson, 2017). Interestingly, perceived eating norms are found to influence vegetable intake among children, especially in a novel context in which there is uncertainty about how to behave. For instance, previous studies investigated the effect on vegetable intake of exposing children to information about the vegetable intake of other children. It was found that children ate more carrots when they believed that others had eaten lot carrots, compared to those who believed others had eaten no carrots or those who were given no information about others' intakes. Children were most influenced by such a perceived eating norm if they were asked to eat in a novel eating context rather than an eating context that children have already encountered (Sharps & Robinson, 2015; Sharps & Robinson, 2017). Therefore, perceived eating norms may exert the influence on eating behaviours through informational social influence.

Live modelling of food intake and selection

In addition to the effect of social norms on eating, other research has focused on an implicit application of social norms: modelling of food intake and selection. In the early lab-based modelling studies, one of the researchers (named as 'confederate') was instructed to eat a certain amount of food intake or chose particular foods to provide a

model consuming a consistent amount (Conger et al., 1980; de Luca & Spigelman, 1979; Goldman et al., 1991). The live modelling setting enables researchers to test whether the modelling behaviour predicts what and how much a participant eats. Previous modelling studies used a taste-test paradigm, in which participants are asked to complete rating scales assessing the food items on offer (Goldman et al., 1991; Vartanian et al., 2013). Participants are also required to complete the study procedure in the presence of someone else (called confederate) (Hermans et al., 2009; Hermans et al., 2010; Feeney et al., 2011). Furthermore, there is usually a cover story to disguise the purpose of the experiment (Bevelander et al., 2013; Cruwys et al., 2012; Hermans et al., 2012). Participants are led to believe that the experiment is about food related research but not social influences on eating behaviour.

The modelling effect has been demonstrated and replicated in laboratory-based experiments. Hermans et al. (2009) reported that young women in a high intake confederate condition ate more healthy snack foods than those in a low intake confederate condition. Hermans et al. (2009) also examined the modelling effect on the vegetable intake and found that females eat more vegetables when they are exposed to a same-sex peer eating a large amount of vegetables than those who are exposed to a peer eating a small number of vegetables. Such a modelling effect was also observed with unhealthy snack foods. Vartanian et al. (2013) conducted a series of studies to examine the effect of low intake model and high intake model on the consumption of M&Ms. Participants in the low intake condition ate less M&Ms than those who were

in the high intake condition. In some studies, a control condition in which the participant eats alone was included in order to be compared with the confederate condition. Feeney et al. (2011) compared the effect of a live model condition and no model condition on pizza intake. It was found that participants eating with a low intake model ate fewer pieces of pizza than those eating alone.

Besides evidence of modelling on healthy and unhealthy snack food intake, modelling effects during main meals have been investigated. Hermans et al. (2010) examined whether social modelling affects young females' breakfast intake in a naturalistic setting. Participants who modelled a peer eating nothing or a small amount of breakfast ate less than those modelled a peer eating a large amount of breakfast. However, intake in the small breakfast group was not significantly different from intake in the large breakfast group. Research suggests that the modelling effects of main meal intake are weaker than the modelling effects of snack food (Clendenen et al., 1994; Salvy et al., 2011). This may be because main meals are often stable and regular in daily routines. People are clearly aware of what and how much they should eat according to their usual practice (Cruwys et al., 2015; de Castro & Brewer, 1992; Hermans et al., 2012; Horne et al., 2009). Hermans et al. (2012) later used an experimental-observational paradigm to manipulate the modelling food intake (small, standard or large confederates' intake) and found that the high intake model leads to a greater meal intake than the low intake model. However, few studies have considered main meal modelling effects. Social modelling on main meal consumption is less prominent than modelling on snack foods

(Hermans et al., 2010; van den Boer & Mars, 2015; Wong & Mullan, 2009).

Modelling effects on food choices has also been taken into account. A study from Robinson and Higgs (2013) supports the idea that the presence of others can influence food choice even though the effect was limited. In their study, the presence of a confederate choosing predominantly high-energy dense foods resulted in selection of less low-energy dense food compared to a confederate choosing predominantly low-energy dense food or a participant choosing alone. However, there was no parallel modelling effects when considering a 'healthy' confederate instead of an 'unhealthy' one. Moreover, the modelling effects were not found for the high-energy dense food consumption. These data suggest that social models may exert small effects on food choice because it is less malleable than food intake (Pliner & Mann, 2004). Overall, the live confederate models have been found to strongly influence eating behaviour, although consumption of snack foods is more influenced than consumption of main meals. Further research is required to understand the underlying mechanisms of modelling of food intake and choice and whether modelling of food intake is stronger than modelling of food choice in different contexts.

Remote modelling of food intake and selection

Modelling effects have also been observed even when a confederate is not physically present (Feeney et al., 2011; Florack et al., 2013; Leone et al., 2007; Pliner & Mann, 2004; Robinson et al., 2013; Roth et al., 2001; Vartanian et al., 2013). This is called a

remote confederate paradigm in which participants are exposed to information about prior participants' food intake and choices. People try to behave 'normally' even when they eat alone (Roth et al., 2001). In some studies, written information about how much food previous participants have eaten is provided, whereas in other studies, a confederate is presented through social media such as a video (Bevelander et al., 2013; Hermans et al., 2012; Romero et al., 2009). Similar to live modelling, remote modelling allows people to use others' intake as a reference to determine their appropriate amount of eating. Remote models provide norms in a more convenient way as live models are sometimes limited in availability. The use of live model may cause potential confounds to the experiment (Feeney et al., 2011) because factors such as characteristics, attractiveness, body weight and social ability of confederates might affect modelling (Feeney et al., 2011).

A study conducted by Roth and her colleagues (2001) examined the remote modelling of cookie intake among a group of young female students. Participants were influenced by the normative information of others' intake but only when they were eating alone. They ate more if they were led to believe that others have eaten a lot, while they eat less if they are led to believe that others have eaten minimally. However, modelling does not appear when participants are observed by the experimenter while they are eating. It is possible that participants attempt to control the amount of eating in order to make a good impression in such a situation. Pliner and Mann (2004) replicated the modelling effect on snack food intake but not on food choice, and the modelling effect

only occurred when palatable food but not unpalatable food was presented. It was suggested that people have already developed certain preference towards food types. Similar to the example of modelling between snack food and main meal, people usually seek for an appropriate norm to guide eating behaviours that they are unsure about. It is hard to force oneself to eat what one dislikes.

Results from recent studies using remote confederates also provide powerful support to the social modelling on food intake. Robinson et al. (2013) examined the effect of high and low intake norm on the amount of cookie intake. Participants who were exposed to information that others had eaten a lot of cookies ate more cookies than those who were given no information. Similarly, participants who were exposed to information that others had eaten few cookies ate fewer cookies than those in the no norm group. It was suggested that intake norms can increase or decrease food intake, which is consistent with early findings. Vartanian et al. (2013) later replicated the study by using the remote confederate design and found a powerful predictive effect of modelling on people's food intake. They further suggested that social models cause a shift in food intake because of the perception of an appropriate norm, rather than providing a simple descriptive norm in a live-confederate situation. Overall, food intake and even food choice are determined by social influence, in which social modelling particularly plays an important role.

1.4.5. Why do people follow eating norms?

There is a growing debate about why people follow eating norms. To date, studies revealed that modelling occurs in two particular circumstances: when individuals are seeking for information about appropriate behaviour to follow under an uncertain situation; or when individuals are seeking to associate with others in a particular social group.

Early theories proposed that an uncertainty-reduction motive leads people to seek information about appropriate behaviour, particularly in uncertain circumstances (Conger et al., 1980; Deutsch & Gerard, 1955; Feeney et al., 2011; Hermans et al., 2009; Higgs, 2015; Higgs & Thomas, 2016; Pliner & Mann, 2004; Robinson et al., 2013; Robinson & Higgs, 2013; Roth et al., 2001; Vartanian et al., 2013). Referring back to the normative model of eating, the appropriate amount of food depends on how much a companion eats, and is not less than the minimal amount eaten by company, but also does not to exceed the largest amount of food eaten (Herman et al., 2003). However, appropriateness may not always influence intake: main meal intake for which individuals have clear routine of what and how much they should normally consume, are not determined by others' normative influences (Hermans et al., 2010; Wong & Mullan, 2009). However, individuals are more likely to rely on a social norm if they are not sure about how to behave from their personal experience. People are eager to look to useful information uncertain situation such as how much snack food one should eat when one has access to a large amount (Feeney et al., 2011; Hermans et al., 2009; Vartanian et al., 2013).

Besides the primary motive of appropriateness seeking, a secondary motive to explain why people adhere to social norms in the context of eating is affiliation to the group (Bevelander et al., 2013; Cruwys et al., 2015; Higgs, 2015; Robinson et al., 2013; Spanos et al., 2015). Affiliation goals play an important role in shaping modelling eating behaviour. It has been reported that modelling is associated with affiliation in a bidirectional way. That is, modelling can be enhanced if people seek to integrate to others in the group, while affiliation can predict whether modelling occurs or not. Evidence has suggested that norm following achieves the affiliation goal that people desire to be liked, accepted and to belong to their particular social groups (Baumeister & Leavy, 1995; Cruwys et al., 2015).

When individuals identify themselves with a given group they gain social approval from their group members, and conforming to the group norm is a positive experience (Christensen et al., 2007; Klucharev et al., 2009). The eating norm provided by a shared group becomes relevant to a person and the likelihood of following norms increases because the person is more likely to think that the group norm is correct and appropriate (Berger & Heath, 2008; Cruwys et al., 2012; McFerran et al., 2010; Stock et al., 2012). To be more specific, affiliation is associated with norm following because of relevant traits such as empathy and self-esteem or contextual factors (Bevelander et al., 2013; Reno et al., 1993; Robinson et al., 2011). Robinson et al. (2011) reported that participants high in empathy and low in self-esteem conformed more to an eating norm

than did participants with low empathy and high self-esteem. It has also been found that the effect of modelling on eating can be enhanced by sociotropy, which is a strong need for social acceptance (Exline et al.; 2012; Hermans et al., 2009). Therefore, norm following has an adaptive function because following the group norm reinforces a sense of belonging in the social group (Higgs, 2015). The social identity model of social influence also supports the idea that individuals look to similar others or a group they affiliate with, in order to obtain normative information about correct eating behaviours (Cruwys et al., 2015).

1.5 Moderators of normative effects on eating

1.5.1. Individual factors

Several factors have been suggested to moderate whether eating norms are followed or not. Individual characteristics including hunger and satiety, gender, age, body weight, personal traits and habitual eating behaviour as well as social factors, including the type of norms, familiarity and affiliation strength have been examined in previous research (Cruwys et al., 2015; Higgs & Thomas, 2016; Robinson et al., 2012). Croker et al. (2009) tested how sex moderates the effect of normative information on intended healthy food choices. Men but not women were more likely to respond to social norm messages by reporting higher intentions to eat more fruits and vegetables. Women tend to show higher intentions to eat healthily on the whole no matter whether they were exposed to a social norm message. However, Hermans et al. (2010) reported a weaker modelling

effect among men than women. It was suggested that women are more likely to show higher conformity (Bond & Smith, 1996). Women perceive more social and culture pressure to conform to the thin ideal and so may be more responsive to normative influence on dietary behaviours than are men (Garner & Garfinkel, 1980; Grogan et al., 1997; Rodin et al., 1984; Thompson & Stice, 2001). It has been suggested that impression management is a key driver of norm following for women and that women adjust their eating more easily to what they perceive as appropriate behaviour (Herman & Polivy, 2010; Roth et al., 2001; Vartanian et al., 2007).

Traits linked to eating have also been argued to affect the strength of norm following. Recently, Hermans et al. (2013) found low-impulsive women but not high-impulsive women model the food intake of a female confederate. It was argued that low impulsivity allowed participants to pay more attention to others 'eating and to be able to control their own intake. In addition, females who lack self-control may be less able to inhibit the influence of peer norms and so are more responsive to eating norms (Robinson et al., 2015; Salmon et al., 2014). However, there is little evidence that individual differences such as self- regulation status predict norm modelling (Florack et al., 2013). Herman et al. (2005) indicated that personality variables did not contribute to the matching of food intake.

There is limited evidence that hunger and satiety moderate social eating (Goldman et al., 1991; Herman et al., 2003). Only one previous study has reported that modelling

was only apparent in men who showed high pre-experimental hunger (Hermans et al., 2010). Moreover, Chistakis and Fowler (2007) found that participants' dietary restraint levels did not moderate the likelihood of conforming to others' food intake.

There is some evidence that the weight status of the confederate or participant moderates the degree of modelling in some previous studies. For instance, Hermans et al. (2008) found that normal-weight participants adjusted their food intake to be similar to the normal-weight confederate model, but not to the slim model, supporting the idea that participants model the intake of similar others. Normal weight participants were not affected by an obese confederate model (Johnston, 2002; McFerran et al., 2009). Furthermore, obese participants modelled food intake only in the presence of an obese confederate (de Luca & Spigelman, 1979).

Habitual eating behaviour has been reported to moderate the effect of normative message on eating (Robinson et al., 2013; Schultz et al., 2007). For example, low habitual fruit and vegetable consumers are more motivated to conform to normative information about fruit and vegetable intake, while high habitual consumers are less motivated, possibly due to the fact that they have already developed healthy eating habits (Robinson et al., 2013). It has been suggested that whether an individual is already adhering to a norm may determine the norm effects on dietary behaviours.

Overall, few moderators have been identified and the effect of modelling is robust

(review: Cruwys et al., 2015; meta analytic review: Robinson et al., 2014; Vartanian et al., 2015; review: Stok et al., 2016), although it has been suggested that habitual consumption of specific food types acts as a moderator of the relation between informational norms and people's food consumption. It is important to note that perceived similarity between participant and confederate is not only about body weight, age or gender and so to take broader view, the role of perceived shared group membership will be discussed in detail in the section of social factors.

1.5.2. Social Identity

As mentioned previously, modelling of food intake can be enhanced when individuals and confederates are similar in some aspects such as gender, body weight, appearance, age or even identity. A modern social-psychological theory of social influence suggests that others' behaviours are accepted and followed if they are seen as similar to the self and the information is self-relevant (Cruwys et al., 2015). This brings in the idea of similarity to the concept of self-categorization and social identity. Self-categorization theory (Oakes et al., 1994) explains individual and group behaviour and the relationship between them. It has been argued that once people self-categorize themselves more as a member of a social group rather than a personal self (which refers to a 'depersonalization' process), their social identity becomes activated, and the group-based behaviours or standards are seen as appropriate (Turner et al., 1987). It has been further proposed that how people identify with the social group is associated with their

performance in that group. Farrow and Tarrant (2009) also indicated that perceptions of ingroup's social consensus are related to eating-related behaviour. What is most important is that the need to affiliate influences the quality of social interaction, and thus may influence the effect of social norms on eating behaviour (Cruwy et al., 2015; Robinson et al., 2013; Higgs, 2015). Greater matching to eating companions or norms occurs when people attempt to ingratiate with their social group to maintain social harmony (Herman et al., 2003). On the contrary, a norm might be rejected and failed to be followed if the norm comes from an 'out-group' or if people do not wish to associate with such a group (Berger & Heath, 2008; Berger & Rand, 2008). In other words, social identity might be one of the most important factors that moderates the normative influences on dietary patterns.

1.5.3. Theoretical Perspective on social identity

Before moving on to the evidence of how social identity moderates the norm following effects on eating, different types of social identity should be discussed. Tajfel and Turner (1979) proposed that a person's concept of self is derived from the social group to which the person belongs. Social groups provide people a sense of social identity, and identity brings people a sense of belonging and a source of self-esteem and a framework for socializing (Tajfel & Turner, 1986). Social identity theory outlines the cognitive processes by which a person becomes part of an in-group or an out-group (Tajfel & Turner, 1979). Firstly, a person defines a sense of self at an individual level,

such as who he/she is and what is most important to him/her. On the basis of personal identity, people categorize themselves into groups to obtain a greater sense of who they are. This process involves deciding the group to which one belongs. Secondly, people attempt to adapt to the identity of the group they select. For example, an individual who categorizes him/herself as a college student, then acts in the way that he/she believes all other college students should act. Conforming to what other group members do results in an increase in self-esteem and an enhancement of social identity. Thirdly, once someone has categorized identified with a group they tend to compare their group with other groups through a process of social comparison. It is important that the distinction between in-group and out-group is clearly stated. In order to maintain self-esteem and in-group status, group members discriminate against an out-group for example by remembering more positive information about their own group but looking at more negative images of the out-group (Tajfel & Turner, 1979) (Figure 1.1).

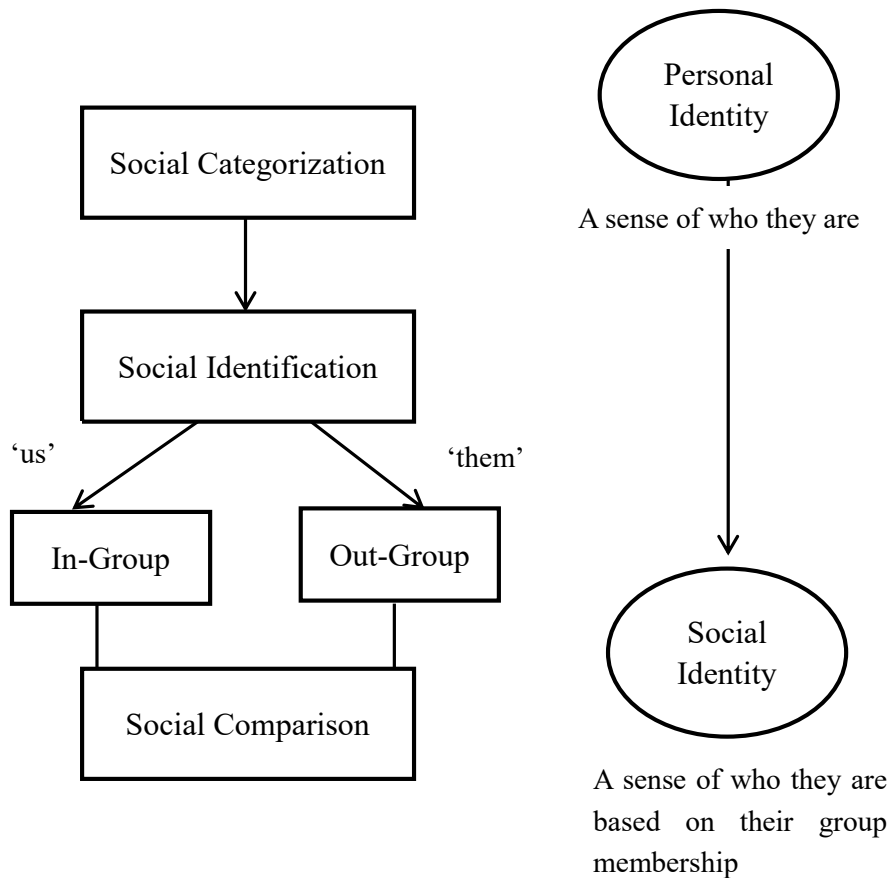


Figure 1. 1. Social Identity Theory-Cognitive Process (adapted from ‘Social Identity Theory’ by Tajfel & Turner, 1979)

In the real world, people identify themselves in relation to others based on what they have in common. People identify themselves in terms of different roles in the social group ranging from race, gender, ethnicity, country origin, culture, social classes, education status, and field of work, etc. More generally speaking, gender identity is one of the most fundamental categories, which interacts with other types of social identity (Deaux, 2001). Three methodological approaches have been proposed to define identity types (Korostelina, 2007). The ideographical approach explains types of identity based on the memberships across groups (e.g. family, professional or national). The component approach is related to the analysis of elements within social identity (e.g.

cognitive and emotional, Klink et al., 1997; self-categorization, group self-esteem and group loyalty, Ellemers et al., 1999). Deaux (1996) highlighted five particular types of social identification based on the taxonomical approach: ethnic and religious identities (e.g. Asian American), political affiliation (e.g. Feminist), vocations and avocations (e.g. Psychologist), personal relationships (e.g. Parent) and stigmatized groups (e.g. Homeless person). Referring back to the theory, the concept of social identity is linked to intergroup behaviour (Tajfel & Turner, 1979; 1986). According to Self-Categorization Theory, when people identify as a member of a social group, they tend to see themselves as similar to others. The depersonalization process enables people to motivate themselves to be a prototype of a certain group, and then perform similar as what other members in the group do (Reicher et al., 1995; Turner et al., 1987). Overall, Social Identity Theory and Self-Categorization Theory have both made theoretical contributions to clarify the underlying social psychological processes that are related to social identity and intergroup behaviour. However, there is a need to test how different types of social identity help explaining how people perceive group norm, and how they actually behave according to the norm.

1.5.4. Research evidence of moderation effect

In modelling studies, the confederate affects how much a participant eats by proving a norm of appropriate intake. However, whether participants follow the eating norm and to what extent participants follow the eating norm depends on the relevance of the norm

(Berger & Heath, 2008; Cruwys et al., 2012; Cruwys et al., 2015; Higgs & Thomas, 2016; McFerran et al., 2010; Stock et al., 2012;). As discussed previously, the reason that people follow normative guidance is due to the uncertainty of how to behave (Conger et al., 1980; Deutsch & Gerard, 1955; Feeney et al., 2011; Hermans et al., 2009; Leone & Pliner, 2007; Pliner & Mann, 2004; Roth et al., 2001) and how eager people would like to fit in the social group (Bevelander et al., 2013; Spanos et al., 2015; Stok et al., 2012; Stok et al., 2014).

Evidence suggests that eating norms are more likely to be accepted if individuals and norm providers are similar either in terms of gender, (Conger et al., 1980), body weight (de Luca & Spigelman, 1979; Hermans et al., 2008; Johnston, 2002; McFerran et al., 2009; Rosenthal & McSweeney, 1979), age (Hendy & Raudenbush, 2000; Tarrant et al., 2014) or social relationship (Howland et al., 2012; Salvy et al., 2007). Hermans et al. (2008) examined whether the physical appearance of a same-sex model affected the imitation of eating behaviour in a naturalistic environment. They found that normal-weight female participants model eating behaviour only when their eating companion is also normal weight, but not when their eating partner is seen as underweight. Consistent with those findings, McFerran et al. (2009) reported that the confederates' body type influences how much participants model food consumption. The modelling effect is greater if the confederate is relatively thin rather than heavy. If a thin person eats minimally this might cause others around eat less. Similarly, a heavy person, rather than a thin person who eats a lot might lead to a larger amount of meal consumption for

others around. Taken together, these data suggest that perceived similarity is a possible moderator of modelling effects on eating.

Perceived shared membership, as one of possible moderators on norm following has also been investigated in previous research. Louis et al. (2007) reported that student identity interacts with norms on healthy eating intentions. Interestingly, Berger and Rand (2008) reported that undergraduate students choose fewer unhealthy food if they are told that postgraduate students consume more junk food on campus. That is probably because undergraduate students do not regard the postgraduate group as relevant to them, therefore they behave oppositely in order to distinguish themselves from the out-group. Cruwys et al. (2012) reported that modelling occurred when the model shared the same identity as the participant, but did not occur when the model was from an out-group, suggesting that how strongly people identify with a norm referent group moderates the effect of an eating norm (Stok et al., 2014). Participants who strongly identify themselves as a typical member of social group are more likely to behave as the eating norm suggests (Stok et al., 2014). The perceived group membership possibly enhances the modelling effect because in-group members are seen as more appropriate models that provide more reliable normative information compared to those who are out-group members (Higgs, 2015).

To date, a considerable amount of research has attempted to identify moderators that might affect the modelling effects on eating, but most studies have failed to detect the

moderation effects (Cruwys et al., 2015). There is some limited evidence that social identity may moderate the effect of social norms on eating but further research is required to establish the precise role played by social identity. Therefore, the present thesis will focus on how social identity interacts with social normative influence on human eating behaviour.

1.6 Thesis motivation and hypothesis

Based on the literature reviewed here, it is argued that social factors are a powerful influence on eating behaviour. Compelling evidence includes the effect of (perceived) social norms on food intake and food choice (Burger et al., 2010; Robinson et al., 2013, 2014), live social modelling of food intake (Feeney et al., 2011; Hermans et al., 2009; Vartanian et al., 2013), and remote social modelling and food intake (Pliner and Mann, 2004; Roth et al., 2001). Factors such as the strength of social identity may moderate the effects of social context on eating behaviour (Cruwys et al., 2012; Stok et al., 2014) but evidence here is more limited. This thesis aims to explore the role of social norms in adults' eating behaviour and the moderation effect of social identity in the relationship between normative information and eating behaviour.

The thesis focuses on four research questions (Figure 1.2). The first question is: Do people perceive correct and appropriate social norms of others' eating behaviour? If so, do the perceived eating norm predicts food consumption? Do perceived eating norms

change across time? Is there a gap between perceived norm and actual norm? Are there any misperceived norms of others' food intake? Chapter 2 will address those issues in investigating the association between norm perception and self-reported food intake (both healthy and unhealthy food items) among a student population. We hypothesized that perceived eating norms predict students' self-reported daily food consumption.

The second question is: do social norms drives people's intention to eat either healthily or unhealthily? Social normative messages have been reported to influence people's food intake, but mostly among the students. Does this effect extend to a community-based sample? Rather than measuring actual eating, what is the role of norm message on eating intentions? Those questions will be assessed in Chapter 3 in an online study. We hypothesise that normative message of others' eating behaviour will predict people's intentions to eat healthy or unhealthy food in context community sample.

The third question concerns the influence of social identity on modelling of food intake. It is hypothesised that the effect of modelling will be greater when people identify strongly with the referent group. Chapter 4 will introduce a laboratory-based study on the moderating effect of student identity on the modelling of actual food intake. It is assumed that people are more likely to follow an eating norm if they consider themselves more closely connected to the norm referent group than when they feel weakly connected with the norm referent group.

The fourth question will be based on the findings from first three studies. Evidence suggests that norm message affect what and how much individuals choose to eat. In addition, social identification, as one of the most powerful moderators, possibly predicts better norm following. Is there any change in people’s response to social norm if their social identity is made to be salient? The effect of manipulation of social identity on the effectiveness of an eating norm will be explored in Chapter 5. We hypothesise that people are more responsive to norm messages after priming their identification with the social group. A general discussion of findings followed by implications for further research will be included in Chapter 6.

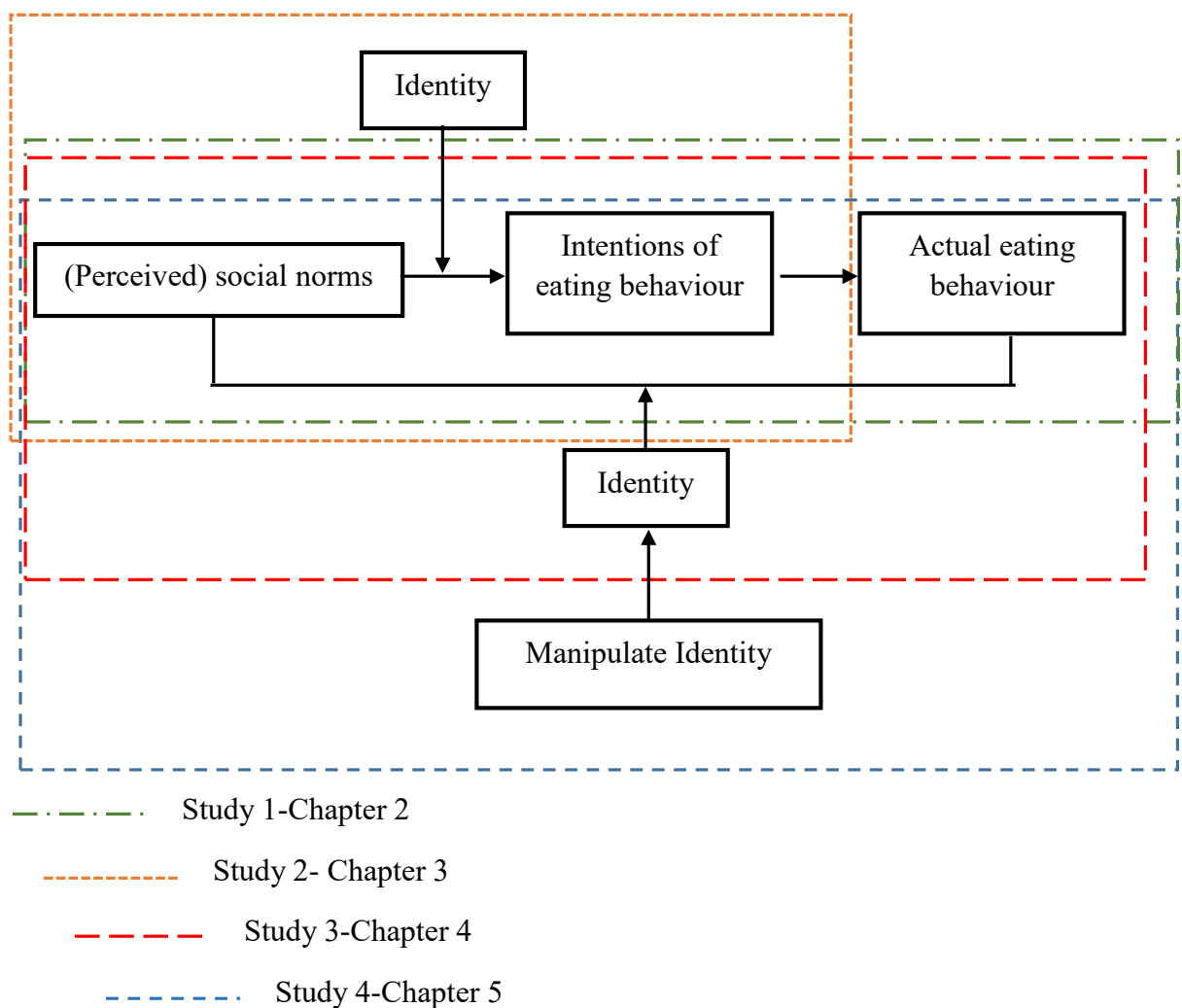


Figure 1. 2. Outline of studies in the thesis

CHAPTER 2: RELATIONSHIPS BETWEEN CHANGES IN PERCEIVED SOCIAL NORMS AND SELF-REPORTED FOOD AND DRINK INTAKE AMONG UNIVERSITY STUDENTS ACROSS AN ACADEMIC YEAR

2.1. Background

Research to date has reported that students transitioning to university experience a variety of lifestyle changes including: increased social eating activities, more alcohol drinking occasions, altered dietary behaviours, and a decline in physical activity (Anderson et al., 2003; Butler et al., 2004; Crombie et al., 2009; Vella-Zarb & Elgar, 2009). Students report low consumption of foods, such as fruit and vegetables, and high consumption of energy dense snack foods (AL-Otaibi, 2014; Alsunni & Badar, 2015; Dodd et al., 2010; Keller et al., 2008; Khalid et al., 2011; King et al., 2007; Musaiger et al., 2011). Therefore, attempts have been made to improve the diet of young people (Laska et al., 2012; Nelson et al., 2008). There is evidence that behaviour change techniques such as motivational strategies, behavioural counselling, feedback and self-monitoring may be effective in encouraging healthy eating and physical activity (Dombrowski et al., 2010; Michie et al., 2009; Michie et al., 2011). Nevertheless, the levels of healthy food intake are still below the recommended guidelines from the National Health Service (Health Survey for England, 2013). Adults aged between 16 and 24 consume the lowest level of portions of fruit and vegetables and are least likely to consume the recommended 5 portions of fruit and vegetables per day, compared to

other age groups (Health Survey for England, 2013). Therefore, alternative strategies are needed to improve the diet of young people.

Evidence is accumulating to suggest that behavioural based interventions may be more beneficial if they target social networks. For example, obesity has been reported to spread within social networks, possibly via the influence of social norms on eating behaviour (Christakis & Fowler, 2007). Social norms are defined as the rules and standards that are accepted by a certain group and can be used to guide behaviour. Several theories have emphasised the influence of social norms on behaviour including the Focus Theory of Normative Conduct (Cialdini et al., 1990; Perkins & Berkowitz, 1986), the Theory of Planned Behaviour (Ajzen, 1985; Ajzen, 1991), Social Cognition Theory (Bandura, 2001) and the Theory of Normative Social Behaviour (Rimal & Real, 2005). Social norms are categorized into two main types: descriptive norms, which refer to beliefs about what other people do, and injunctive norms, which refer to beliefs about what is approved by others (Cialdini et al., 1990).

The impact of social norms on attitudes and behaviours has been explored in a variety of studies including cancer screening intentions (Smith-McLallen & Fishbein, 2008), alcohol consumption (Perkins & Berkowitz, 1986; Perkins, 2002), the use of tobacco (Ali & Dwyer, 2009; Etcheverry & Agnew, 2008; Mead et al., 2014) and promoting household energy conservation (Schultz et al., 2007). Evidence suggests that drinking behaviour is related to students' personal attitudes toward drinking and perceptions

about the prevalence of drinking (Chawla et al., 2007). The more consistency there is between individual attitudes and the group norm, the more likely students are to engage in drinking behaviour (Perkins & Berkowitz, 1986).

In recent years, much progress has also been made in exploring the influence of social information on dietary behaviours. There is robust evidence that people tend to follow others' dietary choice as a guide to what they should eat (e.g. Burger et al., 2010; Hermans et al., 2012; Lally et al., 2011; McFerran et al., 2010; Pelletier et al., 2014; Perkin et al., 2010; Robinson et al., 2013; Robinson et al., 2014; Stok et al., 2014; Vartanian et al., 2013). For instance, there is evidence that peer social norms predict both intended and actual fruit intakes (Stok et al., 2012). It is assumed that perceived eating norms predict the frequency of food consumption such that individuals who perceive that others frequently eat a certain type of food consume the same type of food more frequently than those who do not perceive such an intake. For instance, when people believed that other participants selected predominately unhealthy snack foods, their subsequent unhealthy snack food consumption increased significantly (Burger et al., 2010). In addition, perceived descriptive peer norms have been shown to affect people's food intake and choice in lab studies. For instance, exposing students to a descriptive social norm suggesting that most students consume less junk food than they might realize, led to a significant decrease in high calorie snack food consumption (Robinson et al., 2013). Conversely, exposing students to a descriptive social norm message suggesting that most other students consume plenty of fruit and vegetables

resulted in a significant increase of fruit and vegetable intake (Robinson et al., 2014).

The effect of descriptive social norms has been found to be moderated by participants' habitual food consumption (Robinson et al., 2014). Low usual consumers but not high usual consumers of fruit and vegetables increased their intake after exposure to the norm that most other students consume healthy food regularly (Robinson et al., 2014), although such a habitual intake effect was not consistently observed in some other studies (Robinson et al., 2013; Thomas et al., 2016). It was also demonstrated that descriptive social norms are effective to enhance broccoli intake among low habitual consumers even 24 hours after exposure to the norm (Thomas et al., 2016). Low consumers are more motivated to change their eating behaviour to come in line with the norm, while high consumers may already be adhering to the norm presented.

Previous research has suggested that descriptive social norms may be more effective in promoting healthier eating than are injunctive norms (Robinson et al., 2014; Stok et al., 2014). It may be the case that descriptive norms involve low levels of cognitive activity and thus are more influential than injunctive norms, which involve more complicated cognitive processes (Jacobson et al., 2011; Mollen et al., 2013). Alternatively, individuals may demonstrate psychological reactance to injunctive norms, meaning that they do not comply when they are told what they should or should not do (Brehm, 1966; Hong et al., 1944). Further investigation of both types of norm is required to understand better their influence on eating behaviour.

A broader question concerns the mechanism by which exposure to social norms affects behaviour. One possibility is that exposure to social norms corrects the misperceptions of other people's eating behaviour (Anderson, et al., 2009; Moreira et al., 2009). For instance, there is evidence that misperceived unhealthy sugar-sweetened beverage consumption contributes to an excess calorie intake (Perkins et al., 2010). The same might be true of energy dense foods; we might misperceive that others consume these foods frequently and this perception influences our own consumption. Misperceptions may be especially problematic among college students, as their social distance is much closer than other social groups (Bourgeois & Bowen, 2001).

To date, studies have primarily used cross-sectional designs and observed a positive association between perceived peer eating norms and consumption of fruits, vegetables, snack and fast foods, and sugar-sweetened beverages (Ball et al., 2010; Pelletier et al., 2014; Robinson et al., 2016). One recent longitudinal study reported that among university students, believing that one's peers frequently consumed cakes/pastries was associated with an increased frequency of consumption of these foods over time (Jones & Robinson, 2017). We also found no association for other food/drink items. However, whether eating norm perceptions (or misperceptions) are causally related to a wider variety of dietary intake, and whether changes in norm perception are related to changes in self-reported intake has yet to be fully investigated.

Therefore, the aim of the present study was to conduct a longitudinal investigation of the relationship between changes in perceived social norms and self-reported food intake among university students over 12 months of an academic year. It was hypothesized that there would be a misperception of food consumption among college students, whereby students would hold more negative perceptions of their peers' consumption compared to their own (i.e. greater consumption of junk food and lower consumption of fruit and vegetables by their peers). It was further hypothesized that changes in norm perception and baseline norm perception would predict students' self-reported intake over 12 months. We assessed both injunctive and descriptive norms. Finally, we hypothesised that any relationships between norm perceptions and reported intake might be moderated by levels of habitual intake. That is, the increase in norm perception may lead to an increase in self-reported food intake, but this might be more likely among people who are low habitual consumers.

2.2. Methods

Participants

Participants were recruited from the University of Birmingham. The initial sample consisted of 673 undergraduate students (17% male). Data collection at baseline took place during September 2014 and follow-up assessments during February 2015 and September 2015. At the 3-month follow up, 389 individuals (13% male) completed the questionnaires and at 12-months 268 individuals (11% male) completed the

questionnaires. Therefore, the retention rate was 41%. The study was advertised as a “Student Lifestyle Study”. Participants were informed that the aim of the study was to investigate undergraduate student lifestyle including their eating behaviours and physical activity at different time points across an academic year. Participants completed an online questionnaire at three time points: at the beginning of the academic year and 3- and 12-months later. The length of the study recruitment at each time point was one month. Participants were given the opportunity to win an Amazon voucher during each time point of the study (£50 Amazon voucher at the first two time points and a £200 Amazon voucher at the final time point). Psychology students were able to choose the option of receiving course credits for participation. The study was posted on university web pages, a study research participation portal, Facebook, and there was further recruitment via email and posters on campus. Ethical approval was granted by the Science, Technology, Engineering and Mathematics Review Committee at The University of Birmingham.

Measures

Demographics

Data were collected via the internet using the online survey platform Qualtrics. Participants first provided demographic information such as age, gender, self-reported height and weight, year of study, student status (international or non-international student), nationality, ethnicity and family socioeconomic status (e.g. would you describe your family as ‘low income, middle income, upper-middle income, high

income or prefer not to answer).

Intake measures

Participants self-reported their habitual consumption of vegetables, fruit, junk food and sugar-sweetened beverages at each time point. Participants were asked to self-report the intake of food items (e.g. How many servings of vegetables do you normally eat a day?) (used by Robinson et al., 2014; Thomas et al., 2016) (see Appendix 7).

Norm perceptions

Students' perceptions of both (1) descriptive and (2) injunctive norms of other students' food and drink intake (vegetable, fruit, junk food and sugar-sweetened beverage) were measured with questions such as: (1) 'How many servings of vegetable do you think a UoB (University of Birmingham) student eats a day?' and; (2) 'How many servings of vegetables do you think a UOB student should eat a day?'. The number of servings of food items were recorded. This measure was derived from a previous longitudinal study (Jones & Robinson, 2017) (see Appendix 9).

Additional measures

We collected data on numerous variables and the full set of measures included at baseline is described below. For the present report, we focused on the dietary intake measures. In addition to the measure of self-reported food intake, we also measured intentions to eat food (e.g. How many servings of vegetables do you try to eat a day?)

and enjoyment of eating those kinds of food using a visual analogue scale (e.g. How much do you enjoy eating vegetables from not at all to very much?). The perception of other students' liking of food were also measured on a visual analogue scale. For both sets of liking questions, these scales ranged from 0 (not at all) to 100 (very much). There were also measures of participants' language preference (to check participants' comprehension of questionnaires, Cronbach's alpha= 0.96) (see Appendix 8), physical activity levels (International Physical Activity Questionnaire – IPAQ (Craig et al., 2003); to match the cover story that the study was about the general lifestyle of students.

2.3. Analysis Strategy

To examine the differences between self-reported food intake and perceived norms at all three time points, paired sample t-tests corrected for multiple comparisons were conducted. In addition, correlations between habitual food intake and self-reported follow-up food intake were assessed to determine whether habitual food intake should be included as an independent variable in the following analysis. To assess the association between perceived norms and self-reported consumption behaviour, we conducted regression analyses using PROCESS in SPSS. Changes in perceived norms (descriptive or injunctive norms in separate models) were calculated by using the differences between baseline and 3-months and between baseline and 12-months. We entered baseline habitual food intake and changes in social norm perceptions of others' food intake from baseline to follow up as independent variables. We also controlled for

baseline perceived norms. Age, gender and BMI were found to be associated with dietary behaviour, hence they were included as covariates in the models. The dependent variables were self-reported intake at 3-months and 12-months.

2.4. Results

Participant Characteristics

The study population was mainly female, with an average age of 19.0 (SD=1.1) mean age of 19.0 years (SD=1.1) and an average BMI of 22.0 (SD=3.6). The sample was predominantly British (87%) and Caucasian (73%). Most participants (74%) considered their family income status as either middle or upper middle incomes. The detailed self-reported socio-demographic characteristics from baseline to follow-up are shown in Table 2.1.

Table 2. 1. Demographic Characteristics of the sample at each time point.

	Baseline (N=673)	Three Months (N=389)	Twelve Months (N=268)
Age (years)	19.0 (1.1) Range=17-24	19.2 (1.0) Range=18-25	19.5 (1.0) Range=18-23
Gender	Male=114 (17%); Female=559 (83%)	Male=50 (13%); Female=339 (87%)	Male=29 (11%); Female=239(89%)
BMI	22.0 (3.6)	22.0 (3.5)	22.0 (3.2)
Race	White=492 (73%) Mixed ethnic=27	White=302 (78%) Mixed ethnic=14	White=194 (72%) Mixed ethnic=13

	(4%) Asian=117 (17%) Black=24 (4%) Other ethnic=13 (2%)	(4%) Asian=54 (14%) Black=11 (3%) Other ethnic=7 (1%)	(5%) Asian=44 (16%) Black=10 (4%) Other ethnic=7 (3%)
Family Socioeconomic Status	Low income=93(14%) Middle=277 (41%) Upper-middle=221(33%) High income=36(5%) No answer=45 (7%)	Low income=52(13%) Middle=170 (44%) Upper-middle=125 (32%) High income=26 (7%) No answer=15 (4%)	Low income=30 (11%) Middle=115 (43%) Upper-middle=86 (32%) High income=18 (7%) No answer=19 (7%)

Perceived eating norms and food consumption across an academic year

Descriptive Norms: Perceived descriptive norms for vegetable intake were significantly lower than self-reported intakes at baseline ($t(665)=8.01, p<0.001$), 3-months ($t(369)=-4.69, p<0.001$) and 12-months ($t(264)=-4.1, p<0.001$). However, norms for junk food were significantly higher than self-reported junk food intakes for baseline ($t(663)=-27.48, p<0.001$), 3-months ($t(369)=16.69, p<0.001$) and 12-months ($t(265)=18.50, p<0.001$). Perceived descriptive sugar-sweetened beverage norms were also significantly higher than self-reported sugar-sweetened beverage consumption at baseline ($t(666)=-30.76, p<0.001$), 3-months ($t(365)=22.88, p<0.001$) and 12-months ($t(260)=20.54, p<0.001$). Norms for fruit were significantly higher compared to self-reported fruit intake, but only at 3-months ($t(369)=3.03, p=0.003$) and 12-months of the

study ($t(264)=2.16, p=0.032$) (Table 2.2). Hence, students generally perceive that their peers eat fewer servings of vegetables but more servings of junk food fruit and sugar-sweetened beverages than they do.

Injunctive Norms: Perceived injunctive vegetable norms were significantly higher than vegetable intake at baseline ($t(665)=29.66, p<0.001$), 3-months ($t(370)=21.19, p<0.001$), and 12 months ($t(264)=18.33, p<0.001$). In addition, perceived norms for fruit were significantly higher than habitual fruit intake at baseline ($t(660)=31.19, p<0.001$), 3-months ($t(369)=20.57, p<0.001$), and 12-months ($t(265)=21.02, p<0.001$). In contrast, norms for junk food were significantly lower than junk food consumption at baseline ($t(659)=-15.60, p<0.001$), 3-months ($t(366)=-8.46, p<0.001$) and 12-months ($t(263)=-9.38, p<0.001$). A similar pattern was also observed for sugar-sweetened beverages at baseline ($t(660)=-3.92, p<0.001$), and 12 months ($t(262)=-2.17, p=0.031$) (Table 2.2). Overall, students think others should eat more fruit and vegetables than they think others actually do whereas they think students should be eating less junk food and sugar-sweetened beverages than they perceive the norm to be. In addition, perceived descriptive norms and perceived injunctive norms differed at all time points ($p<0.001$) (see more results in Appendix 20).

Table 2. 2. Norm perception and self-reported servings of food intake between baseline, 3-months and 12-months across academic year.

	Baseline			3-months			12-months		
	Perceived Descriptive Norm	Perceived Injunctive Norm	Self- reported Intake	Perceived Descriptive Norm	Perceived Injunctive Norm	Self- reported Intake	Perceived Descriptive Norm	Perceived Injunctive Norm	Self- reported Intake
Vegetable	1.8 (0.9) ** +++	3.7 (1.3) ***	2.1 (1.3)	1.9 (0.9) **	3.8 (1.2) ***	2.2 (1.2)	1.9 (0.9) **	3.8 (1.1) ***	2.2 (1.2)
Fruit	1.9 (1.0) +++	3.5 (1.3) ***	1.8 (1.1)	2.0 (1.0) **	3.5 (1.2) ***	1.7 (1.2)	2.0 (0.9)	3.6 (1.2) ***	1.8 (1.2)
Junk food	3.1 (1.7) ** +++	0.8 (0.8) ***	1.5 (1.3)	3.0 (1.6) **	0.9 (0.8) **	1.4 (1.2)	3.1 (1.5) **	0.8 (0.8) ***	1.4 (1.2)
Sweetened Beverages	3.3 (1.6) ** +++	1.1 (0.9) ***	1.3 (1.4)	2.8 (1.3) **	0.9 (0.7)	1.0 (1.1)	2.7 (1.2) **	0.7 (0.7) ***	0.8 (1.0)

p<0.01, *p<0.001 Comparisons between perceived norm and self-reported intake at each time point.

+++p<0.001 Comparisons between perceived descriptive and injunctive norms at each time point.

Habitual Food Consumption: This measure at baseline was moderately correlated with self-reported food intake at 3-months and 12-months (Table 2.3).

Table 2. 3. Correlations between baseline food intake and self-reported follow-up food intake.

	Baseline vegetable	Baseline fruit	Baseline junk food	Baseline beverage
Vegetable-3 months	r=.3**			
Fruit-3 months		r=.2**		
Junk food-3 months			r=.3**	
Beverage-3 months				r=.3**
Vegetable-12 months	r=.6**			
Fruit-12 months		r=.4**		
Junk food-12 months			r=.6**	
Beverage-12 months				r=.4**

**p<0.01

Changes in self-reported consumption over time

There was variation in self-reported consumption over time with 31.8% of participants reporting consuming the same amount of vegetables from baseline to follow at 3 months, while 30.7% reported a decrease in consumption and 37.5% reported an increase in consumption (Table 2.2). For fruit consumption, 34.1% of participants reported the same level of consumption from baseline to 3 months follow up, with 33.5% reporting a decrease and 32.4% reporting an increase. For junk food consumption, 37.9% participants did not report any change in the amount of junk food intake from baseline to 3 months follow up, while 34.3% participants reported a reduction and 27.8% participants reported an increase in their intake across time. For sugar-sweetened

beverage consumption, 39.6% of participants reported the same level of consumption from baseline to follow up, while 38.5% reported a decrease and 21.9% reported an increase.

For vegetable consumption between baseline and follow up at 12 months, 38.1% of participants reported similar consumption, with 21.8% reporting a decrease and 40.1% reporting an increase. For fruit consumption, 38.2% of participants had the same amount of consumption from baseline to follow up, with 33.3% decreasing and 28.5% increasing in consumption. For junk food intake, 37.6% of participants did not change the amount of consumption from baseline to follow up, while 40.8% of participants reduced their junk food intake and 21.6% of participants increased their junk food intake. For beverage consumption, 44.5% of participants remain the same amount of consumption between baseline and follow up, and 43.7% of participants reduced their beverage intakes and 11.8% of participants increased their beverage intakes.

Descriptive norms

Predicting vegetable consumption at 3-months

All collinearity diagnostics were in the tolerable range (VIFs<1.26). The regression model for vegetable consumption at 3-months was significant ($F(7,344) = 9.04$, $p < 0.001$, $R^2 = 0.14$). Habitual vegetable intake ($b = 0.29$, $t = 5.06$, $p < 0.001$), changes in perceived vegetable norms between baseline and 3-months ($b = 0.21$, $t = 2.86$, $p < 0.01$), and perceived baseline vegetable norm were significant predictors of vegetable

consumption at 3-months ($b=0.19$, $t=2.27$, $p<0.05$). The interaction between habitual vegetable intake and changes of vegetable norms from baseline to follow up was not significant ($b=-0.10$, $t=-1.93$, $p=0.054$).

Predicting fruit consumption at 3-months

All collinearity diagnostics were in the tolerable range ($VIFs<1.26$). The model for fruit consumption was significant ($F(7,341)=2.58$, $p<0.05$, $R^2=0.07$). Only habitual fruit intake significantly predicted the self-reported fruit intake at 3-months ($b=0.23$, $t=3.56$, $p<0.001$). Neither baseline perceived fruit norm ($b=0.12$, $t=1.33$, $p=0.18$) nor change in perceived fruit norm ($b=0.06$, $t=0.76$, $p=0.45$) predicted self-reported fruit consumption at 3-months. There was no interaction between change in perceived fruit norm and habitual fruit intake for fruit consumption at 3-months ($b=0.06$, $t=0.80$, $p=0.42$).

Predicting junk food consumption at 3-months

All collinearity diagnostics were in the tolerable range ($VIFs<1.42$). For junk food consumption, the regression model was significant ($F(7,343)=4.15$, $p<0.001$, $R^2=0.09$). Both baseline junk food norm ($b=0.12$, $t=2.00$, $p<0.05$) and habitual junk food intake ($b=0.16$, $t=2.31$, $p<0.05$) were significant predictors of self-reported junk food consumption at 3-months. The change in junk food norm did not predict follow up junk food consumption at 3-months ($b=0.06$, $t=0.91$, $p=0.36$) and there was no significant interaction between change in perceived junk food norms and habitual junk food intake for self-reported junk food consumption ($b=0.07$, $t=1.30$, $p=0.20$).

Predicting sugar-sweetened beverage consumption at 3 months

All collinearity diagnostics were in the tolerable range (VIFs<1.72). The regression model was significant ($F(7,341) = 4.25, p < 0.001, R^2 = 0.11$). Baseline beverage consumption ($b = 0.19, t = 3.60, p < 0.001$) and change in perceived beverage norms ($b = 0.12, t = 2.44, p < 0.05$) were significant predictors for 3-months' beverage consumption. The baseline perceived norm of how many beverages other students consume per day did not predict the number of beverages consumed at 3-months ($b = 0.08, t = 1.42, p = 0.16$). Furthermore, there was no interactive effect between baseline habitual beverage consumption and change in beverage norms for beverage consumption at 3 months ($b = 0.01, t = 0.37, p = 0.71$).

Table 2. 4. The association between perceived descriptive norm and food and drink consumption in university students at follow up at 3 months.

Table 2.4:

	Vegetable		Fruit		Junk food		Sweetened beverage	
	B(SE)	95% CI	B(SE)	95% CI	B(SE)	95% CI	B(SE)	95% CI
Age	.03(.07)	-.10 - .15	-.05(.06)	-.17 - .06	-.03(.07)	-.16 - .10	-.04(.06)	-.14 - .07
Gender	.04(.17)	-.29 - .37	-.27(.20)	-.67 - .13	-.05(.18)	-.40 - .29	-.31(.18)	-.67 - .04
BMI	-.02(.02)	-.02 - .05	.01(.02)	-.02 - .05	-.02(.02)	-.06 - .02	.03(.02)	-.01 - .06
Baseline norm	.19(.08) *	-.03 - .35	.13(.10)	-.06 - .31	.12(.06) *	.00 - .24	.08(.05)	-.03 - .19
Habitual intake	.29(.06)	.18 - .40	.23(.07)	.10 - .36	.16(.07) *	.02 - .30	.19(.05) ***	.09 - .29
	***		***					
Norm change	.21(.07) **	.07 - .35	.06(.08)	-.09 - .21	.06(.07)	-.08 - .20	.12(.05) *	.02 - .22
Habitual intake *	-.10(.05)	-.20 - .00	.06(.07)	-.08 - .20	.07(.05)	-.03 - .17	.01(.03)	-.05 - .07
Norm change								
	R^2 -Change	F Change	R^2 -Change	F Change	R^2 -Change	F Change	R^2 -Change	F Change
	.01	3.74	.00	0.64	.01	1.68	.00	.14

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; R^2 -Change: indicates R-square increase due to interaction

Predicting vegetable consumption at 12 months

All collinearity diagnostics were in the tolerable range (VIFs<1.32). The final regression model for vegetable consumption was significant ($F(7,239)=15.11, p<0.001, R^2=0.40$). Habitual vegetable consumption ($b=0.56, t=6.99, p<0.001$) and change in vegetable norms ($b=0.43, t=4.55, p<0.001$) were significant predictors for self-reported vegetable intakes at 12 months. However, perceived descriptive norm at baseline was not a significant predictor of follow-up vegetable consumption at 12-months ($p=0.086$). There was no significant interaction effect between change in vegetable norm and habitual vegetable on self-reported vegetable intakes at 12 months ($b=0.10, t(240)=1.44, p=0.15$).

Predicting fruit consumption at 12 months

All collinearity diagnostics were in the tolerable range (VIFs<1.40). The regression model for fruit consumption was significant ($F(7,238)=11.97, p<0.001, R^2=0.27$). A significant association between baseline fruit intake and self-reported fruit intake at 12 months was found ($b=0.38, t=5.12, p<0.001$). The change in perceived fruit norms was associated with self-reported fruit intake ($b=0.40, t=4.89, p<0.001$). In addition, perceived baseline fruit norm significantly predicted fruit intake at 12 months ($b=0.41, t=4.47, p<0.001$). The interaction between baseline fruit intake and change in fruit norm perception was not significant ($b=0.68, t=0.88, p=0.38$).

Predicting junk food consumption at 12 months

All collinearity diagnostics were in the tolerable range (VIFs<1.44). The model for junk food explained a significant amount of the variance ($F(7,238) = 21.50, p < 0.001, R^2 = 0.45$) and baseline habitual junk food intake ($b = 0.45, t = 7.16, p < 0.001$) and changes of perceived junk food norm ($b = 0.25, t = 3.97, p < 0.001$) were significant predictors of self-reported junk food intake at 12 months. In addition, the baseline junk food norm also predicted junk food intake at 12 months ($b = 0.15, t = 2.80, p < 0.01$). However, there was no significant interaction between habitual junk food intake and changes of perceived junk food norm for self-reported junk food intake ($b = -0.004, t = -0.05, p = 0.96$).

Predicting sweetened beverage consumption at 12 months

All collinearity diagnostics were in the tolerable range (VIFs<1.87). The regression model was significant ($F(7,236) = 4.91, p < 0.001, R^2 = 0.17$). Baseline sweet beverage consumption significantly predicted self-reported beverage consumption ($b = 0.26, t = 0.07, p < 0.001$) and change in perceived beverage norm significantly predicted self-reported beverage consumption at 12 months ($b = 0.14, t = 0.07, p < 0.05$). Moreover, there was a significant association between perceived drink norm and beverage consumption at 12 months ($b = 0.13, t = 2.15, p < 0.05$). However, there was no significant interaction between habitual drink intake and change in perceived beverage norms on beverage consumption ($b = 0.28, t = 0.65, p = 0.52$).

Table 2. 5. The association between perceived descriptive norm and food consumption in university students at follow up at 12 months.

Table 5:

	Vegetable		Fruit		Junk food		Sweetened beverage	
	B(SE)	95% CI	B(SE)	95% CI	B(SE)	95% CI	B(SE)	95% CI
Age	.00(.07)	-.14 - .15	.04(.07)	-.10 - .18	-.14(.06)	-.26 - -.03	-.00(.07)	-.15 - .14
Gender	.37(.21)	-.04 - .78	-.20(.17)	-.54 - .14	.22(.22)	-.21 - .64	-.24(.21)	-.65 - .17
BMI	-.07(.02)	-.05 - .02	-.00(.02)	-.05 - .04	.00(.02)	-.03 - .04	-.03(.02)	-.06 - .01
Baseline norm	.17(.11)	-.05 - .39	.42(.09) ***	.23 - .60	.15(.06) **	.05 - .26	.13(.06) *	.01 - .25
Habitual intake	.56(.08) ***	.41 - .72	.38(.07) ***	.23 - .53	.45(.06) ***	.33 - .57	.26(.07) ***	.12 - .40
Norm change	.43(.09) ***	.24 - .61	.40(.08) ***	.24 - .56	.25(.06) ***	.13 - .38	.14(.07) *	.01 - .27
Habitual intake * Norm change	.10(.07)	-.03 - .24	.07(.08)	-.09 - .22	-.00(.06)	-.13 - .12	.03(.04)	-.06 - .11
	<i>R</i> ² -Change	F Change	<i>R</i> ² -Change	F Change	<i>R</i> ² -Change	F Change	<i>R</i> ² -Change	F Change
	.01	2.21	.00	.77	.00	.00	.00	.42

*p<0.05; **p<0.01; ***p<0.001; *R*²-Change: indicates R-square increase due to interaction

Injunctive norms

Predicting food consumption at 3 months

Habitual vegetable intake ($b=0.27$, $t=4.81$, $p<0.001$), habitual fruit intake ($b=0.26$, $t=4.19$, $p<0.001$), habitual junk food intake ($b=0.21$, $t=3.40$, $p<0.001$) and habitual sweetened beverage intake ($b=0.17$, $t=3.81$, $p<0.001$) predicted self-reported subsequent food intake at 3 months. Besides that, only baseline injunctive vegetable norm predicted 3 months' self-reported vegetable consumption ($b=0.167$, $t=2.44$, $p<0.05$). Overall, changes in injunctive norms did not predict follow up reported consumption (Appendix Table 2.7).

Predicting food consumption at 12 months

To briefly summarize, baseline injunctive vegetable norm perception ($b=0.15$, $t=2.40$, $p<0.05$) and habitual vegetable consumption ($b=0.62$, $t=10.84$, $p<0.001$) significantly predicted self-reported vegetable consumption at 12 months. Similarly, both baseline injunctive fruit norm perception ($b=0.24$, $t=4.02$, $p<0.001$) and habitual fruit consumption ($b=0.39$, $t=6.72$, $p<0.001$) were significant predictors for 12 months' fruit consumption. For junk food and beverage consumption, habitual junk food intake ($b=0.48$, $t=8.59$, $p<0.001$), habitual beverage intake ($b=0.26$, $t=4.91$, $p<0.001$), baseline injunctive junk food norm ($b=0.25$, $t=2.43$, $p<0.05$) and baseline injunctive beverage norm ($b=0.28$, $t=2.73$, $p<0.01$) significantly predicted the follow up consumption. The changes in injunctive norm did not predict follow up vegetable and junk food consumption, but did predict fruit and beverage consumption. Lastly, there was an

interaction between the changes of injunctive vegetable norm and habitual vegetable intake on follow up vegetable consumption. It indicated that the changes of perception on how many vegetables others should eat significantly predict self-reported vegetable intake at 12 months of the study, but only among people who were high habitual vegetable consumers (Appendix Table 2.8).

Attrition

Comparison of non-completers (attended only baseline but not the follow up at 12 months) and completers (attended both baseline and follow up at 12 months) revealed that the perceived vegetable norm for non-completers was not significantly different from completers. However, non-completers reported significantly higher vegetable intake than did completers at baseline. Fruit norm perception and reported intake were similar for completers and non-completers. Perceived junk food and beverage norms were significantly lower among non-completers compared to completers. We further examined whether completers differ from non-completers in terms of the cross-sectional association between perceived descriptive eating norms and food consumption. Perceived descriptive eating norm was and completion status were entered as independent variables, and self-reported food consumption was the dependent variable. There was no evidence that the association between perceived norms and personal consumption for each food item differed between completers and non-completers ($b=0.12$, $t=-0.14$, $p=0.89$).

Table 2. 6.Comparisons between completers and non-completers.

	Non-completers		Completers	
	Perceived descriptive Norm	Self-reported Intake	Perceived descriptive Norm	Self-reported Intake
Veg	1.8 (0.9) **	2.2 (1.3) **	1.6 (0.8)	2.0 (1.3)
Fruit	1.8 (1.0)	1.8 (1.1)	1.8 (0.8)	1.8 (1.1)
Junk food	3.0 (1.7)	1.3 (1.2) ***	3.3 (1.7)	1.7 (1.3)
Beverage	3.2 (1.6) *	1.1 (1.3) **	3.5 (1.6)	1.5 (1.4)

*p<0.05; **p<0.01; ***p<0.001 Difference on perceived descriptive norms (self-reported intake) between non-completers and completers.

2.5. Discussion

This study is the first to assess the longitudinal relationships between descriptive and injunctive norm perceptions and self-reported intake for a range of food and drinks. At baseline, students reported that they think other students consume fewer vegetables than they themselves eat. In contrast, the perception of junk food and sugar-sweetened beverage consumption by other students was higher than their self-reported consumption. Therefore, we found that students thought others were more ‘unhealthy’ in their eating patterns. Furthermore, we found consistent evidence that changes in descriptive norm perception predicted self-reported consumption at 12 months, although the overall amount of variance in intake accounted for was low. Taken together these data suggest that correcting misperceived norms might be a useful approach to

affecting dietary change.

Recommendations on vegetable and fruit intake suggest that people should be consuming at least 5 portions per day and at baseline our sample reported consuming less than recommended amount, which is in line with previous reports (Health Survey for England, 2013). Participants further reported that they believed people should consume more than the recommended amount (injunctive norm). At the same time, they reported believing that actual consumption by other students is well under the recommended amount (descriptive norm). For vegetable intake, participants reported that they think other students consume fewer vegetables than they do themselves. However, at baseline, there was no difference between self-reported fruit intake and the perception of the fruit intake of other students. For junk food intake and intake of sugar-sweetened beverages, students reported that they themselves consume fewer of these items than do other students, but they also reported that these amounts are more than the amounts that they believe students should be consuming. Hence, overall there was a mismatch between the perception of how other students eat and drink, how participants thought they should be eating and drinking, and their own self-reported intake. Participants perceived that other students eat fewer vegetables, but consume more junk food and sugar-sweetened beverages than they report for themselves. These data are consistent with other reports that people generally believe that others eat less healthily than they do themselves (Lally et al., 2011; Perkins et al., 2010).

Given that perceptions about how other people behave have been linked to one's own consumption, the present results suggest that correcting the perception that other people eat "unhealthily" might be useful in promoting healthier eating patterns, but such an approach assumes that norm perception is causally related to behaviour. Due to the cross sectional nature of most previous studies, evidence on this point is scarce (Jones & Robinson, 2017; Pelletier et al., 2014). In the present study, we examined whether both baseline norm perceptions and changes in perception of norms were longitudinally associated with self-reported change in food intake. We assessed both injunctive and descriptive norms because previous lab based evidence suggests that highlighting the perception of what other students do (descriptive norms) is more effective in altering dietary intentions and eating behaviours than highlighting how other students should behave (injunctive norms) (Lally et al., 2011; Robinson et al., 2014; Stok et al., 2014).

We found that baseline descriptive social norms of other students' daily vegetable and junk food intake predicted young adults' own reported intakes at 3 months. There was also a significant association between baseline perceived norms of fruit, junk food and sugar-sweetened beverage intake and self-reported consumption at 12 months. Furthermore, changes in the descriptive norm perception of all food types predicted self-reported at 12 months. At three months, the pattern of results was less clear: change in norm perception was only associated with reported intake of vegetables and sugar-sweetened beverage intake. Overall, these data provide evidence to suggest that perceptions about how other student eat are causally related to students' own dietary

behaviours.

It is possible that exposure to the eating behaviours of other students over 12 months (but not 3 months) was sufficient to alter perceptions about the intake of others and because perceptions about how others behave is a factor that motivates consumption, these changes in descriptive norm perception led to a change in dietary behaviour (conformity). However, the reverse causality is also possible: that a change in dietary habits led to an alteration in the perception of the behaviour of others (projection). Further work is required to tease apart these explanations as had been done research on social norms and alcohol use. For example, Neighbors and colleagues (2016) reported that a social norms intervention altered both norm perception and drinking behaviour and they used structural equation modelling to delineate the mechanistic pathways, finding that both conformity and projection processes are evident in associations between changes in perceived norms and changes in drinking.

It is interesting to note that changes in the perception of fruit consumption were associated with own reports of fruit consumption at 12 months despite the finding that a baseline there was no difference between the participants' own levels of reported intake and what they thought others consumed. This suggests that a difference between self-reported consumption and perception of others eating (I believe other people eat more unhealthy than me) is not a pre-requisite for observing an association between changes in norm perception and self-reported intake. Changes in descriptive norm

perceptions may have occurred because over time it became apparent that other students actually eat more healthily than the participant thought they did (normative misperception correction) and/or because the participants discovered that other students actually eat more healthily than themselves (social comparison) and they adjusted their perceptions of others accordingly. Evidence from a recent study on a social norm intervention for reducing alcohol consumption suggests that both types of comparison (normative beliefs versus actual behaviour and own intake versus actual behaviour) may be important (Neighbors et al., 2016). However, it is likely that the type of comparison which predominates will depend upon the specific behaviour under investigation and the extent to which estimates of one own behaviour and the perception of others behaviour deviate from actual observed behaviours. For example, in the case where there is a large mismatch between norm perception and actual behaviour, normative perception correction may be the more influential comparison.

Regardless of the specific underlying mechanisms, the present data, along with other cross-sectional and laboratory-based findings, suggest that the manipulation of norm perceptions may facilitate positive dietary behaviour change. Indeed, recent findings from a field study in which customers in a restaurant were exposed to information about normative vegetable consumption in that restaurant, suggest that norm based approaches to healthy eating interventions may prove effective (Thomas et al., 2017).

The only other longitudinal study to date that has examined the relationship between

descriptive norm perceptions and self-reported food intake of students (Jones & Robinson, 2017) reported that both baseline perception and change in norm perception was associated with reported intake of cakes/pastries, but not reported consumption of sugar-sweetened beverages or alcohol consumption, which is not entirely consistent with our findings. Some methodological differences may account for the discrepant results, such as the measure used to assess intake, which was frequency of consumption in the Jones and Robinson (2017) study and daily portions of intake in the present study. The results of the present study add to the mixed evidence from the study of Jones and Robinson (2017) to suggest that beliefs about how often one's peers eat or drink specific food and beverages types may affect future eating and drinking behaviour.

The pattern of results for the association between perception of injunctive norms and self-reported intake suggests that injunctive norms may be less influential on dietary behaviour than are descriptive norms, as has been suggested previously (Lally et al., 2011; Robinson et al., 2014; Stok et al., 2014). There were no consistent associations between changes in injunctive norm perception and self-reported intake at either 3 months or 12 months, although we did find consistent relationships between baseline injunctive norm perception and reported intake at 12 months. Other evidence suggests that a change in the perception of descriptive norms can alter the influence of injunctive norms on behaviour (Smith et al., 2017). For example, it has been reported that intentions to engage in pro-environmental behaviour were undermined when a supportive injunctive norm was presented with an unsupportive descriptive norm

(Smith et al., 2014). In the present study, the association between baseline injunctive norm perceptions and self-reported intake may have been observed at 12 months because by that point, some correction of the “unhealthy” descriptive norm perception had occurred and hence the injunctive and descriptive norms perceptions were more closely aligned. Future studies should further investigate the potential interactions between injunctive and descriptive norms in predicting food intake.

We found no clear evidence that habitual food intake moderated the longitudinal relationship between perceived norms and self-reported consumption. The results of laboratory-based studies have suggested that low consumers of vegetables may be more responsive to social norm based message about vegetables (Robinson et al., 2014). However, in these laboratory-based studies, the norms were explicitly relayed to participants via messages on flyers (e.g. did you know that typical student eats their five servings of fruits and vegetables each day?). In the present study, the norm was that which was perceived by the individual participants. Hence, both high and low habitual consumers may have changed their perceptions of how other students eat over time and this was then reflected in changes in self-reported intake.

Strengths and Limitations

The present study is the first longitudinal study of social norms and eating to include assessment of multiple dietary behaviours (vegetable, fruit, junk food and sugar-sweetened beverage consumption) and to track participants across 12 months.

A limitation is that we relied on self-report measures, which are prone to error and bias (Adams et al., 1999). Rather than asking people to recall what they usually consume, it would be better to track actual daily food intake and/or assess intake in a controlled environment. In addition, we sampled a specific population of undergraduate students, which means that the generalisability of the findings to other populations is limited. There was also substantial attrition of the sample at 12 months. The number of drop outs was not out of line with other cohort studies (Jones & Robinson, 2017), but there was evidence that the completers had a diet that was lower in vegetables and higher in junk food than non-completers. This means that the findings may be limited to a subsample of participants who may have been motivated to stay in the study because of concerns about their diet. However, there was no evidence that the cross sectional association between perceived norms and personal consumption for each food item differed between completers and non-completers, and studies of the biasing effects of drop outs suggest that associations may be relatively robust to the effects of attrition (Gustavson et al., 2012).

2.6. Conclusion

The results of the present study suggest that young adults' dietary behaviour is longitudinally associated with their perceptions of others' behaviour over 12 months, but habitual intake does not moderate the association of norm perception changes and

dietary change. Students in the present cohort perceived that other students ate fewer vegetables and more junk food and sugar-sweetened beverages than they did themselves. Taken together, these results suggest that providing information to correct perceptions about the “unhealthy” eating habits of others may provide an alternative approach in intervening to improve dietary behaviours.

CHAPTER 3: THE EFFECT OF SOCIAL NORM MESSAGES ON DIETARY INTENTIONS: THE MODERATING EFFECT OF SOCIAL IDENTIFICATION

3.1. Background

Despite the widespread implementation of healthy eating campaigns, most people in the UK and many other countries do not consume the recommended amounts of fruit and vegetables (Hall, et al., 2009; National Diet and Nutrition Survey, NDNS, 2014). In addition, young people in particular report low consumption of fruit and vegetables but high consumption of energy dense foods (Minaker & Hammond, 2016), a dietary pattern that may be detrimental to health (Aune et al., 2017; He et al., 2007; Hung et al., 2004; Vieira et al., 2016). Hence, there is an increasing interest in developing more effective ways to promote healthier diets.

A novel approach to encourage healthier eating is based on social norms. Social factors have been suggested to exert a strong influence on eating behaviour (Cruwys et al., 2015; Herman et al., 2003; Vartanian et al., 2015). People tend to match their food intake to their dining partners in a social eating context, probably because other people provide a norm of appropriate intake (Herman et al., 2003; Salvy et al., 2007). A body of evidence has accumulated to suggest that social norms can influence dietary behaviours (Burger et al., 2010; Croker et al., 2009; Robinson et al., 2013; Stok et al., 2011) and health-related behaviours more generally (Ball et al., 2010; Perkins, 2002).

Providing social normative information that most other people eat fruit and vegetables has been reported to increase intentions to eat fruit and vegetables (Crocker et al., 2009; Stok et al., 2014), actual intake in a laboratory setting (Robinson et al., 2013) and purchase of vegetables and restaurant settings (Mollen et al., 2013; Thomas et al., 2017). In addition, norm messages about intake of junk food have been reported to reduce high calorie snack food consumption in the laboratory (Robinson et al., 2013).

Commonly, social norms can be categorized as two types. Descriptive norms refer to perceptions of how other people actually behave, while injunctive norms refer to perceptions of behaviour that are approved by other people (Cialdini et al., 1990; Cialdini et al., 1991). The way that descriptive social norms influence individuals' decision and action is probably through providing accurate information and clear guidance (Cialdini, 2008). The Social Proof Principle suggests that if most other people are behaving in a certain way, it must be the most appropriate way to behave (Cialdini, 1988; 2001). Much of the research to date has found that descriptive norms are more influential on eating behaviours than are injunctive norms (e.g. Lally et al., 2011; Robinson et al., 2014; Stok et al., 2014).

There is evidence to support the idea that social norms operate in the context of group dynamics. Social identity theory (Tajfel, 1972) argues that people derive value and a sense of well-being from their social groups. Group membership provides people with a sense of social identity: who they are in terms of the shared value with others (Tajfel

& Turner, 1986). Social groups are categorized into frameworks that allow people to determine which others are like themselves (in-group) and which are not (out-group). The sense of belonging to social group also serves an important purpose in that it allows people to embed norms of the social group, whereby group norms are internalized into self-concept, which in turn increases the motivation to perform specific behaviours (Hogg & Vaughan, 2002). Importantly, individuals typically identify with multiple social groups and it has been reported that manipulating the salience of particular social identities can impact intentions. Tarrant and Butler (2011) reported that students viewed “healthy” behaviours as less congruent with their student identity than with their National identity. When student identity was made salient, weaker intentions to reduce salt and alcohol intake were reported than when National identity was made salient (Tarrant and Butler, 2011).

Based on the perspective of social identity, a person is more likely to conform the group’s behavioural standards if this person has strong associations to the group (Turner et al., 1987). This is because people are usually behaving in the same way as other group members in order to express belonging to the group and the strength their social identity (Hornsey, 2008). There is evidence that norm effects can be enhanced when people identify with the norm referent group (Louis et al., 2007; Stok et al., 2011; Stok et al., 2014). For example, participants who saw a majority descriptive norm conveying that most group members consume sufficient vegetables, self-reported eating substantially more vegetables than those who saw a minority descriptive norm

suggesting that only a few group members eat sufficient vegetables, but only when they strongly identified with the norm referent group (Stok et al., 2014). However, Banas and colleagues (2016) reported recently that participants who strongly identified with a norm referent group behaved in a manner that was opposite to the depicted norm. These results suggest that the relationship between social identity and normative effects on eating is complex and that under some circumstances ironic effects may be observed such that people who identify highly with a social group may engage in behaviour contrary to that of other group members (Banas et al., 2016).

A question that has yet to be addressed in relation to the moderating effect of group identification on eating norms is the role of specific components of in-group identification. Leach and colleagues have proposed a hierarchical, multicomponent model of in-group identification that distinguishes group-level self-definition (i.e., individual self-stereotyping, in-group homogeneity) from self-investment (solidarity, satisfaction, and centrality). The dimension of 'group-level self-investment' indicates the extent to which people find group membership motivationally significant, whereas, 'group-level self-definition', indicates the extent to which people see themselves as similar to the group and group members as similar to one another (Leach et al., 2008). Interestingly Hackel and colleagues (2016) have reported that group-level self-investment, but not self-definition, is related to evaluations of identity relevant foods such that participants from the Southern United States with high group-level self-investment expected Southern foods to be tastier than non-Southern foods and

Southerners with low group-level self-investment expected Southern foods to be less tasty than non-Southern foods. These data suggest that components of group-level self-investment might predict responses to social eating norms, but this remains to be tested.

To date, there has been also little investigation of the mechanisms underlying the effects of social norms on eating behaviours (Stok et al., 2014). The theory of planned behaviour (TPB) (Ajzen & Fishbein, 1980) suggests that perceived behaviour control, which similar to Bandura's concept of self-efficacy, may underlie norm effects on behaviour. It has been reported that self-efficacy for performing a behaviour increases when a person feels they ought to be able to perform like other group members (Stok et al., 2014). The TPB further suggests that there are gaps between behavioural intention and behaviour. An intention is an individual's motivation to perform a particular behaviour while the behaviour is how individuals actually act in a given situation. The intention to perform a behaviour is strong when there are positive attitudes, subjective norms and greater perceived behavioural control towards that behaviour. Moreover, evidence from Stok et al. (2014) suggests that exposure to a majority norm from a salient group leads to increased self-identification, more positive attitudes and higher self-efficacy toward vegetable intake in comparison with a minority norm. These authors suggested that the norm effect on vegetable eating intentions may be due to changes in self-identification, attitudes and self-efficacy towards vegetable consumption (Stok et al., 2014).

The aim of the present studies was to 1) examine the moderating effect of specific components of group identification on the relationship between social norms and eating intentions and 2) examine the potential mediating effects of self-identification, attitudes and self-efficacy (Stok et al., 2014). In Study 1, we used an online questionnaire to compare the effects of exposure to a social norm versus a health message about vegetable consumption on intentions to eat vegetables while measuring social identity strength. In line with previous findings, we predicted that exposure to social norm but not the health message would be associated with an increase in intentions to eat vegetables and that this effect would be stronger for those participants from a community sample who find membership of the referent group (British Nationals) motivationally significant. Study 2 was similar to Study 1, but we tested the effect of social norm messages on intentions to reduce junk food consumption in a student population. We hypothesized that students exposed to descriptive social norm messages about limiting “junk food” intake would report greater intentions to reduce their “junk food” intake compared to those who are exposed to a control message, particularly among students who strongly identify with others in the same university. In both studies, we predicted that the effect of the social norm message on eating intention would be mediated by individuals’ attitudes, self-identification and self-efficacy.

Study 1: The Effect of a Social Norm message and British identity on vegetable eating intentions

3.2.1. Method

Participants

Three hundred and ten British participants (80% females) aged between 18 and 65 were recruited (Mean age=25.5, SD=10.0). We performed calculations using GPower 3.0.10 to determine the sample size. To achieve 85% power with a $p < 0.05$, the minimum sample is estimated as 277 participants. The small effect size ($d=0.2$) was based on previous studies: an online study of the relationship between perceived social norms and drinking behaviour (Wardell & Read, 2013) and a web-based social norm intervention on substance use behaviours (Helmer et al., 2016). The study was advertised as ‘British Lifestyle Survey’ through social media networks such as Facebook. Participants were informed that they would be asked their opinion of some posters and would be asked to complete some questionnaires on personality, mood, physical activity styles and food preferences. Participants took part in the study via a website link that was displayed on advertisements. There was an opportunity to win a £50 Amazon voucher, which was also mentioned in the advertisements. Informed consent was obtained online. Only British Nationals were eligible to take part in the study. The study was approved by the Science, Technology, Engineering and Mathematics Ethical Review Committee at the University of Birmingham.

Design

The study used between-subjects design, with 2 conditions: message type (descriptive norm message vs. health message vs. control message) and norm referent group (high

identifiers vs. low identifiers). Participants were randomly allocated to one of the three message conditions.

Messages

In the social norm condition, participants were exposed to a social norm message about the daily vegetable intake of British people ‘Did you know that 80% of people in Britain try to eat at least 5 portions of vegetables a day (Consumer and Attitudes to Food Survey, 2008)’. In the health condition participants saw a health message about the health benefits of eating vegetables ‘Did you know that people in Britain who eat 5 or more portions of vegetables a day have a lower than average risk of heart disease and cancer? (World Cancer Research Fund, 2007)’. In the neutral control condition, they saw a message about internet access information in Britain ‘Did you know that 36 million (73%) people in Great Britain access the Internet every day? (Office for National Statistics, 2013)’. The messages were matched for word length. In all three conditions, participants viewed two posters containing one of above messages displayed in the middle of the poster. The text was surrounded by four different British-related images around (e.g. Britain flag, map of United Kingdom, Big Ben and London red buses). The messages on the two posters were same, but the background pictures differed, to ensure that participants paid attention to information provided. On viewing the posters, the participant was informed that he/she would be asked about his/her preferences for the different posters and to study them carefully as she/he would be asked questions about them later. This task was to distract the participant from the main purpose of the study

which was to examine the effect of poster exposure on vegetable eating intentions (example of posters see Appendix 21).

Self-report measures

(questionnaires listed below were in the order that completed by participants, more details see procedure)

Demographics Participants' provided background details (e.g. age, gender, smoker or not, ethnicity) were assessed from a demographic questionnaire.

Usual Vegetable Intake Usual vegetable intake was assessed using two open-ended questions asking 'How many servings of vegetables do you normally eat a day?' and 'Think back carefully - How many servings of vegetables did you eat yesterday?' (Robinson et al., 2014).

Self-Identification toward Eating Vegetables Two items derived from previous studies assessed self-identification towards eating vegetables (de Bruijn et al., 2012; Sparks & Shepherd, 1992; Stok et al., 2014). e.g. 'Eating sufficient vegetables is something that fits with who I am' on a 5-point likert scale ranging from strongly disagree to strongly agree (see Appendix 11).

Attitude toward Vegetable Consumption For this measure, four pairs of words were presented on both sides of a 5-point scale (nice-stupid, wise-unwise, pleasant-unpleasant, good-bad) and participants rated their attitudes towards vegetable

consumption (de Bruijn et al., 2012; Stok et al., 2014) (Cronbach's alpha = 0.83) (see Appendix 12).

Self-Efficacy for Eating Sufficient Vegetables Perception of self-control over vegetable eating behaviour was assessed using two items using a 5-point scale ranging from not at all like me to just like me (de Bruijn et al., 2012; Stok et al., 2014). e.g. 'Eating sufficient vegetables is in my own hands' (see Appendix 13).

International Physical Activity Questionnaire (IPAQ-SF) The short form of the IPAQ questionnaire was used to measure three specific types of activity undertaken by adults in everyday life. The IPAQ-SF includes 9 items assessing the frequency and duration of walking, moderate-intensity activities and vigorous intensity activities (Craig et al., 2003; Lee, et al., 2011). The purpose of this questionnaire was to test for the possibility that any health-related intention, rather than just eating intentions, might be affected by exposure to the poster due to demand characteristics. In other words, we tested the possibility that participants might have responded to the messages because they thought they should report healthy intentions (social desirability bias) (Cronbach's alpha = 0.31) (see Appendix 10).

Identification with the Norm Referent Group The Multicomponent In-Group Identification Scale (Leach et al., 2008) was used to measure identification with the British norm referent group. It is a 14-item scale including five subscales of Solidarity, Satisfaction, Centrality, Individual Self-Stereotyping and In-Group Homogeneity (Cronbach's alpha = 0.86).

Ten-Item Personality Inventory (TIPI) The TITP is a 10-item scale measuring the Big Five trait dimensions, assessed on a 7-point Likert scale ranging from strongly disagree to strongly agree (Gosling et al., 2003) (Cronbach's alpha = 0.55). This scale was used as a filler to distract from the true purpose of the study and was not analysed further (see more details in Appendix 14).

Poster evaluation questionnaire Participants completed a poster evaluation questionnaire, rating the poster on key aspects (trustworthiness, believability, relatability, meaning, clarity, comprehension and professional appearance) using a 5-point Likert scale with the response scale ranging from strongly disagree to strongly agree (Cronbach's alpha = 0.64) (based on a similar measure used by Robinson et al., 2014).

Visual Analogue Mood Scale Appetite and mood was assessed before and after the exposure of flyer using 100 mm lines scale where '0' means not at all and '100' means very much. ('How hungry/alert/anxious/happy are you right now?'). This was to check for possible baseline differences between the groups (Cronbach's alpha = 0.53).

Vegetable eating and exercise intentions Participants were asked to report the number of portions of vegetables they intended to eat per day the following week as the primary measure of eating intentions. Four additional questions assessed participant attitudes towards future vegetable eating based on the study of Stok and colleagues (2014). The questions asked participants to rate on a 5-point scale whether the intended/planned/wanted/expected to eat sufficient vegetables in the near future (next

week)' (Stok et al., 2014). These items were highly correlated and so an average attitude score was computed (Cronbach's alpha = 0.90). As a control for possible demand effects, participants were also asked about their intentions regarding future exercise. They answered one question on exercise intentions derived from the study by Marcus & Forsyth (2003): 'I intend to be more physically active in the next two months' using a 5-point scale. It was expected that the effect of exposure to the social norm poster should be specific to vegetable eating intentions (see examples in Appendix 15).

Procedure

After reading the participant information sheet and giving consent to take part, participants completed the set of questionnaires. Firstly, participants filled in their demographic information such as age, gender, smoking status and ethnicity. Then they were asked to report habitual vegetable consumptions per day, attitudes towards vegetable eating and habitual physical activity. After that, participants stated the extent to which they identify themselves as British. In this part of the questionnaire, there was a catch question (Please click 'Neither Agree nor Disagree' button) to test that whether participants were paying attention to the questions or not. They then completed the personality questionnaire as a filler. The posters were then presented to participants according to the condition to which they were randomly assigned. Participants were then asked to evaluate posters. Participants' mood and hunger status immediately before and after seeing the posters were also measured. Participants' self-reported vegetable

eating intentions and physical activity intentions in the near future were then assessed and they self-reported their weight and height. Finally, they wrote down what they thought the study was about and if they thought exposure to the posters had affected their responses and if so how. All participants were debriefed thanked at the end of the study. On average, the whole questionnaire took approximately 30 minutes to complete.

3.2.2. Analysis Strategy

One-way ANOVA was used to assess whether the groups differed in basic descriptive variables and any significant differences were explored using corrected t-tests. To establish a factor structure for the multicomponent identification scales and poster evaluation scales, principal components analyses were run with varimax rotation. Analysis of the 14 items of identity scales yielded 5 factors, accounting for 83.4% of the total variance: solidarity, satisfaction, centrality, individual self-stereotyping and in-group homogeneity, which is consistent with original dimensions from the multicomponent identification scale (Leach et al., 2008). The same PCA analysis describe above was run on the 5-item poster evaluation scale. Two factors were generated with eigenvalues >1 , accounting for 60.6% of the total variance: clarity (clear level of posters and understanding of posters, explained 43% of variance) and credibility (profession, believability and relatedness of posters, explained 22% of variance).

Correlation analysis indicated that the vegetables that participants eat per day was significantly and positively associated with vegetables that participants ate the day before ($r=0.77$, $p<0.001$). Therefore, habitual vegetable intake was determined by average two scores above. The average amount of vegetables that participants usually consume was 2.7 (SD=1.6).

Correlations between baseline factors such as hunger, BMI and habitual food intake and intentions were also assessed to check if any of above factors should be controlled for in the analysis. It was found that habitual vegetable intake was positively correlated with intentions to eat vegetables in both scores ($r=0.49$, $p<0.001$) and numbers ($r=0.77$, $p<0.001$). Therefore, habitual vegetable intake was controlled in the analysis.

The main regression analysis was conducted using the PROCESS program in SPSS. The independent variables entered into the model were dummy variable of conditions (social norm versus health and social norm versus control), subcategories of identification and the dependent variable was intention to eat vegetables, attitudes towards eating vegetables in the future and intentions to exercise. A multiple mediation analysis was also conducted in PROCESS to investigate whether the influence of social norm message (or health message) on vegetable eating intentions (the number of portions of vegetables they intended to eat per day the following week) was mediated by self-identification, attitudes and self-efficacy toward eating vegetables. The indirect

effect of the social norm on vegetable consumption intentions via self-identification, attitude, and self-efficacy was tested using the multiple mediation bootstrap procedure for indirect effects outlined in Preacher and Hayes (2008). Using 5,000 bootstrap resamples, 95 per cent bias-corrected bootstrap confidence intervals were derived for the total indirect effect as well as for each mediator separately. A moderated mediation model was also run to investigate whether identification with the norm moderated any of the indirect effects.

3.2.3. Results

Manipulation check

At the later stage of questionnaires, participants were asked to write down the contents of norm messages (e.g. both contexts and pictures). Based on the recall of messages, of the original 354 participants, 87.6% reported correctly. 44 participants who recalled the message incorrectly were excluded (social norm=14, Health=15, control=15). Therefore, the analyses were conducted on 310 participants.

Participant characteristics

For the whole population, the mean age for sample was 25 years old (SD= 10.0), mean BMI was 23.3 (SD= 4.0). There were 104 students in the participant sample (34%). The mean multicomponent identification score was 4.6 (SD=1.0) (mean scores for subscales: solidarity=4.9 (SD=1.3), satisfaction= 5.5 (SD=1.1), centrality= 4.2 (SD=1.3), self-

stereotyping= 4.3 (SD=1.2) and in-group homogeneity= 3.7 (SD=1.3)). The mean scores for three assumed mediators were: self-identification (M= 3.4, SD=1.0), attitudes (M=1.6, SD=0.6) and self-efficacy (M=3.5, SD=0.6).

The number of participants, mean age, BMI and the distribution of gender and ethnicity were relatively equal across three conditions. One-way ANOVA was conducted to compare whether descriptive variables differ from each other among three message condition groups (social vs. health vs. control). There were no significant differences of above variables among conditions, except for the credibility scores under poster evaluations ($F(2,307) = 9.400, p < 0.001$). T-test showed that credibility of posters was slightly but significantly lower in the social norm condition than those in the control condition. In addition, posters containing health messages were reported significantly less credible than those containing control message. There was no significant difference on credibility of posters between social norm and health condition. However, inclusion of credibility as a covariate did not affect the norm effect on intentions to eat, to make it easier, credibility was not controlled in the main analysis (Table 3.1).

Table 3. 1. Participants' characteristics across three conditions. (Mean/SD).

	Control (N=127)	Health (N=96)	Social (N=87)
<i>Age (years)</i>	26.1 (10.5)	25.4 (9.8)	24.1 (8.6)
<i>Gender</i>	Male=25	Male=23	Male=21
<i>BMI</i>	23.4 (4.3)	23.7 (4.4)	22.6 (3.2)
<i>Ethnicity</i>	White=122	White=94	White=83

	Other=20	Other=17	Other=18
<i>Average Usual and Yesterday Veg (serving/per day)</i>	2.7 (1.8)	2.8 (1.6)	2.5 (1.5)
<i>Hunger Baseline (0-100)</i>	32.4 (31.2)	31.2 (29.4)	32.9 (29.5)
<i>Identification Subscales (1-7):</i>			
<i>Solidarity</i>	4.7 (1.5)	4.9 (1.1)	5.0 (1.1)
<i>Satisfaction</i>	5.3 (1.3)	5.6 (0.9)	5.6 (0.9)
<i>Centrality</i>	4.1 (1.5)	4.4 (1.1)	4.2 (1.3)
<i>Self-Stereotyping</i>	4.3 (1.3)	4.2 (1.1)	4.4 (1.2)
<i>In-group Homogeneity</i>	3.8 (1.3)	3.7 (1.3)	3.4 (1.2)
<i>Personality Subscales (1-7):</i>			
<i>Extraversion</i>	4.0 (1.5)	4.1 (1.3)	3.9 (1.6)
<i>Agreeableness</i>	4.7 (1.2)	4.6 (0.9)	4.8 (1.2)
<i>Emotional Stability</i>	4.1 (1.5)	4.1 (1.4)	4.1 (1.5)
<i>Consciousness</i>	5.1 (1.3)	5.2 (1.2)	5.2 (1.3)
<i>Openness</i>	5.0 (1.2)	4.9 (1.0)	4.9 (1.1)
<i>Physical Activity MET (mins)</i>	2207.5 (2446.8)	2099.8 (1710.0)	2356.9 (2567.1)
<i>Poster Evaluations (0-5):</i>			
<i>Clarity</i>	4.2 (0.5)	4.1 (0.5)	4.1 (0.5)
<i>Credibility</i>	3.1 (0.7)	2.8 (0.7) *	2.6 (0.7)***
<i>Mediation Scores:</i>			
<i>Self-identification (1-5)</i>	3.4 (1.1)	3.4 (0.9)	3.3 (0.9)
<i>Attitudes (1-4)</i>	1.7 (0.7)	1.5 (0.6)	1.6 (0.6)
<i>Self-efficacy(1-5)</i>	3.5 (0.6)	3.4 (0.6)	3.5 (0.6)

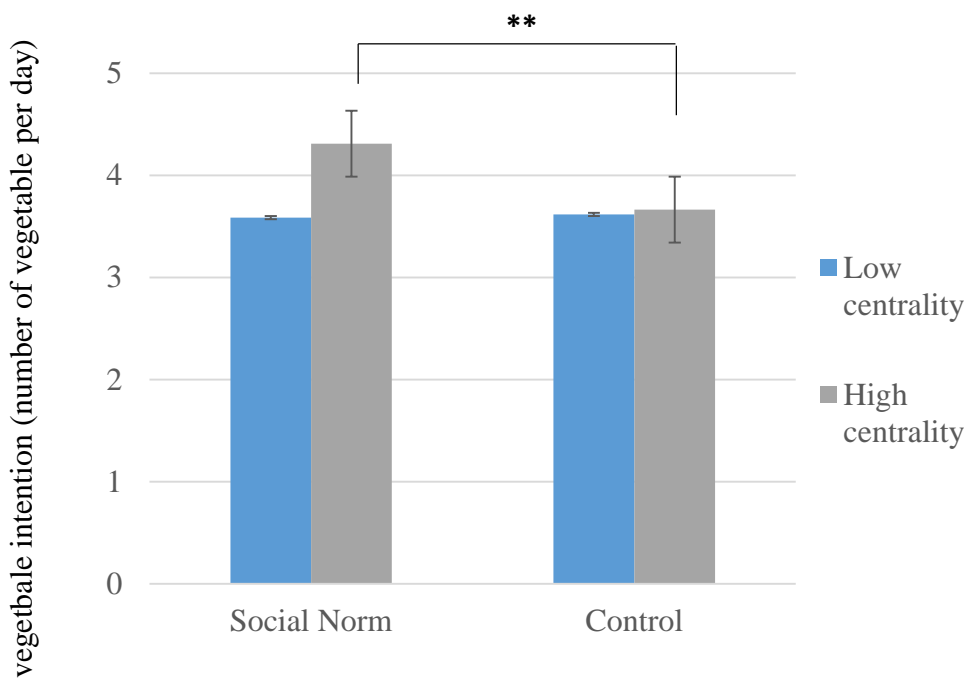
*p<0.05, ***p<0.0001 Comparisons of social/health from control condition

Intention to consume vegetables

Moderation analysis

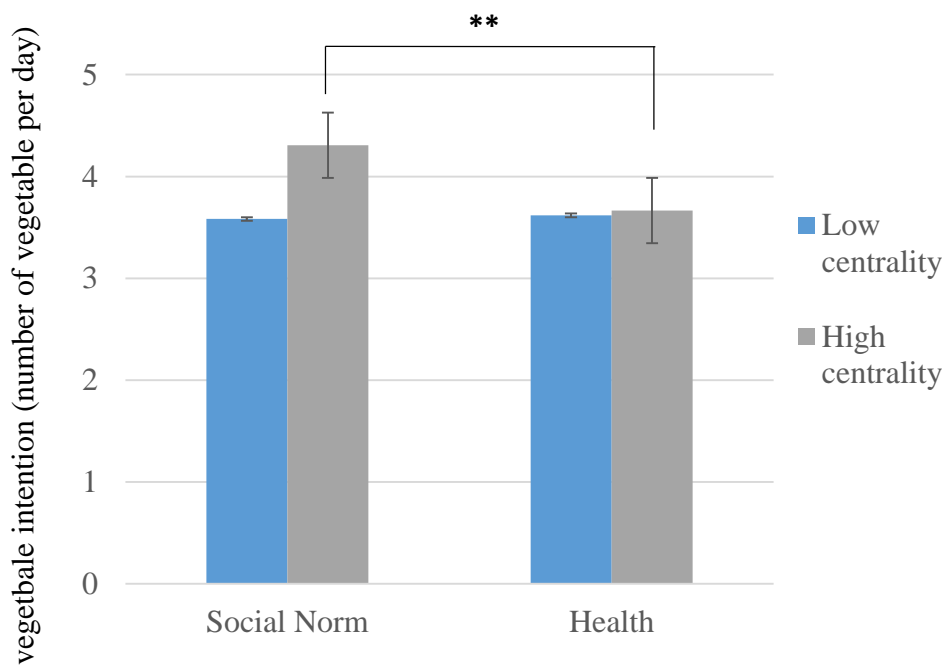
When comparing the effect of social norm and neutral control, a significant regression model was generated, $F(5, 302)=109.1, p<0.001$ which accounted for 61.0% of variance. The main effect of social norm on intention to consume vegetables (number of intended portions) was significant ($b=0.31, t=2.06, p=0.041$). In addition, there was a significant interaction between social norm and centrality on vegetable eating intention (number of intended portions) ($b=0.25, t=2.37, p=0.018$). There was a greater intention to eating vegetables in social norm versus the control condition, but only among participants who reported high level of centrality ($p=0.004$) (Figure 3.1). However, there was no effect of health message ($b=-0.02, t=-0.13, p=0.899$) and no interaction effect ($b=0.01, t=0.05, p=0.960$) on intentions to consume vegetables (number of intended portions).

In comparison with health message, a significant effect of social norm message on vegetable eating intentions (number of intended portions) was observed ($b=0.30, t=2.04, p=0.043$). There was also significant interaction effect ($b=0.25, t=2.37, p=0.018$) such that higher eating vegetable intention (number of intended portions) were higher in the social norm versus the health condition, but only among participants who reported high level of centrality ($p=0.004$) (Figure 3.2).



**p<0.01

Figure 3. 1. The interaction effect of condition (social norm vs. control) and centrality on vegetable eating intention (number).



**p<0.01

Figure 3. 2. The interaction effect of condition (social norm vs. health) and centrality on vegetable eating intention (number)

Regression models showed no significant interaction effects when taking other components of identity into account. In other words, solidarity, satisfaction, individual self-stereotyping, in-group homogeneity or identification with norm referent group did not moderate the effect of social norm on intentions to eat vegetables (all $p>0.05$). No significant main effects of the social norm message on attitudes towards eating sufficient vegetables were observed, nor were there any significant interactions with identification components.

Mediation analysis

The social norm did not significantly predict self-identification, attitudes or self-efficacy toward eating vegetables, all $p>0.05$ (path a). The three mediators did not predict vegetable eating intentions (path b), $p>0.05$. However there was a significant direct effect of the social norm on vegetable eating intentions, $F(3,304)=174.21$, $p=0.042$, $R^2=0.60$ (path c) (Figure 3.3). The indirect effect of social norm on intentions to eat sufficient vegetables through the three mediators was non-significant: self-identification ($B=-0.01$, $CI[-0.07,0.03]$), attitudes ($B=0.02$, $CI[-0.01,0.10]$), and self-efficacy ($B=0.00$, $CI[-0.01,0.05]$). See Table 3.2 for bias-corrected 95% confidence intervals from a bootstrap procedure using 5000 bootstrap resamples. Adding centrality

as a moderator did not change this pattern of results.

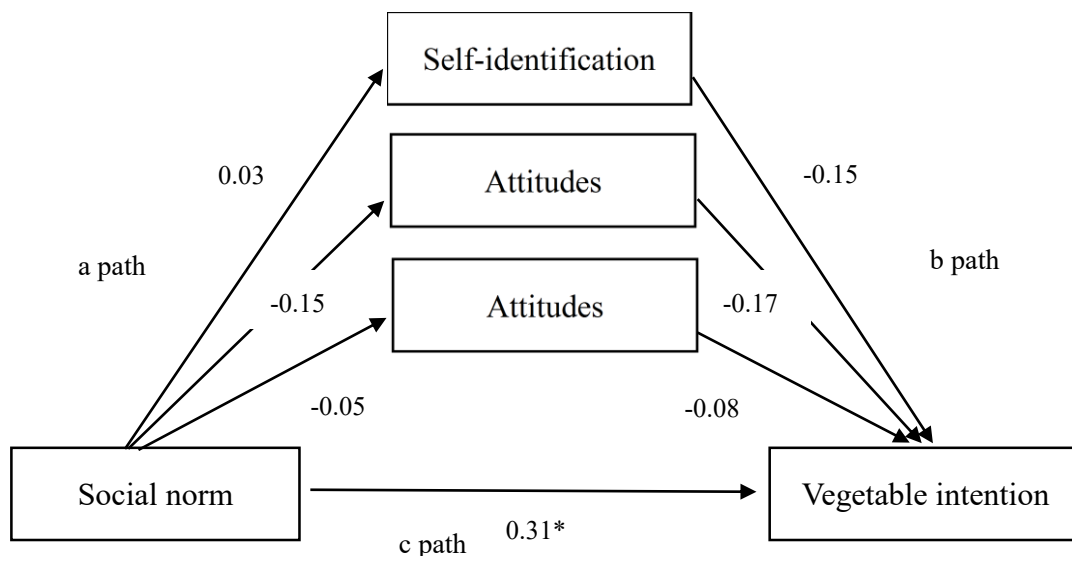


Figure 3. 3. Mediation direct and indirect paths.

Table 3. 2. Multiple mediation analysis.

<i>Direct path</i>		<i>Coefficients and significance levels (standard errors)</i>	
<i>Mediation analysis</i>	a paths	(1) self-identification	B=.03 (.11)
	(social norm → mediators)	(2) attitude	B=-.15(.08)
		(3) self-efficacy	B=-.05 (.08)
		b paths	(1) self-identification
	(mediators → intention)	(2) attitude	B=-.17 (.13)
		(3) self-efficacy	B=-.08 (.11)
		c path	
(Social norm → intention)			
c' path		B=.29 (.16)	
(Social norm → intention corrected for indirect effect)			
<i>Indirect path</i>		Bootstrapped coefficients and confidence intervals	
<i>Bootstrap</i>	a*b paths	1) self-identification	B=-.01 CI[-.07,.03]
	(Norms → intention via mediators)	(2) attitude	B=.02 CI[-.01,.10]
		(3) self-efficacy	B=.00 CI[-.01,.05]
		total effect	B=.02 CI[-.02,.09]
Pairwise contrasts between mediators	(1) vs (2)	B=-.03 CI[-.14,.02]	
	(1) vs (3)	B=-.01 CI[-.09,.03]	
	(2) vs (3)	B=.02 CI[-.02,.09]	

* $p < 0.05$

Intention to conduct physical activity

Compared to the neutral control condition, there was no significant main effect of social norm or interaction between social norm and identification (subcategories of identity) on intentions to be more physically active (all $p > 0.05$). However, significant effects of identity on physical activity intentions were observed in all models (all $p < 0.05$). High level of identity was associated with greater intentions to conduct physical activity than low level of identity. Similarly, when comparing to the neutral control condition, there was no significant main effect of health message or interaction on physical activity intentions (all $p > 0.05$), although there were significant effects of identity on physical activity intentions (all $p < 0.05$). High levels of identity were associated with greater intentions to conduct physical activity than were low level of identity.

3.2.4. Interim summary

The current study compared the effect of exposure to a social norm message, a health message and a control message on intentions to eat vegetables in a British population. Individuals who received social normative information about other people's vegetable consumption reported that they intended to eat more portions of vegetables the following week period than those participants who received health message or neutral control message, but this was only if they identified strongly with the norm referent group, specifically if they scored highly on a measure of centrality of group identity (the salience and importance of the in-group membership). The aim of Study 2, was to

extend these findings by examining the effect of exposure to a social norm message about limiting “junk food” intake on intentions to consume junk food.

Study 2 Norm message and student identity on junk food eating intentions

3.3.1. Method

Participants

568 students from the University of Birmingham of Birmingham were recruited. Based on the calculations from GPower 3.0.10, to achieve 95% power with a $p < 0.05$, effect size (f)=0.15, a minimum sample size of 489 participants should be recruited. Participants were recruited through campus advertising and social media such as Facebook and Bham portal. The study was advertised as a ‘Student Lifestyle Survey’ which investigating students’ lifestyle at University of Birmingham. Only students at University of Birmingham (UoB) were eligible to sign up. Similar to Study 1, participants voluntarily took part in the study and all of them had the opportunity to win an Amazon voucher. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and was approved by the University of Birmingham Research Ethics Committee.

Design

The study used between-subjects design, with 2 conditions: message type (descriptive

norm message vs. control message) and norm referent group (high identifiers vs. low identifiers). Participants were randomly allocated to one of the two conditions.

Messages

The study was presented online through Qualtrics system. One of two messages were randomly presented to each participant: a social norm message about UoB students' junk food intakes (social norm condition) or a neutral message about students' accommodation costs in Birmingham (control condition). Each participant was exposed to two posters containing one of the two messages in the middle and four different images about university of Birmingham (e.g. logo, campus map and landmarks of university). The messages on the posters were same but the background colour and pictures differed. The social norm messages and control messages were matched for word length and marked with the data source. In the social norm condition, the message was 'Students eat less junk food than you might realise. Most students at University of Birmingham limit how much junk food they are eating to 1 or less than 1 serving a day. (based on a 2012 study)' (Robinson et al., 2013). In the health condition, the message was 'Students spend less money on accommodation than you might realise. Most students in Birmingham spend less than £100 in rent per week with the cheapest rent at £62 per week (Survey from NUS, 2012)'.

Measurements

A demographic questionnaire was firstly used to collect participants' background details (e.g. age, gender, smoker or not, ethnicity, the year of study). To measure usual junk food intake, participants were asked to indicate how many servings of junk food they normally eat a day. Similar to Study 1, to measure different kinds of physical activities that people do in their everyday lives, we used International Physical Activity Questionnaire (IPAQ) which provides a comparison measurement on health-related physical activity and was parallel to the measurement of habitual eating behaviour (Craig et al., 2003). The volume of activity was represented by a MET-minute score. To corroborate the cover story, participants were given Ten-Item Personality Inventory (TIPI) to state their personality (Cronbach's alpha = 0.64) as well as Visual Analogue Mood Scales (100mm) to rate their mood status (Cronbach's alpha = 0.57). In addition, the poster evaluation scale measure participants' feeling about posters was identical to Study 1.

Student identity, as a possible moderator was assessed using the 14-item modified multicomponent identification scale (Cronbach's alpha = 0.90). Three mediators were measured in a series of questionnaires: self-identification as a person who eats less junk foods (e.g. Not eating lot of junk food is something that fits with who I am); attitudes toward eating junk foods and self-efficacy for eating less junk foods (e.g. Not eating a lot of junk food is in my own hands) (details see Study 1). Moreover, intention for eating junk food was assessed with four items (scores): 'I intend/plan/want/expect to

limit my intake of junk food in the near future' and an open question (number): 'please write down how many servings of junk food you intend to eat per day next week' (Cronbach's alpha = 0.91). Parallel to the measurement of eating intention, intentions to conduct physical activity was assessed identical to Study 1. At the end of questionnaire, weight, height was self-reported.

Procedure

Participants took part in the study online. They were firstly informed about the study and then filled in the consent form. Participants then completed a range of questionnaires mentioned above. They were also exposed to posters that contained either the social norm message or the neutral control message and asked to remember and recall the contents of messages. Finally, participants completed measurements of eating intentions and physical activity intentions. All participants were thanked and debriefed at the end of the study.

3.3.2. Analysis Strategy

We firstly examined whether the groups differ in participant characteristics (e.g. age, BMI, usual junk food intake) using an independent sample t-test. Any variables that correlated with the main outcome measurements were used as covariates in subsequent analyses. Principal components analysis (PCA) was run with varimax rotation extracted

5 factors (items loaded > 0.5) for the modified multicomponent in-group identity scale, accounting for 82.1% of the variance. Factors included solidarity, satisfaction, centrality, self-stereotyping and homogeneity were consistent with the categories of identity in the original paper (Leach et al., 2008). Similarly, PCA was run for the poster evaluation scale and 2 factors emerged with eigenvalues above 1, accounting for 61.4% of the variance: legitimacy (believability and relatability of posters) and understanding (clarity and meaning of posters). Ratings of how professional the posters did not load onto those two factors, and they were analysed separately.

Our main planned analysis strategy was to use regression to compare the social norm effect and interaction effect of norm and identity on intentions to eat junk food. We planned the same analysis strategy to compare the social norm effect and interaction effect of norm and identity on intentions to do physical activity. Lastly, we planned a multiple mediation analysis to examine whether self-identification, attitudes and self-efficacy mediated the influence of social norm (or health information) on intention to eat junk food.

3.3.3. Results

Participant characteristics

Participants were a sample of students with mean age of 20 years old ($SD=3.4$), mean BMI of 22.1 ($SD=3.7$). In terms of how participants identified themselves as students at UoB, the mean score for each subcategory of identification were: solidarity ($M=5.3$,

SD=1.1), satisfaction (M=6.1, SD=0.8), centrality (M=5.0, SD=1.2), self-stereotyping (M=4.6, SD=1.3), in-group homogeneity (M=4.2, SD=1.2), and motivation (M=5.3, SD=1.0). In addition, mean scores for mediators were: self-identification (M=3.2, SD=1.1), attitudes (M=3.1, SD=0.7) and self-efficacy (M=2.7, SD=0.6).

No significant differences in terms of participants' characteristics and baseline measurements were found between social norm and control condition (Table 3.3). Because baseline hunger ($r=0.11$, $p=0.009$) and usual junk food intake ($r=0.48$, $p<0.001$) were significantly correlated with intentions to eat junk food, therefore, those two variables were included as covariates in the main analysis.

Table 3. 3. Participants' characteristics between social norm and control condition (Mean/SD).

	Control (N=286)	Social (N=282)
<i>Age (years)</i>	19.7 (3.0)	20.0 (3.7)
<i>Gender</i>	Male=44	Male=37
<i>BMI</i>	22.1 (3.6)	22.2 (3.9)
<i>Ethnicity</i>	White=206 Other=80	White=201 Other=81
<i>Usual junk food intake (serving/per day)</i>	1.5 (1.0)	1.5 (0.9)
<i>Hunger Baseline (0-100)</i>	35.6 (29.4)	34.8 (29.6)
<i>Identification Subscales (1-7):</i>		
<i>Solidarity</i>	5.3 (1.1)	5.3 (1.1)
<i>Satisfaction</i>	6.1 (0.8)	6.1 (0.9)

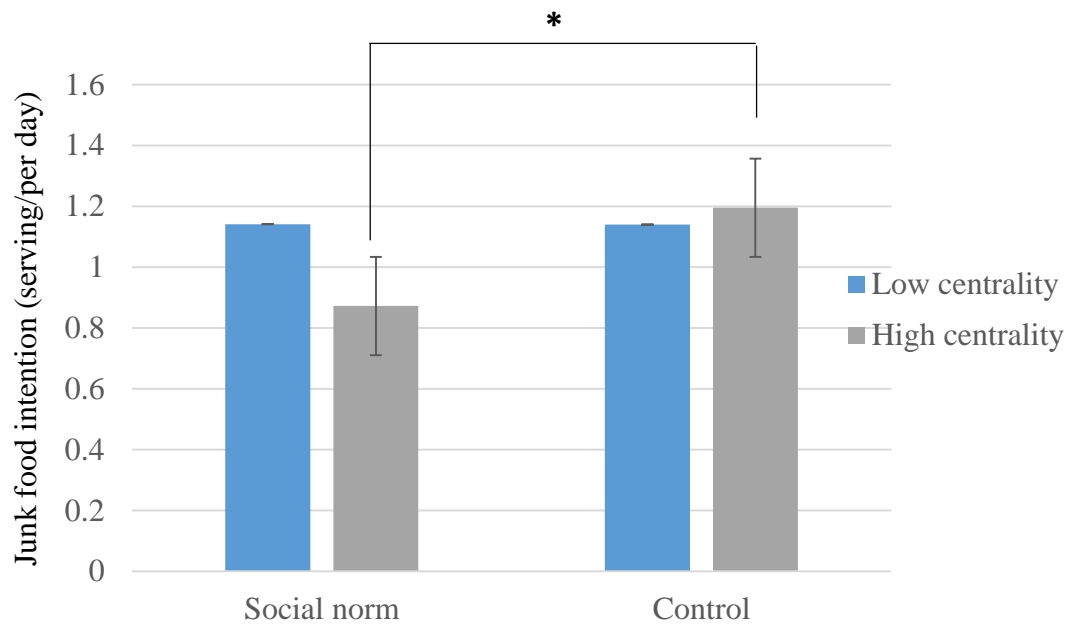
<i>Centrality</i>	5.1 (1.2)	5.0 (1.2)
<i>Self-Stereotyping</i>	4.6 (1.3)	4.6 (1.3)
<i>In-group Homogeneity</i>	4.2 (1.3)	4.2 (1.2)
<i>Motivation</i>	5.4 (1.0)	5.2 (1.1)
<i>Personality Subscales (1-7):</i>		
<i>Extraversion</i>	4.4 (1.4)	4.3 (1.4)
<i>Agreeableness</i>	5.0 (1.0)	5.1 (1.0)
<i>Emotional Stability</i>	4.0 (1.4)	4.2 (1.4)
<i>Consciousness</i>	5.0 (1.1)	5.0 (1.1)
<i>Openness</i>	5.0 (1.1)	4.9 (1.1)
<i>Physical Activity MET (mins)</i>	2563.3 (1914.4)	2696.5 (1834.9)
<i>Poster evaluation (1-5)</i>		
<i>Legitimacy</i>	4.0 (0.8)	3.9 (0.8)
<i>Understanding</i>	4.2 (0.7)	4.1 (0.9)
<i>Professional</i>	3.1 (1.3)	2.9 (1.2)
<i>Mediation Scores:</i>		
<i>Self-identification</i> (1-5)	3.2 (1.1)	3.2 (1.1)
<i>Attitudes (1-4)</i>	3.0 (0.7)	3.1 (0.7)
<i>Self-efficacy (1-5)</i>	2.7 (0.6)	2.7 (0.6)

Intention to consume junk foods

Moderation analysis

The regression model including the centrality subscales scores was significant, $F(5, 550)=22.96$, $p<0.001$, and explained 25.0% of the variance. There was a significant main effect of condition on intention to eat junk foods ($b=-0.16$, $t=-2.2$, $p=0.027$). There

was also a significant interaction effect ($b=-0.13$, $t=-2.0$, $p=0.047$). Intentions to eat junk food were lower in the social norm condition than the control condition but only among participants scoring high on centrality ($p=0.003$) (Figure 3.4).



* $p<0.05$

Figure 3. 4. The interaction effect of condition (social norm vs. control) and centrality on junk food intention.

There was no main effect of norm condition ($b=0.09$, $t=-1.30$, $p=0.195$) nor any interaction with centrality for attitudes towards limiting junk food ($b=-0.11$, $t=-1.60$, $p=0.11$) or when taking other subcategories of identity into account (all $p>0.05$).

Intention to conduct physical activity

There was no significant difference between social norm and control condition on

intentions to do physical activity, and also identification (sub-categorical components of identity) did not moderate the social norm effect on physical activity intentions (all $p>0.05$). Moreover, the results were consistent with the results from Study 1, in that physical intentions differed between high and low level of identity (solidarity, satisfaction, centrality and self-stereotyping) ($p<0.05$). A high level of identity was associated with greater intentions to do physical activity than low level of identity.

Mediation analysis

A multiple mediation analysis was conducted to examine whether the influence of social norm on intentions to eat junk food was mediated by the changes in self-identification, attitudes and self-efficacy. The a, b, c, c' paths from the mediation results were presented in Table 3.4. Social norm condition did not significantly predict any of mediators (all $p>0.05$) (a path). In addition, attitudes significantly predicted intention to consume junk food, $b=-0.20$, $t=0.80$, $p<0.001$, but self-identification and self-efficacy did not (all $p>0.05$) (b path). Social norm condition predicted intention to eat junk food directly, $F(3,552)=34.91$, $b=-0.16$, $t=-2.12$, $p=0.034$, $R^2 =0.24$. However, there was no evidence of an indirect influence of the effect of social norm on junk food intentions via the mediators ($b=-0.14$, $t=-1.94$, $p=0.053$). Adding centrality as a moderator did not affect the pattern of results.

Table 3. 4. Multiple mediation analysis.

<i>Direct path</i>		<i>Coefficients and significance levels (standard errors)</i>	
<i>Mediation analysis</i>	a paths	(1) self-identification	B=.02 (.08)
	(social norm → mediators)	(2) attitude	B=.09(.06)
		(3) self-efficacy	B=.04 (.05)
		b paths	(1) self-identification
	(mediators → intention)	(2) attitude	B=-.20 (.05)***
		(3) self-efficacy	B=.09 (.07)
		c path	
(Social norm → intention)			
c' path		B=-.14 (.07)	
(Social norm → intention corrected for indirect effect)			
<i>Indirect path</i>		Bootstrapped coefficients and confidence intervals	
a*b paths (Norms → intention via mediators)	1) self-identification		B=.00 CI[-.00,.02]
	2) attitude		B=-.02 CI[-.05,.00]
	3) self-efficacy		B=.00 CI[-.00,.02]
	total effect		B=-.01 CI[-.04,.01]
Pairwise contrasts between mediators	(1) vs (2)		B=.02 CI[-.00,.05]
	(1) vs (3)		B=-.00 CI[-.02,.01]
	(2) vs (3)		B=-.02 CI[-.05,.00]

* $p < 0.05$, *** $p < 0.001$

3.3.4. Interim summary

Study 2 examined the effect of a social norm message versus a control message on intentions to limit junk food intake in a student population. Viewing a message suggesting that other students limit their junk food intake was associated with intentions to consume fewer portions of junk foods in the near future relative to a control message, but this was only the case for participants who reported a high level of identification with the norm referent group, specifically if they scored highly on a measure of centrality of group identity (the salience and importance of the in-group membership).

3.4. General discussion

Two studies were conducted to investigate the effects of exposure to a social norms message about the eating habits of others on eating intentions. Potential moderators and mediators of any association were also assessed. Exposure to a social norms message, but not a health-related or control message, was associated with increased intentions to eat vegetables (Study 1) and increased intentions to limit junk food intake (Study 2), but only for participants who scored highly on a measure of how central the norm referent group was to their identity. There was no effect of exposure to the norms message on intentions to exercise, suggesting that the manipulation did not induce a general increase in socially desirable responding. These findings are consistent with

previous evidence that eating intentions are affected by exposure to social normative information (Croker et al., 2009; Vartanian et al., 2013) and that this effect may be moderated by strength of identification with the norm referent group (Coppin et al., 2016; Hackel et al., 2016; Masson & Fritsche, 2014; Stok et al., 2014). The results are also broadly consistent with evidence that the interplay of identity and (perceived) norms affects intentions towards health-related behaviours such as drinking, exercise and sun-protective behaviour (Johnston & White, 2003; Terry & Hogg, 1996).

It should be noted that in both Study 1 and Study 2, only the centrality component of group identification with the norm referent group moderated the relationship between exposure to social normative information and eating intentions. This pattern of results suggests that specific aspects of self-investment in the norm referent group may be more important than self-definition as a group member in determining the degree of conformity with the norm. In other words, the moderating effect of identification with the norm may be driven by motivational components of social identity, such as how important the group is to my identity, rather than perceived similarity with the group. This suggestion is supported by the findings of Hackel and colleagues, who found that group-level self-investment, but not self-definition, was related to the hedonic evaluation of identity relevant foods (Hackel et al., 2016). Acting in line with the presented group norm maybe more likely when individuals regard their membership of the group as being important to their identity (Masson and Fritsche, 2014).

There was no evidence that the effect of exposure to the social norm message on eating intentions was mediated by self-identification, attitudes or self-efficacy toward eating vegetables/junk food. This pattern of results is in contrast to the findings of Stok and colleagues who reported that the effect of a majority eating norm about vegetable consumption increased self-reported vegetable consumption, relative to a minority eating norm, and that this effect was partially, but not fully, mediated by changes in self-identification and self-efficacy (Stok et al., 2014). In addition, unlike Stok and colleagues (2014), we found no effect of the social norms message on a measure of attitudes towards future eating sufficient vegetables in the future (Stok et al., 2014). A number of significant differences between the present studies and that of Stok and colleagues (2014) may explain the discrepant results. One possibility is that because in the in the study by Stok and colleagues (2014) there was no comparison with a no norm control condition, it might have been that the effects were driven by minority norm decreasing intentions to eat vegetables rather the majority norm increasing intentions. Further work is required to investigate whether different mechanisms underlie the responses to majority versus minority normative information. One possibility is that the exposure to a majority norm (for people who see the norm group as important) influences the anticipated or actual evaluation/perception of food (Higgs, 2015), which was not assessed here, but has been reported to be influenced by salient social identity (Coppin et al., 2016). Alternatively, it may be that the majority norm signals appropriate behaviour for the group, which then motivates consumption intentions, as has been reported for the effect of a social model on food intake (Vartanian, et al., 2013).

A few limitations of the present studies should be noted. Only intentions to consume foods were assessed and the gap between behavioural intention and actual behaviour should not be ignored (Ajzen & Fishbein, 1980). Future studies are required to examine whether similar results are obtained for measures of food consumption. Study 1 recruited participants from a community sample, but the sample comprised mainly young, white, women and so further work is required to extend the work to more representative and diverse samples.

Recent studies have begun to test the effectiveness of norm based interventions to promote purchase of vegetables in field studies (Mollen et al., 2013; Thomas et al., 2017). Given the present results, it may be important that future social norm interventions consider the salience/importance of the referent group to the target audience, since this may determine the effectiveness of the intervention.

Overall, present studies provided evidence that the centrality of social identification with a norm referent group moderates the effects of social norm messages on intention to eating vegetables and limit junk food intake. The data suggest that social identity plays a role in motivating food choices and that consideration of social factors might be considered the development of interventions design to promote healthier eating.

CHAPTER 4: MODELING OF FOOD INTAKE: THE MODERATING EFFECT OF SOCIAL IDENTITY

4.1. Background

Much evidence has accumulated to suggest that social context is a powerful influence on eating behaviour (e.g. Cruwys et al., 2015; Herman et al., 2003; Higgs, 2015; Higgs & Thomas, 2016; Robinson & Higgs, 2013; Robinson et al., 2014). Individuals determine what is appropriate in terms of eating behaviours by looking to social and environmental cues (Nisbett & Storms, 1974). Cues such as the intake of others or portion sizes indicate what is normative consumption and people are likely to adjust their eating to ensure that it is in line with the norm, which is known as modelling (Herman et al., 2003; Roth et al., 2001). Modelling behaviour has been studied widely in the laboratory and in a typical social modelling study, participants' eating behaviours are observed in the presence of someone else (a confederate of the experimenter who acts as the eating companion and eats as directed by the experimenter) (Herman et al., 2003). What has been found is that participants imitate the level of food intake of the confederate (e.g. Conger et al., 1980; de Luca & Spigelman, 1979; Feeney et al., 2011; Goldman et al., 1991; Hermans et al., 2009; Hermans et al., 2010; Pliner & Chaiken, 1990; for review see Cruwys et al., 2015). It has been proposed that participants use the intake of their eating companion as a source of normative information about how much they may consume, especially when there are no clear guidelines about what constitutes appropriate intake in that context (Herman et al., 2003; Hermans et al., 2010; Leone et

al., 2007).

In the modelling literature, it has been reported that people eat more when their eating companions eat more, while they eat less when their eating companions eat less (Herman et al., 2003; McFerran et al., 2010). In addition, social modelling of food choices has been observed in recent studies. Participants are less likely to choose, and consume, low energy dense foods in the presence of an 'unhealthy' eating partner (who chooses predominantly high energy dense foods), compared to a situation when they are in the presence of an 'healthy' eating partner (who chooses predominantly low energy dense foods) or when eating alone (Robinson & Higgs, 2013).

Modelling of food intake has also been reported in situations where there is no person present and the eating norm is communicated by alternative means. In the remote-confederate paradigm, information is provided about the behaviour of other participants in the experiment (Bevelander et al., 2013; Feeney et al., 2011; Florack et al., 2013; Leone et al., 2007; Pliner & Mann, 2004; Robinson et al., 2013; Roth et al., 2001; Vartanian et al., 2013). The effect of a remote confederate model on eating behaviour has been reported to be similar to that of a live confederate model (Feeney et al., 2011). It has been proposed that the fictional information about what non-present others ate in the experiment guides the participants' eating behaviour. For instance, when participants believe that previous people in the study had eaten large amount of snack food, their own snack intake increased (Hermans et al., 2012; Pliner & Mann, 2004;

Roth et al., 2001). More recently, participants were found to consume significantly more cookies if they were exposed to a high intake norm (information that previous experiment participants eat large amount of cookies) compared with participants who were exposed to no information (Robinson et al., 2013). Vartanian et al. (2013) also reported that exposure to a low intake model led to significantly less cookie intake compared with exposure to high intake model. Most remote confederate modelling studies have assessed food intake rather than food choice and evidence for modelling of food choices is more limited, perhaps because people feel more certain about the type of food they like or dislike and have already developed their own eating habits (Pliner & Mann, 2004). To achieve the largest modelling influence, the current study will measure food intake rather than food choice.

Empirical evidence has also suggested that there are some factors that moderate social modelling effects. For instance, low self-esteem and high empathy were found to be associated with a strong modelling effect in a live confederate study (Robinson et al., 2011), although a later study did not find a moderation effect of trait empathy in a remote confederate design (Robinson et al., 2013). Gender was also suggested to influence modelling of eating from the theoretical perspective that women may pay more attention to normative cues than do men who may model less readily than women (Hermans et al., 2010; Vartanian et al., 2007). However, there is not enough empirical evidence to confirm the greater vulnerability of women to modelling of food intake, it is important to note that only a few studies have directly compared men and women

(Cruwys et al., 2015). Nevertheless, the present studies only women were recruited because strong modelling effects have been reported for female samples.

Other moderating factors, such as similarity to the norm referent group, have been examined in previous research. For example, people are more likely to model food intake if the normative information is provided by a member of social in-group (e.g. a student from the same university), but they are less likely to model if the information is from an out-group (e.g. a student from a different university) (Cruwys et al., 2012). Lakin and Chartrand (2003) also found that people tend to model more if they have a goal to affiliate to a social group. According to Social Identity Theory (Tajfel, 1978; Tajfel & Turner, 1979), people model others when there is some similarity between the self and the model (Cruwys et al., 2015), perhaps in part because people adjust their food intake to how much others consume in order to affiliate with them (Exline et al., 2012; Herman et al., 2003; Hermans et al., 2009; Robinson et al., 2011). To date, no remote confederate study has examined the moderating effect of group identity on modelling of eating.

Importantly, an individual's identification with an in-group has been conceptualized along different dimensions. As indicated in the multicomponent model of in-group identification devised by Leach et al. (2008), in-group identification is organized under two dimensions (group level self-definition and self-investment) containing five specific components (solidarity, satisfaction, centrality, individual self-stereotyping and

in-group homogeneity). Evidence from Chapter 3 indicated that the effect of an eating norm on eating intentions is stronger for people with high 'Centrality' scores toward the norm referent group. It was suggested that norm interventions might target centrality of in-group identification, as this is the component that focuses on the salience and importance of the in-group membership. However, there is evidence that perceived similarities between group members are more important for modelling effects, which can be seen as similar to the concept of the individual self-stereotyping (partial in-group homogeneity) component of identification (Cruwys et al., 2012; 2015). In other words, the degree to which individuals perceive themselves as having something in common with another person may moderate modelling effects. To date, there has been no examination of the importance of different components of identification in moderating modelling effects. Rather than simply examining how the strength of identification affects modelling, the aim of the present study was to investigate which component of identification may moderate modelling.

Evidence suggests that people readily model the consumption of palatable, energy dense foods, such as cookies (Robinson et al., 2013; Roth et al., 2001; Vartanian et al., 2013), chocolate M&Ms (Robinson et al., 2011) and popcorn (Cruwys et al., 2012). However, there is little evidence concerning the modelling of nutrient rich foods, such as vegetables and some evidence to suggest that people may not model of intake of 'healthy' or unpalatable foods (Goldman et al., 1991; Pliner & Mann, 2004). To date, only one live modelling study has involved consumption of vegetables (Hermans et al.,

2009). Participants consumed more vegetables if they were exposed to a peer eating a large amount of vegetables than if they were exposed to a peer eating a small amount or no vegetables. Although a modelling effect on vegetable intake was observed, the effect size was small and it is unclear whether there are any moderators of the effect. According to HSE (2013), less than 40% people in England meet the NHS recommendations of '5 portions' of fruit and vegetables a day, and so more research should be conducted on examining the modelling effect of healthy food intake, in order to broaden our understanding of the scope of modelling on eating behaviour.

To briefly summarize, social modelling has been shown to have a powerful influence on food intake in several contexts. Although a previous study conducted by Stok et al. (2014) considered the moderating effect of identification with the norm referent group and found that participants followed the eating behaviour of majority group members but not minority group members, no study to date has investigated actual food intake. The aim of the present studies was to find out whether identification with the norm is associated with modelling of intake, and in particular, which component of identity is most influential.

Two studies were conducted examining 1) the modelling of a palatable, energy-dense snack (cookies) and 2) modelling of a low-energy-dense nutrient rich snack (vegetables). The first aim was to investigate modelling of intake of both energy dense and nutrient rich food (Cruwys et al., 2012; Hermans et al., 2009; Robinson et al., 2011; Robinson et al., 2013; Roth et al., 2001; Vartanian et al., 2013). A second aim was to

examine evidence for the moderating influence of social identity on intake modelling. For both studies, it was hypothesized that 1) participants would eat more snack foods when they were exposed to high normative information than when they were exposed to no normative information and that 2) they would consume fewer snacks when they were exposed to low intake normative information than when they were exposed to no normative information. It was further hypothesized that any modelling effects would be stronger when participants identified themselves strongly as a member of the norm group.

Study 1 Modelling of Cookie Intake

4.2.1. Method

Participants

Ninety students at University of Birmingham (all females) with a mean age of 21.2 years ($SD=2.5$) were recruited through advertisement on via online portals and posters around campus. Based on calculations using GPower 3.1.0, at 85% power with a $p<0.05$ and effect size (f) of 0.4, a minimum sample of 82 participants was needed for a 3x2 ANOVA study. Students voluntarily signed up for participation. All students were compensated with either course credits or a £5 cash upon the completion of the study. Only females were recruited because of evidence that modelling effects may be stronger for men than for women (Conger et al., 1980). Based on both remote and live modelling study conducted by Robinson et al. (2013) and Robinson and Higgs (2013), a cover

story was used to disguise the aims of the study. The adverts suggested that the study was about ‘Cookie Taste and Mood Status’. Smokers and those with food allergies were excluded from participation. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and was approved by the University of Birmingham Research Ethics Committee.

Design

The study used a 3 x 2 between-subjects design, with 2 conditions: message type (high intake norm vs. low intake norm vs. no intake norm) and student identity (high identifiers vs. low identifiers). Participants were randomly allocated to one of the three message conditions.

Remote confederate manipulation

In the experimental conditions (high intake norm and low intake norm), participants were exposed to a sheet containing fictitious information about previous participants. The sheet contained 5 prior participants’ details such as their name, age and amount of cookies eaten. The level of cookie intake was based on previous research and the results of a pilot study. Firstly, Robinson et al. (2013) reported that female psychology students on average consumed about 4 cookies in their experiment. The high norm was about 8, 9, 10 cookies. Secondly, Roth et al. (2001) and Vartanian et al. (2013) displayed 13 to 15 cookies in the high-intake condition in a remote modelling study. More importantly, the data we collected from our pilot study suggested that female students ate 5 cookies

on average. Based on the above data, and to ensure a large difference to between the high norm and no norm condition, in the high norm condition, the amount of cookies listed on the sheet was around 13-15 (15,13,13,14,15) cookies for the high norm condition and 1-2 (2,2,1,2,1) cookies in the low norm condition.

Food

The cookies were ‘Sainsbury Maryland Chocolate Cookies’. All cookies were served in bowl and a glass of water and napkins were also provided. Each bowl contained 20 cookies with a total pre-selection weight around 210 grams.



Figure 4. 1. Pictures shows a standard serving of cookies.

Measurements

Participants' baseline hunger (and fullness and desire to eat) were measured on a 100mm scale. Participants were asked to indicate ‘how hungry are you right now’ between ‘not at all’ and ‘extremely’. To corroborate the cover story, participants were

given visual analogue scales (100mm) to rate their mood status (including how happy, alert, drowsy, light-headed, anxious, nauseous, sad, withdrawn, faint, thirsty are you right now) (Cronbach's alpha = 0.42). To assess the strength of student identity, we modified the multicomponent identification questionnaire with 14 items (a 7-Likert scale) which was derived from Leach et al. (2008) (Cronbach's alpha = 0.85). Participants stated their identity between 'strongly disagree' and 'strongly agree' (e.g. I am glad to be a student at University of Birmingham). The multicomponent identity questionnaire includes five subcategories of identity: solidarity, satisfaction, centrality, individual self-stereotyping and in-group homogeneity. We also added an additional subcategory of identity named as 'motivation': that is to what extent students are motivated to be identified as a student at University of Birmingham (e.g. I want to see myself as a UoB student/identify with other UoB student). This was because modelling of food intake has been linked to desire to affiliate with an in-group (Robinson et al., 2011) and so we wanted to assess whether students who expressed greater motivation to see themselves as part of the group were more likely to model. Usual snack food intake was measured by two items (e.g. how many high dense snack foods do you normally eat a day/ think back carefully, how many high dense snack foods did you eat yesterday). This was based on previous research that habitual intakes moderate norm following on food selection (Robinson et al., 2014). The liking of cookies was also rated in a 100mm scale from 0 (not at all) to 100 (very much). To assess dietary patterns (hunger, disinhibition and cognitive restraint eating), participants completed the Three Factor Eating Questionnaire (TFEQ) (e.g. indicate true or false on questions 'I am

usually so hungry that I eat more than three times a day') (Stunkard and Messick, 1985) (see Appendix 6) (Cronbach's alpha = 0.76). There were also demand check questions to find out if participants were aware of study aims and whether participants noticed the norms on the information sheet.

Procedure

All experimental sessions took place between 10:00- 12:00 and 14:00- 18:00 on weekdays. The participant was informed to refrain from eating for 2 hours prior to the experiment session. On arrival, the participant was informed about the study details and asked to provide informed consent (more details see Appendix 1). Then she was given the sheet with all prior participants' details and she filled in her own information such as age and gender at the bottom. In the high norm and low norm conditions, the participant saw an information sheet showing either high or low cookie intakes. In the no norm condition, no information was provided about the cookie intake of previous participants (the cells were left blank). After that, the experimenter removed the information sheet and served the cookies. The participant was told to eat as much as she liked in 10 minutes while completing the taste ratings. The participant also completed the appetite and mood scales before and after eating. Immediately after the taste test, the participant was asked to complete the habitual food consumption questionnaire, the student identification scales and the TFEQ. The participant was also asked to guess the aims of the study, report whether she was aware of the information on the fictitious sheets, to write down the number of cookies eaten if she remembered

it and report whether that information affected her intake in the study or not. Before leaving, the participant's weight (kg) and height (cm) were recorded. Finally, the participant was debriefed and thanked for her time. Participants' cookie intake was measured in both grams and numbers by the experimenter.

4.2.2. Analysis Strategy

Before performing the main analysis, we first examined whether the conditions differed in terms of participant age, baseline hunger, BMI and cognitive restraint. In addition, we also examined whether the conditions differed in terms of reported habitual snack food intake and liking of cookies and whether those two variables were correlated with cookie intake. A between-subjects 3 x 2 ANOVA was conducted to compare the effect of message type and student identification, and their interaction on cookie intake. Significant interactions were further examined with follow-up ANOVA and Bonferroni post hoc tests, which allowing comparisons between norm messages and control message. We also examined whether identity moderated the degree of 'matching' to the norms (Robinson et al., 2011; Robinson et al., 2013). The absolute differences (in numbers) between participants' cookie intake and the average number of cookies that fictitious previous participants consumed was calculated. Then we compared the identity scores and matching scores to assess whether identity was associated with the degree of matching by using Pearson's correlation analysis.

4.2.3. Results

Manipulation checks

None of participants were aware of the true study aim and most reported an aim in line with the cover story. All participants in the norm conditions (N=60) reported that they remembered the norm information given and correctly reported the number of cookie intakes (high norm was around 13 to 15 cookies and low norm was around 1 to 2 cookies). Participants in the control condition (N=30) reported no awareness of normative information.

Participant characteristics and baseline measures

The two items measuring habitual snack food intake (snack food per day and yesterday) were positively and significantly correlated ($r=0.64$, $p<0.001$). Therefore, we calculated the average scores for those two items as the habitual snack food intake. There was no difference in age, baseline hunger, BMI, TFEQ scores and liking of cookies and habitual snack food intake across three conditions (Table 4.1). For the whole sample, the appetite ratings were consistent with the participants being moderately hungry: baseline hunger score $M=54.1$, $SD=27.3$, baseline fullness score $M=27.9$, $SD=21.0$ and desire to eat scores $M=63.3$, $SD=24.0$. The mean restraint eating score was 8.9 ($SD=5.1$) which suggests that dieting tendencies were not high in the population. The average liking of the cookies was 71.6 ($SD=21.9$) across all conditions, which suggests the cookies were liked. There was no significant correlation between baseline hunger, baseline fullness, baseline desire to eat, liking of cookie, age or BMI and cookie intake and so there was

no need to control for these variables. Habitual snack food intake was significantly correlated with the total amount of cookie intake and we controlled for habitual snack food intake in the subsequent analyses.

Table 4. 1. Participant characteristics in three conditions (Mean and SD).

	No Norm (N=30)	Low Norm (N=30)	High Norm (N=30)
Age (years)	21.6 (3.3)	20.8 (2.1)	21.2 (2.0)
BMI	21.8 (2.0)	21.1 (1.6)	21.3 (2.1)
Ethnicity	White=14 Asian=10	White=15 Asian=10	White=17 Asian=8
Baseline Hunger (0-100)	57.1 (25.0)	55.0 (28.8)	50.3 (28.4)
Baseline fullness (0-100)	27.4 (21.2)	22.8 (20.5)	33.4 (20.7)
Baseline desire to eat (0-100)	67.3 (19.4)	63.6 (28.2)	59.1 (23.9)
Liking of cookies (0-100)	75.1 (17.7)	75.1 (21.8)	64.7 (24.7)
Restraint eating (0-20)	9.4 (5.6)	8.0 (5.2)	9.3 (4.5)
Habitual snack intake (serving/per day)	1.1 (1.0)	1.2 (0.8)	1.4 (1.0)

Student identity

Across all three conditions, one-way ANOVA shows that participants did not differ in the student identification strength (Table 4.2). We then used a median split to characterise participants into low and high identifiers in terms of their sub-categorical

identification scores in the subsequent analysis.

Table 4. 2. Student identity scores (average scores) by conditions (ranged between 1 and 7).

	No Norm	Low Norm	High Norm
Solidarity	5.1 (1.1)	5.3 (0.8)	5.3 (0.8)
Satisfaction	6.0 (0.7)	6.0 (0.8)	6.1 (0.7)
Centrality	4.5 (1.2)	4.7 (1.3)	5.1 (1.2)
Self-Stereotyping	3.9 (1.2)	4.1 (1.5)	4.5 (1.4)
Homogeneity	3.9 (1.3)	3.9 (1.0)	3.7 (1.0)
Motivation	5.1 (1.0)	5.0 (1.0)	5.1 (1.1)

Cookie intake

We conducted a 3 x 2 ANOVA on the effect of condition, identity and their interaction. After controlling for the habitual snack food intake, significant modelling effects were detected. More detail regarding the effect of subgroup of identity and interactions are listed in Table 4.3.

Firstly, we conducted ANOVA using the individual components of multi-in group identity. We found a strong and significant main effect of modelling on cookie intake $F(2, 83)=12.96, p<0.001$. Participants ate significantly more cookies in the high norm condition ($M=68.9, SE=4.6$) than in the low norm ($M=37.5, SE=4.1$) or no norm condition ($M=52.6, SE=4.2$), and participants ate significantly less cookies in the low norm condition than no norm or high norm condition. Bonferroni post hoc test showed that the difference between no norm and low norm ($p=0.038$), no norm and high norm

($p=0.034$), low norm and high norm ($p<0.001$) were all significant. There was no significant interaction effect between condition and the centrality score on cookie intake, $F(2, 83)=1.36, p=0.26$ (Figure 4.2).

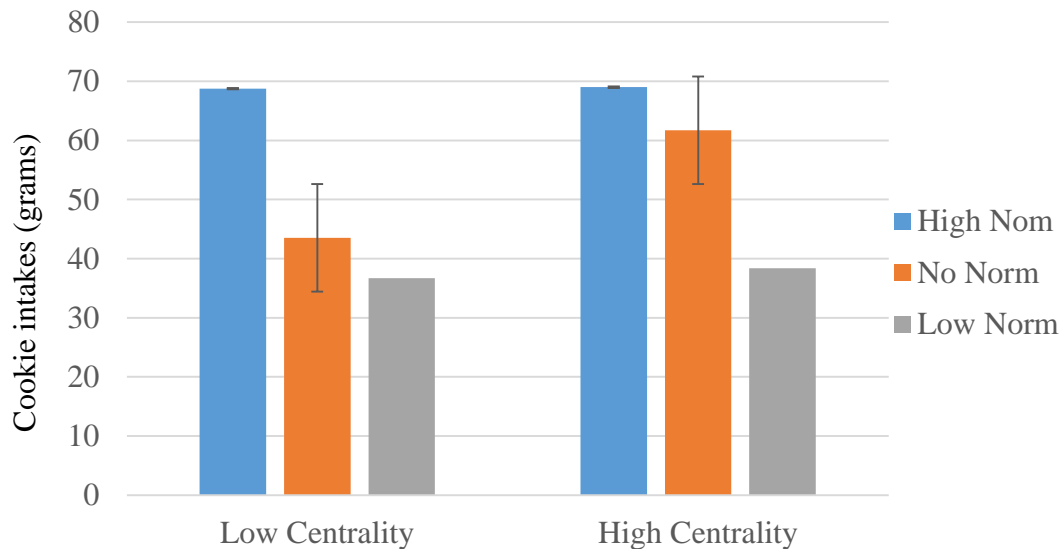
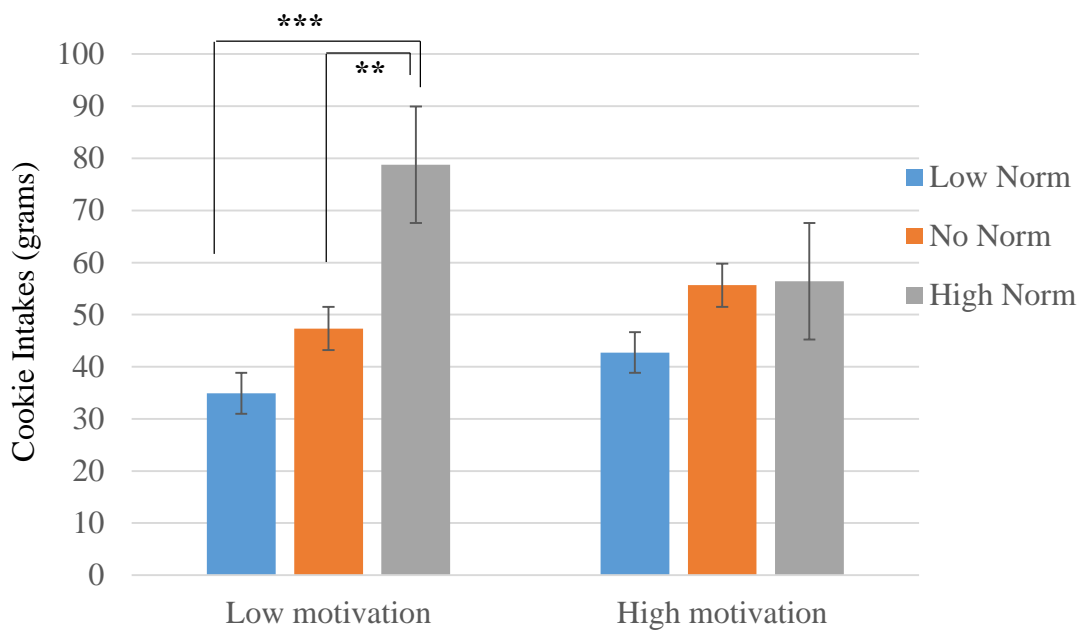


Figure 4. 2. The cookie intakes across conditions between low and high centrality levels.

Then we conducted ANOVA analysis by including other sub-categorical identities. In all of those models, Similar significant main effects of condition were observed in all analyses ($p<0.001$). There were no interactions between condition and sub-categorical identities on cookie intake (all $p>0.05$).

The additional identity measurement ‘motivation’ was analysed using ANOVA. There was a significant interaction effect between condition and motivation on cookie intake, $F(2, 83)=4.58, p=0.01$. There was a significant main effect of condition for participants

who were less motivated identifying as UoB students $F(5, 84) = 8.34, p < 0.001$. Intake in the high norm condition was significantly higher than intake in the low norm condition ($p < 0.001$) and no norm condition ($p = 0.001$). There was no effect of condition for those participants who reported being highly motivated to be identified as UoB student (Figure 4.3).



* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 4. 3. The interaction effect of condition and motivation on cookie intake.

We also conducted regression analysis using identity scores as continuous variables. In the regression model, we included centered condition (dummy variables), centered sub-categorical identity, centered sub-categorical identity* condition interactions.

There was a significant modelling effect: higher cookie intakes in high norm condition

compared to control condition ($b=18.70$, $t=2.61$, $p=0.011$) and fewer cookies intakes in low norm condition compared to control condition ($b=-13.12$, $t=-2.37$, $p=0.020$). There was no significant moderation by identity scores.

Identity and matching scores

The absolute value of matching scores were significantly smaller in the low intake norm condition ($M=2.2$, $SD=1.5$) than matching scores in the high intake norm condition ($M=7.4$, $SD=2.6$), $t(58) = 8.35$, $p=0.05$). Participants in the low norm condition were more likely to match their intake to the normative information provided than those participants in the high norm condition. Overall, there was no significant correlations between sub-categorical components of identity or motivation and matching scores (all $p<0.05$).

Table 4. 3. Significance level for the main and interaction effects of cookie intakes.

	Effect of condition	Effect of identity	Interaction effect	Covariate of habitual snacks
Solidarity	p<0.001	p=0.007	p=0.484	p=0.052
Satisfaction	p<0.001	p=0.270	p=0.081	p=0.059
Centrality	p<0.001	p=0.183	p=0.263	p=0.033
Self-Stereotyping	p<0.001	p=0.517	p==0.384	p=0.067
Homogeneity	p<0.001	p=0.460	p=0.444	p=0.047
Motivation	p<0.001	p=0.666	p=0.013	P=0.064

4.2.4. Interim summary

We found a clear modelling effect for cookie intake in that participants who were led to believe that previous participants had eaten a large amount of cookies (a high intake norm condition) ate significantly more cookies than participants who were given no information about how many cookies others had eaten (no norm condition). Participants who were led to believe that previous participants had eaten a small amount of cookies (a low intake norm) ate significantly less than participants in the no norm condition. This pattern of results is consistent with previous findings that providing normative information about the intake of others affects amount consumed (Robinson et al., 2013). In addition, consistent with previous research, the low intake model had a greater effect on food intake than did the high intake model, suggesting that social models may be more likely to inhibit than to augment intake (Herman et al., 2003; Vartanian et al., 2013).

Study 1 also examined whether student identity moderates modelling of cookie intake. When considering sub-categories of identity, we found no evidence that strength of identification with the norm referent group according to scores on the multicomponent identification questionnaire moderates the modelling effect. However, we did find that how motivated a student is to be identified as a part of their university affected the modelling of cookie intake. Students who reported low motivation to identify themselves as a UoB student were more likely to model that those who were strongly

motivated to identify as UoB students. One interpretation of this pattern of results is that the students who were highly motivated to identify with the norm referent group were behaving in way that distanced themselves from the group norm. Similarly, Banas and colleagues reported an ironic effect of identification with the group norm on measures of eating behaviour: high identifiers did not align their behaviour with the group norm but reacted against it, consuming more when presented with a healthy eating norm and consuming less when presented with an unhealthy eating norm (Banas et al., 2016). Although there was no overall effect of condition on intake for the group scoring high on motivation to identify as a UoB student in the present study, the pattern of results suggests that they were less likely to follow the high norm than the low norm intake. One possible explanation for this finding is that the high identifiers experienced conflict between the presented group norm and their own desire to avoid overeating cookies and so reacted against the norm to challenge it (Packer, 2008). However, because the moderating effect of motivation was only found in the ANOVA and not the regression analysis, this finding should be interpreted with caution and further studies are required to test whether specific aspects of motivation to identify with a group norm do indeed moderate modelling of food intake.

In Study 1, the average liking of cookies for the whole sample was high and it is currently unclear whether modelling effects are also observed for types of food that are less well liked, such as vegetables in a remote confederate design. The aim of Study 2 was to investigate modelling of vegetable intake and the potential moderation of

modelling effect by strength of identification with the norm referent group.

Study 2 Modelling of vegetable intake

4.3.1. Method

Participants

We recruited 84 students at University of Birmingham (all females) with a mean age of 20.5 years (SD=3.2) for Study 2. Based on calculations using GPower 3.1.0, at 85% power with a $p < 0.05$ and effect size (f) of 0.4, a minimum sample of 72 participants was needed for a 2x2 ANOVA study. The medium effect size was determined from previous social norm study (Robinson et al., 2014). We aimed to recruit few more participants so that the sample size was comparable to that from Study 1. Similarly, Study 2 was advertised on Psychology School Participation Scheme, university online portal and posters around campus. Students voluntarily signed up for participation and they were compensated with course credits or a £5 cash upon the completion of the study. A cover story suggested that the study was about 'Vegetable Taste and Mood Status'. All criteria for taking part were as same as Study 1. We excluded 14 participants from the original data sheet (7 underweight, 4 guessed study aims and 4 reported awareness of norms but in the control condition). The study was conducted according to the guidelines laid down in the Declaration of Helsinki and was approved by the University of Birmingham Research Ethics Committee.

Design

The study used a 2 x 2 between-subjects design, with two conditions: message type (high intake norm vs. no intake norm) and student identity (high identifiers vs. low identifiers). This study only adopted the high norm condition because the result of Study 1 suggested that there would be more variability in following of the high norm condition, which is consistent with there being potential moderators of the effect. Participants were randomly allocated to one of the message conditions. Study 2 adopted the same remote-confederate design as Study 1, whereby participants were exposed to information about other participants' food intake.

Remote confederate manipulation

In the experimental condition, participants were exposed to a fictitious sheet containing information about previous participants, including their name, age and amount of vegetable intakes. A pilot study was conducted to investigate the average number of vegetable sticks that students usually consume, in order to determine the high intake norm. The total number of vegetable sticks that pilot participants consumed ranged between 6 and 60. On average, each participant consumed 21 vegetable sticks. The median for total vegetable number was 16. To make a clear difference between high norm and control condition, the high norm was decided as the double of the average and slightly above. Therefore, the high intake norm showed that previous participants consumed 40 to 45 vegetable sticks in the study.

Food stimuli

Two types of vegetable were used: raw cucumber and red pepper. The average vegetable slices prepared for participants was about 4cm long. All vegetables were served in a rational sized bowl for participants. A glass of water and napkins were also provided during the experiment.

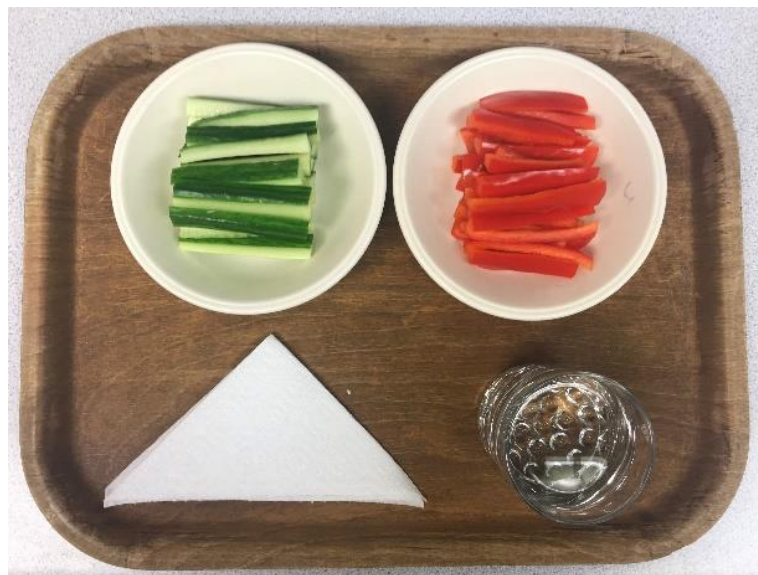


Figure 4. 4. Pictures shows a standard serving of cucumber and red peppers.

Measurements

The same questionnaires from Study 1 were used in this study including medical history questionnaire (see Appendix 3), appetite and mood visual analogue scales, habitual vegetable consumptions, liking rating scales for cucumber and red pepper, Three Factor Eating Questionnaire (TFEQ) (Cronbach's alpha = 0.79), and multicomponent in-group identification questionnaires (Leach et al., 2008) (Cronbach's alpha = 0.87) (see Appendix 19). Besides that, we added a four items identification scales (0-100) in order to measure a wider range of identity. The four-item scale was derived from a Group

Identification Scale (GIS) (Cronbach's alpha = 0.80) (Doosje et al., 1995). We asked participants to indicate the extent to which they agree or disagree each statement: I identify with other UoB students, I see myself as a UoB student, I am glad to be a student at UoB, and I feel strong ties with UoB students. Participants' food intake and BMI were also measured in this study. The main outcome measurement was vegetable consumption.

Procedure

We followed the similar procedure of Study 1. All test sessions were conducted between 10:00- 12:00 and 14:00- 18:00 on weekdays. Participants were informed to refrain from eating for 2 hours prior to the test session. The study information was introduced and participants were asked to give a consent at the beginning. They were also given a fictitious normative sheet containing either a high amount of vegetable consumption from previous participants or no information of others' intake. After that, the experimenter removed the information sheet and served participants vegetables, and participants ate for 10 minutes and provided a liking rating of vegetables. Participants filled in mood questionnaires (both before and after eating), habitual vegetable consumption, student identification scales and TFEQ. Finally, experimenter measured participants' height and weight and participants were debriefed and thanked (see Appendix 18). After the session, the amount of vegetable intake was weighed and calculated.

4.3.2. Analysis Strategy

By using analysis methods from Study 1, we first examined whether participants differed between each condition in terms of their age, baseline hunger and BMI, cognitive restraint rating, habitual vegetable intakes and their likeness of vegetables. We planned an independent sample t-test, any of the above measurements differed between conditions was controlled as covariates in the main analysis. Additionally, we used correlation analysis to see if any variables that correlated with vegetable intake. As in Study 1, the main planned analysis was a 2 x 2 ANOVA, with between subject factors condition and identity (average scores for the multicomponent identification scales). The dependent variable was vegetable intake (in both grams and slices). Moreover, regression analysis was conducted by including identity as a continuous variable rather than a categorical variable, to examine whether identity moderated modelling of vegetable intake. Finally, correlation analyses were conducted on identity and matching scores.

4.3.3. Results

Manipulation checks

No participants guessed the study aim correctly. We also asked participants if they were aware of the number of vegetable sticks consumed by previous participants listed on the information sheet: all participants in the high intake norm condition (N=42)

remembered the details correctly, and participants in the no norm control condition (N=42) reported no awareness on the number of intake.

Participant characteristics and baseline measures

We analysed participant characteristics and baseline measures as a randomization check.

There was no significant difference between conditions on the measures: age, BMI, TFEQ scores (cognitive restraint, disinhibition and hunger), liking of cucumber and red pepper, baseline hunger and baseline mood status. Details are shown in Table 4.4.

Pearson's correlation revealed that age was positively correlated with total vegetable intake in grams ($r=0.23$, $p=0.04$) and in slices ($r=0.24$, $p=0.03$). Liking of cucumber was positively correlated with total vegetable intake in grams ($r=0.22$, $p=0.05$).

Moreover, we found that liking of cucumber was positively correlated with cucumber intake in grams ($r=0.49$, $p<0.001$) and slices ($r=0.50$, $p<0.001$) and liking of red pepper was positively correlated with red pepper intake in both grams ($r=0.56$, $p<0.001$) and slices ($r=0.53$, $p<0.001$). Thus, age and liking of cucumber and red pepper were controlled for the analysis of modelling on vegetable intake (Table 4.4).

Habitual vegetable intake

The two item measures on vegetable intake per day and vegetable intake yesterday were found strongly correlated with each other ($r=0.87$, $p<0.001$). We averaged those two items to form a single measure of habitual vegetable intake. Surprisingly, there was no correlation between habitual vegetable intake and total vegetable intake in grams ($r=-$

0.08, $p=0.48$) and slices ($r=-0.11$, $p=0.32$). However, t-test showed that habitual vegetable intake was significantly lower in the no norm condition than high norm condition ($t(81) = -1.10$, $p=0.001$), which suggested that habitual vegetable intake should be controlled as a covariate in the analysis of food intake.

Table 4. 4. Participant characteristics between high intake norm and control condition (Mean and SD).

	No Norm (N=42)	High Norm (N=42)
Age (years)	20.3 (2.6)	20.7 (3.7)
BMI	21.6 (1.9)	21.2 (1.8)
Ethnicity	White=20 Asian=16	White=22 Asian=14
Baseline Hunger (0-100)	46.4 (26.3)	47.8 (27.3)
Liking of cucumber (0-100)	64.4 (25.2)	65.1 (26.1)
Liking of red pepper (0-100)	65.8 (24.1)	62.1 (30.2)
Restraint eating (0-20)	8.7 (5.1)	9.2 (5.2)
Habitual vegetable intake (servings/per day)	2.3 (1.1)***	2.6 (1.7)***

*** $p<0.001$ Comparison between high norm and no norm

Student identity

Similarly, independent sample t-test was used to examine whether the identity (subcategories of identity) scores differed between participants in high norm condition and control condition. The results showed that there were no significant differences for each subcategory of identity or total identity between those two conditions (Table 4.5).

Table 4. 5. Student identity scores between high intake norm and control condition.

	No Norm	High Norm
Solidarity (0-7)	5.2 (0.8)	5.4 (0.8)
Satisfaction (0-7)	5.9 (0.8)	6.2 (0.7)
Centrality (0-7)	4.8 (1.2)	4.7 (1.2)
Self-Stereotyping (0-7)	4.4 (1.2)	4.5 (1.2)
Homogeneity (0-7)	4.0 (1.0)	3.9 (1.3)
Motivation (0-7)	5.2 (0.9)	5.3 (1.0)
GIS Identification (0-100)	72.0 (14.4)	73.6 (13.4)

Total vegetable intake

Similar to Study 1, centrality was firstly included in the model. Using a 2 x 2 ANOVA, there was a main effect of condition on vegetable intake with participants eating a greater amount of vegetables in high intake norm condition (M=141.2, SD=10.1) than those in control condition (M=107.6, SD=10.2), $F(1, 75)=5.40$, $p=0.023$. However, there was no significant interaction effect between condition and centrality scores, $F(1, 75)=2.347$, $p=0.130$. All participants in the high intake norm condition ate significantly more vegetables than those in the control condition, no matter how strong their student identification (Figure 4.5)

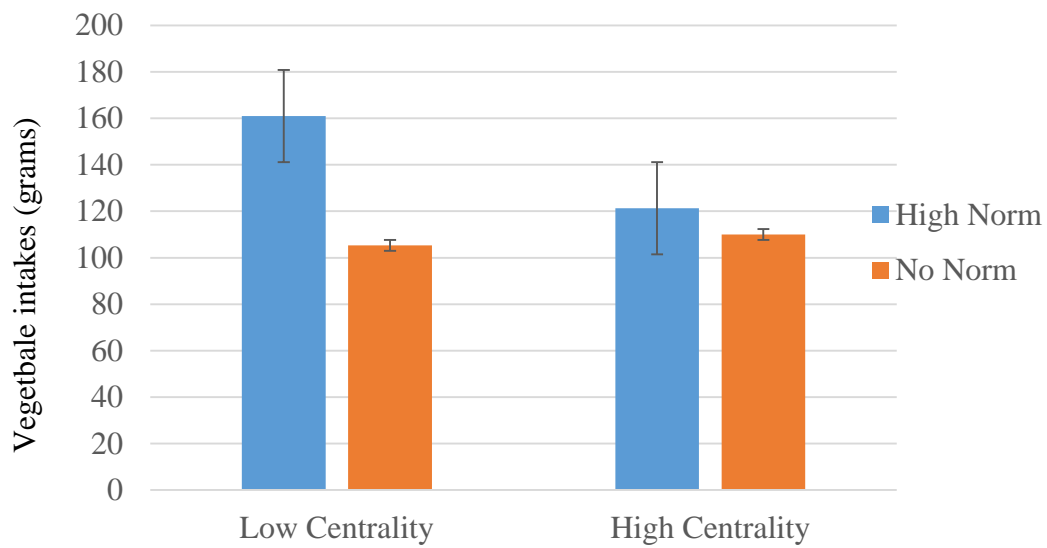


Figure 4. 5. Vegetable intakes across conditions and centrality levels.

Other subcategories of identity including motivation were also included in the ANOVA model one by one. Significant main effects of norm condition were observed when taking sub-components of identity into account (all $p < 0.05$). Participants ate significantly more vegetables when they were exposed to a high intake model than those who were given no information. However, no significant interactions between condition and sub-categorical identity on vegetable intake were found (all $p > 0.05$).

Similar to Study 1, regression analysis was also conducted by using PROCESS program to examine whether identity moderates the modelling of vegetable intakes. In the regression model, we entered sub-categorical identity as continuous variables and included centered condition, centered sub-categorical identity score * condition interactions. In line with results from ANOVA analysis, there was a significant main effect of condition on vegetable intake, but no significant interaction effect between

identity and condition on vegetable intake.

Table 4. 6. Significance level for the main and interaction effects of vegetable intakes.

	Effect of condition	Effect of identity	Interaction effect	habitual vegetable	age	Liking of cucumber	Liking of red pepper
Solidarity	p=0.013	p=0.072	p=0.571	p=0.254	p=0.043	p=0.008	p=0.043
Satisfaction	p=0.016	p=0.160	p=0.197	p=0.140	p=0.096	p=0.006	p=0.081
Centrality	p=0.023	p=0.229	p=0.130	p=0.186	p=0.045	p=0.006	p=0.138
Self-Stereotyping	p=0.021	p=0.991	p=0.592	p=0.231	p=0.073	p=0.008	p=0.128
Homogeneity	p=0.010	p=0.107	p=0.151	p=0.310	p=0.025	p=0.014	p=0.099
Motivation	p=0.020	p=0.401	p=0.702	P=0.199	p=0.051	p=0.009	p=0.149
GIS Identity	p=0.019	p=0.902	p=0.910	p=0.196	p=0.058	p=0.008	p=0.126

Identity and matching scores

The absolute value of matching scores between averaged norm intake and actual intake was calculated. Correlation analysis showed a significant association between satisfaction and absolute matching scores ($r=0.41$, $p=0.007$). The higher the satisfaction score, the higher the matching scores, therefore a lower level of matching to the presented norms. No significant correlations were found for other sub-categorical identities.

4.3.4. Interim summary

Study 2 examined the modelling of vegetable intake and it was found that young adults modelled other people's intake of vegetables (Hermans et al., 2009; Robinson et al., 2013; Vartanian et al., 2013). To our knowledge, this was the first study to examine modelling of vegetable intake using a remote-confederate design. People who were led to believe that previous participants had eaten a lot of vegetables (a high intake norm) ate significantly more vegetables than did participants who were given no information about others' vegetable intake (control condition). This finding is consistent with the research on live confederate modelling on nutrient-dense foods among young women (Hermans et al., 2009), in which young women adapted their intake of vegetables to that of their eating companion. The results of the Study 2 support the idea that awareness of the healthy eating habits of others may be used to promote healthy dietary

choices (Robinson et al., 2012; Robinson et al., 2013).

Study 2 also reported that social identity did not moderate the effect of an eating norm on food intake. The modelling of vegetable intake was significantly higher when presenting information of a large amount of vegetable consumption from other students rather than no information, regardless of how strongly students reported identifying with the norm referent group.

4.4. General Discussion

The present studies examined modelling of cookie and vegetable intake and further examined how social identity interacts with such a modelling effects. In both studies we found that young adults adopted their intake to be more in line with the normative intake presented, for example, eating more food when they were led to believe that others had eaten a large amount of either cookies or vegetables, compared to when they were given no information about the intake of others. However, there was no consistent evidence to suggest that strength of identification with the norm referent group moderated this effect. This pattern of results is consistent with previous reports that modelling of eating behaviour is a robust phenomenon (Cruwys et al., 2012; Hermans et al., 2009; Robinson et al., 2011; Robinson et al., 2013; Roth et al., 2001; Vartanian et al., 2013). Overall, the results were consistent with the growing body of research which suggests that people look outward to food cues as the appropriate amount of food

to consume and modelling of intake occurs even when another person is not physically present (Herman et al., 2003).

The lack of moderation of modelling by strength of identification with the group norm contrasts with previous findings that individuals model the eating behaviour of others from the same social group, particularly when individuals are highly identified with the norm referent group (Cruwys et al., 2012; Stok et al., 2012). There are a number of possible reasons why identification with the norm was not a significant moderator of modelling of intake. One is that there was not sufficient variability in-group identification to reveal a moderating effect. Scores on the multicomponent identification scale were high on average and so it is possible that there were not sufficient participants who scored low in identification in the present sample to reveal difference in the responses of low versus high identifiers. It is also possible that factors such as how the eating norm is conveyed and the nature of the normative information influence whether or not identification with the norm referent moderates norm following. For example, moderation might be more likely if the norm is conveyed by the behaviour of another present person, as in the live confederate design rather than in the remote confederate design, because similarity or otherwise to the norm referent might be more salient in the live situation. Alternatively, because we did not manipulate whether the norm came from an in versus out-group, it is possible that in the present context it was sufficient that the norm came from a relevant group for it to be perceived as relevant and that the strength of identification with the group has no additional

influence. In the present context there may have been a high degree of uncertainty about the appropriate amount to eat and the information about prior participants' consumption provided provide a context specific norm to follow (i.e. this is what other people in this context do). Other studies in which identification with the norm referent has been shown to be important have conveyed messages that refer to a population norm (e.g. 27% of Dutch students eat two portions of fruit per day) rather than participants in a specific context (e.g. prior participants in a study), as in the present study. Future studies could investigate the specific conditions under which identification with a norm referent moderates norm following.

The present study assessed the modelling of food intake only in young female college students. Although there is some evidence to suggest larger modelling effects for women than for men (Hermans et al., 2010), possibly because women are more concerned with how others perceive their eating behaviours (Vartanian et al., 2007). It remains unclear whether gender would interact with social identity to affect modelling of food intake. Moreover, we only recruited lean participants and since previous evidence has suggested that there is an interaction between participant body weight and the model's body weight on the degree of modelling (de Luca & Spigelman, 1979; Hermans et al., 2008; Johnston, 2002; McFerran et al., 2010), it would be of interest to examine whether group identification also interacts with weight to affect modelling.

To conclude, the results of the present studies provide evidence of robust modelling of

eating behaviour regardless of identification with the norm referent. We suggest moderating factors such as social identity might only affect following of food intake norms under certain conditions that remain to be elucidated.

CHAPTER 5: THE INTERACTIVE EFFECT OF SALIENT IDENTITY, DIETARY HABITS AND SOCIAL NORM ON EATING BEHAVIOUR

5.1. Background

Although health related campaigns aimed at changing dietary choices have been widely accepted by the public (Snyder, 2007), the effectiveness of using health information to alter eating behaviours has been questioned (Jepson et al., 2010). Social factors, particularly social norms have been reported to influence food consumption (Cruwys et al., 2015; Herman et al., 2003; Vartanian et al., 2015), which has led to the development of norm-based interventions to encourage healthy eating behaviours. Most previous intervention studies have investigated whether social norm messages are effective in promoting healthy food consumption (Robinson et al., 2014; 2015). For instance, exposure to descriptive social norm messages suggesting that most students eat sufficient vegetables resulted in more consumption of vegetable in a lunch buffet, in comparison to exposure to a message about health related information of eating sufficient but only among individuals who reporting being low habitual consumers of vegetables. High habitual consumers were not responsive to social norm message because they may have already adhered to the norm (Robinson et al., 2014).

According to social identity approach (Tajfel, 1972; Turner et al., 1987), social norms reflect a group's attitudes, values and ways of behaving. People seek belonging and

approval from in-group members. The identity-based motivation model (Oyserman et al., 2007) suggests that social identity influences such beliefs and in-group goals. When a behaviour is identity infused, engaging in that group behaviour provides positive ways for people to express affirmation to their social group. Health-promotion activities may then become social identity-infused habits rather than simply personal choices. In line with this idea, research suggests that identity might moderate the effect of group norm on health behaviours, particularly eating behaviours. Louis et al. (2007) reported that student group norms and their identity interacted to predict healthy eating intentions. The perceived group norms were more likely to be followed when students identified more strongly with their student group, than when they identified weakly attached with student group. Such salient identities may shape behaviours as well as intentions. People who identified highly with a particular social group were more likely to report conforming to the behaviour of the in-group (Stok et al., 2014).

Salient social identity has been suggested to influence intentions to eat healthily (Tarrant & Butler, 2011). For example, British students showed stronger intentions to reduce salt and alcohol intake when their British identity was made salient, compared with then their student identity was emphasised. To date, most previous research has investigated how existing social identity interacts with group norms on behaviours. Group norms influenced eating behaviours, especially for those who were strongly attached to their norm referent group (Hogg & Smith, 2007). However, it is unknown whether raising the strength of identity would increase the ability to adhere to group

norms in people who are less strongly identified or connected to their social group. Few studies have investigated the effect of manipulating identity in the ‘norm-behaviour’ relationship.

We aimed to examine whether manipulation of student identity affects responses to eating norms (or health information). It was hypothesized that: (1) students would eat more fruit and vegetables when they were exposed to a social norm message about others’ healthy eating behaviours, than when they were exposed to a health message about advantages of eating healthily; (2) Such a social norm effect would be enhanced when their student identities were made to be salient, particularly among low habitual consumers of fruit and vegetable intakes.

5.2. Methods

Participants

According to the findings from Robinson’s study (2014), a sample size of 60 participants should be enough to find out the effects of social norms on vegetable consumption in a two-way between-subjects design. The effect size was 0.4 with 85% power. In their later study, a total of 75 participants were recruited for three conditions and significant effects of descriptive social norms on increasing healthy foods as well as reducing unhealthy foods were also indicated. Based on previous sample size, we aimed to recruit comparable number of participants in this study (at least 100

participants and around 25 participants in each condition). Eleven incomplete participants' data was removed from the study. In total, 160 participants (mean age=20.1, SD=2.4; mean BMI=21.8, SD=3.3) were left in the study. All participants were students at University of Birmingham without smoking habits, eating disorders or food allergies on food items provided. Participants were recruited from the RPS system, bham portal, posters around campus. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and was approved by the University of Birmingham Research Ethics Committee.

Design

The study used a between-subjects design including 2 conditions: message type (social norm message vs. health message) and identity priming (priming vs. non-priming). Participants were randomly allocated one of conditions: social norm plus priming, social norm plus non-priming, health plus priming, health plus non-priming using a randomization website: www.randomizer.org.

Cover story

The study contained two separate experiments conducted by different researchers, in order to reduce the likelihood of participants guessing study aims (Thomas et al., 2016). The study was advertised as: (1) Attitude and Poster study to collect feedback on eating advertisements developed; (2) Mood and Food study to examine the effects of eating on mood. Participants were compensated with either course credits (students from

psychology school) or £5 cash upon the completion of study. Participants were required to sign up for both studies before taking part.

Messages

Messages were presented either in a poster style or in a flyer style. In the poster, the message was placed in the centre surrounded by pictures of fruit and vegetables (e.g. oranges, strawberries, tomatoes, corns, peppers and squashes. In the flyer, images of animated fruit and vegetables were placed in the middle with the message above and below images. Participants were exposed to both a poster and a flyer with either a social norm or a health message. The messages read as follows. Social norm message in the poster: 'Did you know most UoB students eat a lot more fruit and vegetables than you might realise? Although a lot of people aren't aware, most UoB students eat over 5 servings of fruit and vegetables each day'. Social norm message in the flyer: 'Most UoB students eat more fruit and vegetables than you'd expect. A lot of people aren't aware that most UoB students eat over 5 servings of fruit and vegetables each day'. Health message in the poster: 'Did you know eating a lot of fruit and vegetables is good for your health? Although a lot of people aren't aware, heart health and cancer risk can be improved by eating over 5 servings of fruit and vegetables each day'. Health message in the flyer: 'Eating a lot of fruit and vegetables is good for your health. A lot of people aren't aware that heart health and cancer risk can be improved by eating over 5 servings of fruit and vegetables each day'. The statistics on the message was derived from a pilot study on undergraduates in 2011. Whether participants believe the statistics and

message presented were assessed in the later post/flyer evaluation scale (example of posters see Appendix 25).

Food stimuli

Participants were provided with a buffet consisting of four types of food items (purchased from Tesco): carrot sticks (200g), green grapes (250g), crisps (50g) and chocolate cookies (150g). Four bowls each containing one of the food items, a glass of water and napkins were provided. Food weights were different in order to visually match bowls and provide enough food so that participants could eat as much as they liked without finishing the bowl. To measure how much food the participant ate, each bowl of food was weighed before and after the test session. Any food that was selected from the bowl but not eaten was removed from the total amount eaten.



Figure 5. 1 Picture shows a standard serving of food buffet.

Questionnaires

Demographic Questionnaire Questions were asked about age, gender, ethnicity, and student category (international or home student) in the first part of study and to assess age, gender, ethnicity, smoking, eating habits (breakfast, lunch, disorders), medical illness and psychological issues, drinking habits and dietary restriction in the second part of study (see Appendix 2).

Visual Analogue Scales (VAS) Mood and appetite status were assessed using VAS: alert, drowsy, light-headed, anxious, happy, nauseous, sad, withdrawn, faint, hunger, full, desire to eat and thirsty. Participants indicated their appetite and mood status on a 100mm horizontal line. The anchors were 'not at all' and 'very' (Cronbach's alpha = 0.47) (see Appendix 4).

Student Identity Scale A two-item scale derived from a previous study (Stok et al., 2014) was used to measure the strength of identification with norm referent group before and after the priming manipulation (e.g. 'I identify with/feel a connection to University of Birmingham students). Participants indicated the extent to which they agreed or disagreed with the identification statement on a 100mm horizontal line from 'not at all' to 'very much so'. An average score of the two items was calculated to indicate the strength of identification (correlation between items: $r=0.7$, $p<0.001$).

Poster/ Flyer Evaluation Scale To maintain the cover story for the first part of study, participants provided ratings about the poster/flyer exposed from different aspects (e.g. clarity, understanding, professional appearance, comprehension, believability, trustworthiness, and relatedness) on a 5-point likert scale (Cronbach's alpha = 0.85).

Participants also indicated their preference on either poster or flyer (see examples in Appendix 17).

Food Liking Questionnaire (FLQ) Participants indicated how much they liked individual food items from the buffet foods on a 100mm scale with anchors ‘not at all’ and very much’ (see Appendix 5).

Three Factor Eating Questionnaire (TFEQ) The TFEQ was used to measure eating styles including dietary restraint, disinhibition and hunger (Cronbach’s alpha = 0.88) (Stunkard and Messick, 1985).

Habitual Fruit/Vegetable Intake Two-items asking ‘how many servings of vegetables/fruits do you normally eat a day?’ and ‘think back carefully- how many servings of vegetables/fruits did you eat yesterday (Robinson et al., 2014; Thomas et al., 2016) were used to assess habitual vegetable intake.

Demand Check Questions were used to check: (1) what participants thought was the purpose of the study; (2) whether they thought anything from the first study (Attitudes and Poster) affected their behaviour in the second study (Mood and Food); (3) whether they could recall the content of the messages in the poster/flyer from the first study; (4) whether and how they were explicitly aware the links between two studies. All questions used open-ended response formats.

Manipulation of Student Identity Participants in the identity prime condition indicated their attitudes and experiences as University of Birmingham (UoB) students by

answering three questions: (1) list three things that you and most other UoB students do relatively often; (2) list three things that you and most other UoB students generally do well; (3) list three things that make you proud to be a UoB student. There were also additional four questions measuring how students feel about University of Birmingham compared to other university in terms of education quality, resources, prestige and level of status on a 7-point likert scale. In the non-priming condition participants were provided with on the same questions but were asked to assess personal attitudes and experience: the words 'you and most other UoB students' were replaced by 'you personally'. The manipulation was based on that used by Haslam et al. (1999) (see more details in Appendix 16).

Procedure

The experimental sessions took place in the lab between 9:30 and 12:00 in the morning and between 13:30 and 17:00 in the afternoon on weekdays. On arrival at the laboratory, participants were informed that they are taking part in a study on poster evaluations. Participants were asked to sit alone in a testing room. After reading information sheets and signing the consent form, participants were asked to fill in a set of questionnaires including demographic details, VAS and the student identity scale. Then, participants were asked to complete identity manipulation task. Next, the posters/flyers containing either a control or a social norm message were presented to participants and an evaluation questionnaire was completed. Then the first study was finished and participants were asked to go to their second study immediately after.

When participants arrived at experimental session 2, they were presented with a new information sheet that introduced the study on ‘Mood and Food’ and consent was provided. Participants were asked to complete another demographic questionnaire and rate their mood and appetite. Then they were asked to select from the food buffet and were provided with a glass of water and napkin. After eating, participants were asked to fill in another set of questionnaires about their liking of foods, mood and appetite status, and their usual fruit and vegetable intake. Finally, a demand awareness questionnaire was completed to see whether participants guessed study aims, and they were asked to remember the messages they saw in the first study and to state whether they thought the studies were linked. Height and weight were measured and participants were all thanked and debriefed after the completion of study. Researchers then weighed and recorded the amount of foods that participants consumed in grams. Figure 5.2. shows an overview of the study procedure.

Poster Study				
Information sheet & Consent form	Questionnaires	Poster/Flyer	Poster/Flyer evaluation	Debrief
Mood and Food Study				
Information sheet & Consent form	Questionnaires	Food buffet	Questionnaires	Debrief

Figure 5. 2. Flowchart of study procedure.

5.3. Analysis Strategy

Firstly, an average score of habitual vegetable intake (fruit intake) was calculated because usual vegetable (fruit intakes) and intakes of vegetable (fruit) yesterday were found to be positively correlated with each other (all $p < 0.001$). A median split on the habitual healthy food intake measure was calculated: low consumers reported consuming less than 2 portions of vegetables and fruits per day, while high consumers reported consuming 2 or more portions of vegetables and fruits a day.

Secondly, covariates were determined by conducting correlation analysis. It was found that liking of carrots ($r = 0.26$, $p = 0.003$) and grapes ($r = 0.26$, $p = 0.001$) was significantly correlated with the total healthy food intake. Therefore, liking of carrots and grapes were controlled in the analysis for healthy food intake. Liking of crisps ($r = 0.34$, $p < 0.001$) and cookies ($r = 0.33$, $p < 0.001$), hunger ($r = 0.29$, $p < 0.001$) and cognitive restraint scores ($r = -0.24$, $p = 0.002$) were significantly correlated with total unhealthy food intake and were included as covariates. In addition, age was found to be correlated with total healthy and total unhealthy intakes ($p < 0.05$).

Independent sample t-tests were conducted to examine differences between social norm and health conditions on participants' characteristics (e.g. age and BMI) and baseline measures (e.g. habitual food intake, baseline VAS and likeness of food items) to

determine additional covariates for inclusion in subsequent analyses.

Principle components analysis (PCA) with varimax rotation was run for the 13-item VAS scales. Items loaded above 0.5 were included, resulting in 4 factors: appetite (hunger, fullness [reversed], desire to eat and thirsty), mood (anxious, happy [reserved], sad, withdrawn), physical symptoms (light-headed, nausea and faint) and arousal (alertness and drowsiness), with eigenvalues >1 , accounting for 68.4% of the variance. PCA analysis was also run on the poster evaluation scale and three factors emerged: clarity (clearness, meaning and easiness), legitimacy (believability, trustworthiness and relatedness of poster) and professional appearance with eigenvalue > 1 , accounting for 62.0% of the variance. In addition, two factors were generated for the flyer evaluation scale: clarity (clarity, understanding, comprehension) and credibility (professional appearance, believability, trustworthiness and relatedness of poster) with eigenvalue > 1 , accounting for 65.2% of the variance.

To compare the identification before and after the priming manipulation, two-way ANOVA was conducted with condition and strategy as independent variables and identity before and after as dependent variables. Post-hoc Bonferroni tests were used to follow up significant main effects. The main analysis was a mixed ANOVA, to examine food consumption (grams of food consumed) with the following factors: food type (healthy foods and unhealthy foods), condition (social norms and health control), strategy (priming and non-priming), and habitual healthy food intake (low and high

consumers).

5.4. Results

Participant characteristics and baseline measures

A hundred and sixty participants (male=38, female=122) were included in the main analysis after removal of 11 incomplete sets of data. The mean age of the sample was 20.1 years old (SD=2.4), mean BMI was 21.8 (SD=3.3). The mean baseline hunger was 60.5/100 (SD=23.3) which shows that participants are generally hungry before consuming the food items. The mean cognitive restraint score was 9.1/21 (SD=2.9). The baseline student identity score was 70.8/100 (SD=15.9), suggesting that most students identified themselves as UOB students.

Table 5.1 shows participants' characteristic in the social norm and health control conditions. Participants reported that the legitimacy of posters and the credibility of flyers which displayed social norm messages were significantly higher than those displayed health control messages (all $p < 0.001$). Besides that, no significant differences in terms of participants' characteristics and baseline measures were reported.

Table 5. 1. Means (SD) for participants' characteristics between conditions.

	Health (N=80)	Social (N=80)
<i>Age (years)</i>	20.4 (2.5)	19.9 (2.2)
<i>Gender</i>	Male=16	Male=22

<i>BMI</i>	22.0 (3.3)	21.6 (3.3)
<i>Ethnicity</i>	White=36 Asian=32 Other=12	White=33 Asian=39 Other=8
<i>Habitual healthy food intakes (serving/per day)</i>	2.1 (1.0)	1.9 (1.0)
<i>Hunger baseline (0-100)</i>	59.2 (25.1)	61.9 (21.5)
<i>Liking of carrot (0-100)</i>	49.6 (32.9)	47.8 (33.2)
<i>Liking of green grapes (0-100)</i>	86.9 (18.1)	83.5 (17.4)
<i>Liking of crisps (0-100)</i>	66.8 (28.3)	68.8 (27.9)
<i>Liking of cookies (0-100)</i>	68.9 (26.2)	69.9 (25.0)
<i>Baseline identity (0-100)</i>	72 (17.6)	69 (15.8)
<i>Poster evaluation (1-5)</i>		
<i>Clarity</i>	4.5 (0.6)	4.5 (0.6)
<i>Legitimacy ***</i>	2.9 (0.8)	3.9 (0.8)
<i>Professional</i>	2.9 (1.0)	2.8 (1.0)
<i>Flyer evaluation (1-5)</i>		
<i>Clarity</i>	4.4 (0.6)	4.3 (0.6)
<i>Credibility***</i>	2.8 (0.8)	3.5 (0.7)

Manipulation check

When asked what the purpose of the study was, 20.6% of participants guessed/ partially

guessed correctly. Exclusion of those participants did not change the overall pattern of results. When asked whether posters in the first study affect eating behaviour in the second study, 44.4% of participants reported there was/might be an influence (e.g. made them eating more vegetables). When asked the awareness of links between two studies during experiment sessions, 70.6% of participants reported awareness that two studies might linked to each other because they saw same questions in measurements; they assumed the study link at sign ups; or they thought foods presented were relevant to posters.

To examine whether manipulation of identity changed student identification across condition before and after, a two-way ANOVA was conducted. At the baseline analysis, there were no significant main effect of condition, strategy or interaction effect between condition and strategy (all $p > 0.05$). At the post manipulation, there was a significant main effect of strategy on identity after ($F(1, 156) = 7.24, p = 0.008$). Follow-up post-hoc test showed that priming strategy resulted in a significantly higher student identification compared to non-priming (74.3 vs. 67.3 out of 100). Besides that, there were no other significant main effects of condition or interaction effects between condition and strategy on identification after (all $p > 0.05$).

Healthy and unhealthy food consumption (grams)

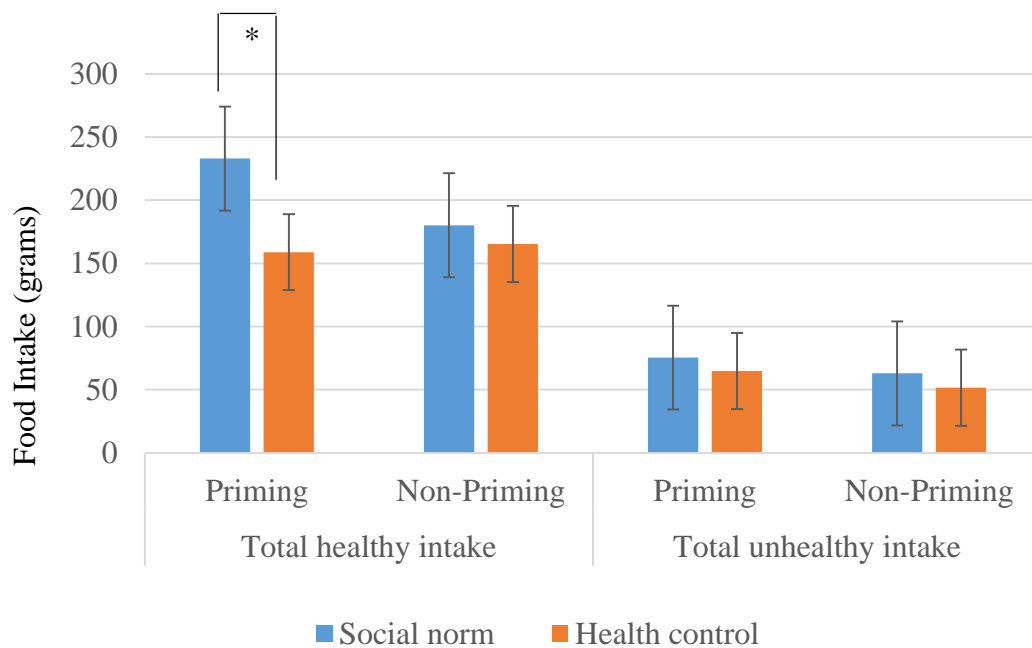
A mixed four-way ANOVA revealed a significant main effect of condition with participants consuming a greater amount of foods in the social norm condition than in

the health control condition (110.2g vs. 137.9g, $F(1, 86)=6.14$, $p=0.015$). There was also a two-way interaction between food type and condition, $F(1, 86)=4.69$, $p=0.033$. By breaking down the interaction, healthy and unhealthy food intake were analysed separately in separate two-way ANOVA. A significant effect of condition was observed for total healthy consumption ($F(1,90)= 6.96$, $p=0.010$), but not for total unhealthy consumption ($F(1, 90)=2.51$, $p=0.117$). Participants in the social norm group ate significantly more healthy foods than those in the health control group (210.0g vs. 163.0g).

In addition, there was a significant two-way interaction between food type and habitual healthy food intakes ($F(1, 86)= 4.95$, $p=0.029$), whereby low habitual consumers had significantly less total healthy foods than high consumers (135.6g vs. 186.8g, $t(158)=-3.30$, $p=0.001$). There was no significant differences between low and high habitual consumers on total unhealthy food consumptions ($t(158)=0.78$, $p=0.439$). Respectively, there were significant differences between total healthy and total unhealthy food consumptions in both low and high habitual consumers ($p<0.001$).

Moreover, there was a marginal significant three-way interaction effect between food type, condition and strategy, $F(1, 86)= 3.85$, $p=0.053$. By separating priming from non-priming strategy, there was a significant main effect of condition on total healthy food consumption but only for priming strategy group ($F(1, 1138)=7.17$, $p=0.011$). Social

norm led to more healthy food intakes than health condition, only after priming of identity. Such a condition effect was not observed for total healthy food consumption/unhealthy consumption for non-priming strategy group (all $p > 0.05$) (Figure 5.3).



* $p < 0.05$.

Figure 5. 3. Interaction between food type, condition and strategy.

5.5. Discussion

In the present study, we investigated whether manipulating salient social identity moderates the effect of social norm versus health message on food intake. In line with previous findings, we found that exposure to a social norm message was associated with increased intake of fruit and vegetable items from a buffet but there was no effect of exposure to a health message (Robinson et al., 2014). In addition, we did not observe

any effect of social norm or health information on consumption of energy dense food items. We further found evidence that manipulation of student identity might moderate the effect of a social norm message on selection of fruit and vegetables because the effect of the social norm message was evident only when salient student identity was primed.

According to social identity approach, group norms influence health-related behaviours particularly for individuals who are strongly affiliated to the norm referent group (Louise et al., 2007; Terry & Hogg, 1996; Turner et al., 1987; Stok et al., 2011; Stok et al., 2014). Previous research already suggested that high identifiers tend to align their eating behaviour with their group norm to affirm their commitment to their shared group (Cruwys et al., 2012; Stok et al., 2014). In the present study, priming the participants' student identity salience may have increased their affiliation with the norm referent group making it more likely that their behaviour was more in line with the norm. The effect of exposure to the social norm message on healthy food consumption occurred only in the primed condition, which suggests that enhancing social identity did affect the effectiveness of social norms.

Habitual intake of fruit and vegetables was also considered as a possible factor that moderates the effect of norm message, in line with suggestion from Croker et al. (2009) and Robinson et al., 2014). However, evidence from this study did not support the idea that social norm messages was more effective in increasing fruit and vegetable

consumptions for low habitual healthy food consumers in the previous research (Robinson et al., 2014). This might be explained by the absence of significant differences in overall levels of healthy food consumption between low and high consumers. Habitual fruit and vegetable intakes were not correlated with subsequent healthy food consumptions based on current findings ($r=0.14$, $p=0.090$).

Specific thoughts related to the study should be noted. The interaction between condition, priming and food type was only marginally significant and so the present findings should be replicated with a larger sample to verify the robustness of the effect. In addition, the overall level of identification as a student was relatively high and so the increase in level of identification achieved by the manipulation was small and possibly subject to ceiling effects. Further work might seek to improve the priming strategy to maximize an increase in social identity. Moreover, other types of norm referent group with more variety in the strength of identification may be considered as we were interested in increasing the level of low identification to improve the effectiveness of group norms. Finally, our sample contained only a small number of male participants. Previous research suggested that females are more likely to respond to social normative information than males (Cruwys et al., 2015; Hermans et al., 2010). In the present study, we controlled gender as a covariate, it might be still worth investigating how norm effects differ between males and females after a manipulation of norm referent identity.

The present results are a novel addition to research in the field of social norms. Along

with previous findings, the data suggest that norm effects on eating could be boosted if identification with the norm referent group is enhanced (Stok et al., 2014). One implication of the present findings is that in the future intervention based social norm research, frequent and repeated emphasises on the strength of identification might increase the effectiveness of norm messaging. However, the underlying mechanism was still unclear and further evidence on the role of social identity and norms in determining eating behaviours should be verified.

5.6. Conclusion

To conclude, the present findings are consistent with previous research suggesting that social norms are more effective than health information in promoting healthy eating behaviour. There is also initial evidence to suggest that manipulating salient social group identity influences how people adjust their eating behaviours based on the norms. However, this finding require replication in future work that seeks to enhance the identity manipulation strategy and to verify the role of identity in social norm based interventions.

CHAPTER 6: GENERAL DISCUSSION

6.1. Review of Thesis Aims and Objectives

The overall objective of the thesis was to examine the role of social identity in the relationship between social normative information and adults' eating behaviour. This included the following broad aims: (1) to investigate perceptions of eating norms and how changes in perceptions relate to subsequent eating behaviour decisions; (2) to test how group norm drives people's intention or actual eating behaviour if identification with the norm referent group is taken into account; (3) to empirically test the effect of manipulation of salient identity on responses to relevant eating norms. I will discuss how this thesis has addressed these questions in terms of the findings from each study. The links between studies will be also reviewed and the findings integrated. Finally, I will discuss the strengths and limitations of present studies and possible future directions of this work.

6.2. Overview of Findings

Chapter 2 conducted a longitudinal investigation among a university student population on the relationship between perceived eating norms and self-reported food intake across an academic year. Existing research suggested young adults generally report a dietary pattern that includes low intake of fruit and vegetables, but high intake of energy dense foods. The results of Chapter 2 confirmed that on average the self-reported consumption of fruit and vegetables were below the NHS recommendations of ‘five portions a day’. Besides that, it was found that students perceived that others consume fewer vegetables than the amounts they themselves eat, while they perceive that others consume more junk food or sugar-sweetened beverages than they consume. In other words, there was an overall misperception of the eating habits of others. It was also found that changes in perceived descriptive eating norms significantly predicted self-reported intake at 12 months for all food types, although the trend was not that clear at 3 months. Not surprisingly, the results also verified the lack of robust association between injunctive norm perceptions and self-reported food intake over time.

The online studies presented in Chapter 3, compared the effect of social norm and health (or neutral) information on eating intentions in both community and student samples. It was found that British participants who were exposed to a social norm about the vegetable intake of others intended to eat more vegetables in the near future, than those who received health information about the benefits of eating vegetables or neutral

control information about non-foods. However, this effect was only evident when people strongly identified as British. A follow-on study replicated the effect that viewing a message about limiting junk food intake led to a significantly weaker intention to consume junk foods, than viewing a neutral message. Similarly, only students who reported high levels of identification with others in the university responded strongly to the norm. It should be noted that while both of the studies in Chapter 3 considered different aspects of identification, only the centrality component of identity emerged as a significant moderator.

Chapter 4 presented a pair of studies on how social identity moderates the effect of social information on eating using a remote confederate design. A strong modelling effect for food intake (cookie or vegetable) was reported, such that people who believed previous participants had consumed a large amount of food (cookie or vegetable) ate significantly more food than people who had no information about the intakes of previous participants. The first study in this chapter also found that a low intake model compared to no model was associated with reduced cookie intake. In both studies, social identity did not moderate the modelling effect on food intake.

Chapter 5 brought forward the idea that manipulating the strength of identity might influence how social norms affect eating behaviour. The results from Chapter 5 showed that exposure to a social norm message about most students' fruit and vegetable consumptions was more effective than health information in promoting healthy food

consumption. There was also some evidence to suggest that making student identity salient enhanced following of the presented eating norm.

In summary, an effect of social norms on eating behaviour (and eating intention) has been observed across a range of studies including a longitudinal investigation (Chapter 2) (Jones & Robinson, 2017), self-reported intention measures (Chapter 3) (Crocker et al., 2009; Louis et al., 2007), remote-confederate experiments (Chapter 4) (Hermans et al., 2009; Robinson et al., 2013; Vartanian et al., 2013) and intervention-based studies (Chapter 5) (Robinson et al., 2013; 2014). Mixed findings suggested that social identity possibly influence the effectiveness of normative information on eating, but this effects may depend on the specific eating situation (Cruwys et al., 2012; Stok et al., 2014). The links between studies can be seen in Figure 6.1.

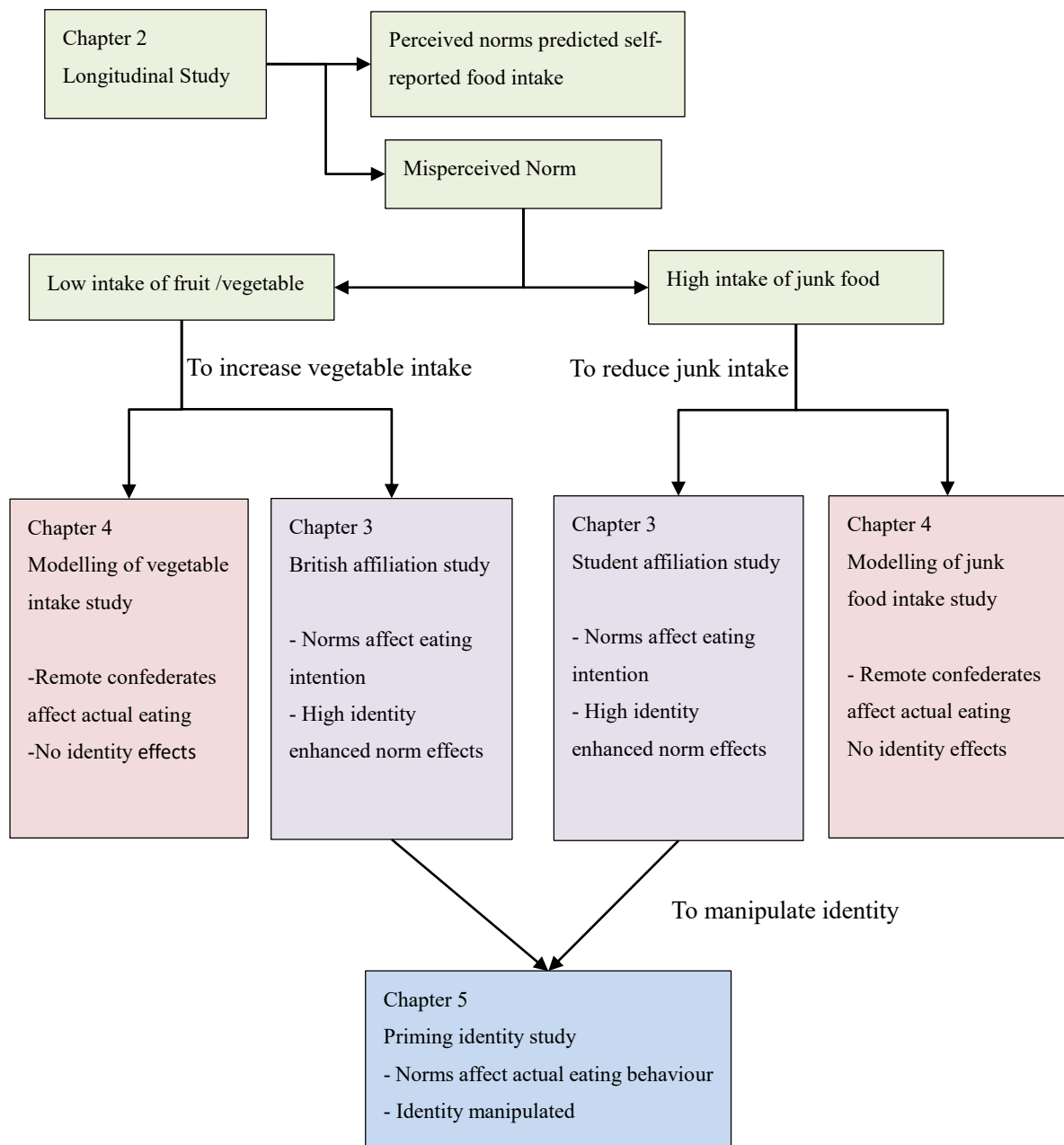


Figure 6. 1. Flowchart shows links between studies.

6.3. General Norms vs. Context-specific Norms and Moderation by Social Identity

Social norms that were explicitly and clearly presented to people triggered a strong influence on eating behaviour and intentions to eat (Chapter 3 and Chapter 5). General

norms such as descriptive social norms affect eating by providing people with guidance of appropriate behaviours (Cialdini et al., 1990; Cialdini, 2008). People who reported high identification with the norm referent group showed stronger norm effects on eating than those who reported low levels of identification, which could be explained by the social identity approach. When there was a strong connection to the social group, people brought their behaviour in line with the perceived group norms (Tajfel & Turner, 1986). Potentially, participants who felt less affiliation toward their social group might be less motivated to follow the norm of the shared group.

In the remote modelling study presented in Chapter 4, participants were typically presented with eating norms that suggested how previous others behaved in the same context, particularly about how many foods others have eaten in the current study (Roth et al., 2001; Pliner & Mann, 2004; Robinson et al., 2014). The specific research environment in the experiment was relatively novel and unfamiliar to participants. In this situation, the participants modelled others' food intake regardless of the strength of identity with the referent group. Two possible reasons might explain the phenomenon: (1) Participants were uncertain about how much to eat, especially when the eating norm was implicitly presented. Unlike intervention-based studies, the remote modelling studies only presented a latent norm without emphasising the eating habits of others. In this context-sensitive situation (e.g. particular experiment), perhaps the participants were afraid of to be distinct or alternative from others, even though they might doubt whether the norm fully represented most others' behaviour. (2) Identification with other

participants in the study, rather than general student identity might be a more apparent factor that affects the extent of following the eating norm. There was a clear and strong situational cue. How strong that participants identified themselves as part of the university was less relevant to how they perceived eating norms from other participants. So long as the norm indicated behaviours from a shared in-group membership, people matched behaviours to that norm referent group.

Overall, the data presented in this thesis suggest that social normative information is important in shaping individuals' behaviour but the underlying mechanisms of norm effect and its interaction with social identity on eating are complex and may depend on how the norm is presented and the context in which it is presented.

6.4. Broad Identity vs. Specific Identity

Referring back to the self-categorization theory, if individuals express greater desire to be involved in a particular social group, they are more likely to comply with that group's standards (Oakes et al., 1994). Social groups that our studies focused on were mainly a student population or a community population. Findings from our studies showed that identification with the social group (e.g. national or student group) somewhat interacts with the group norms on predicting food consumption. However, it has been argued previously that a more proximal norm referent group may elicit a stronger influence on subsequent behaviour (Stok et al., 2016). Specifically, researchers

have suggested greater identification with certain student groups (e.g. same-sex, same-race or same-Greek-status) is associated stronger relationships between perceived drinking norms and own drinking behaviours in that group (Neighbors et al., 2010). Therefore, rather than broad types of identity, the influence of specific or narrow types of identity is worth investigating in future.

6.5. Healthy Eating vs. Unhealthy Eating

Identification with the norm referent group was found to influence the effect of social norms on fruit and vegetable consumption (Stok et al., 2014; 2016). A recent study also revealed that the identification with the student group moderated the relationship between healthy eating behaviour ascribed to popular peers and own healthy eating behaviours (König et al., 2017). The stronger the identification with their peers, the more participants' own eating was aligned with the healthy eating attributed to a popular peer. (König et al., 2017). Only one previously published study investigated university student identification in the context of unhealthy eating behaviours (Louis et al., 2007). In our studies, we found evidence that social norms influence selection and intake of both fruits and vegetables and high energy dense foods and that identification with a norm referent group moderates the relationship between intentions to both increase fruit and vegetable intake and limit junk food intake. These data suggest that interventions aimed at both prompting “healthy” food intake and limiting “unhealthy” food intake should be considered in future work.

6.6. Injunctive versus Descriptive Norms

Chapter 2 reported that perceived descriptive norms were more effective than injunctive norms in predicting self-reported food intake. Besides that, we found descriptive social norms predicted intentions to increase vegetable intake and to limit junk food intake was reported in Chapter 3. The strength of identity was also found to moderate descriptive norm effects on dietary behaviours, consistent with previous suggestions (Louis et al., 2007). Although there are a few conflicting findings regarding the effect of injunctive norms on intentions to eat (Staunton et al., 2014; Yun & Silk, 2011), not many studies have investigated whether social identity differentially moderates the relationship between descriptive norm and injunctive norms and eating intentions. Based on the data in this thesis it is suggested that (perceived) descriptive social norms may be more related to intentions to eat, rather than injunctive norms.

6.7. Strengths and Limitations

Two important strengths of this thesis should be noted. Firstly, the series of studies presented examined the moderating role of social identity on the relationship between group norms and eating behaviour through a variety of study designs, including cross-sectional and longitudinal observations, randomized controlled trial, remote-confederate paradigm and intervention-based research. For instance, Chapter 2

observed a student sample over 12 months to track changes in norm perceptions and eating behaviour. It filled a research gap as most previous research only investigated the association between perceived eating norms and food consumption in a cross-sectional context (Ball et al, 2010; Pelletier et al, 2014; Robinson et al, 2016). Chapter 4 adopted a remote confederate design by displaying information of others' intake to elicit the strong modeling effects on eating healthy or snack foods. To our knowledge, few modelling studies have assessed healthy food consumption, as most of them were interested in more palatable but unhealthy foods such as cookies (Robinson et al., 2013) and chocolates (Vartanian et al., 2013). Secondly, most of our studies included a hierarchical, multicomponent model of in-group identification, which not only measures strength of identity, but a variety of components of identity. The results consistently suggested that a specific dimension, rather than general aspects of identity, such as centrality is an important moderator. It would be fruitful if future social norm studies emphasised the use of such a comprehensive measurement to assess identification with the norm referent group.

This thesis also has some limitations regarding the methodologies of studies. Except for the laboratory-based experiments, most studies used self-report questionnaires to assess participants' food consumptions or intentions to eat, which are open to misreporting and bias. Additionally, the present samples were predominantly young adults, particularly young females, due to the use of a convenience sampling method in a university setting. It is therefore unclear whether and to what degree the influence of

social norms on eating behaviour may be generalized to broader settings, or to other population groups. Lastly, our study focused more on food intake rather than food selection, based on suggestions from previous research that people are more certain about liked or disliked foods than the proper amount of intakes (Pliner & Mann, 2004). However, there is also evidence that social norm manipulations may alter food preference but not directly influence subsequent eating behaviour (Templeton et al., 2016). Besides that, particular social modelling effects were more evident when palatable foods are under consideration (Cruwys et al., 2012; Leone et al., 2007; Pliner & Mann, 2004). Therefore, there is a need to consider what food should be included in the future studies, how many food types should be considered and whether food preference mediates the effect of social norm on consumption of foods provided.

6.8. Future Work

Improvements on addressing the limitations of the present studies has been outlined separately above and in each chapter. Expanding upon these, I list possible directions for future research related to social identity, norms and eating. Firstly, one direction of future research would to examine whether the correction of misperceived norms e.g. via social norm marketing campaigns can influence dietary choices. In addition, when designing norm-based interventions to changing eating behaviours it will be important to consider whether reference to a close or a general norm referent group is most effective in message targeting. Previous research has suggested that the norm referent

group might range from small (e.g. neighbours or friends) to large (e.g. a community). Interventions that target members of a particular social group may enhance the effectiveness of the group norm, while targeting to a broad social group may enlarge the range of audiences that may be reached. For instance, a more appropriate norm referent group for a student might be the group of friends rather than the general college student population, as the social distance between the student and the referent group should be closer (Rimal & Real, 2005). Therefore, targeting the most appropriate norm group is likely to be important in norm-based interventions. Furthermore, it would be fruitful to examine whether norm-based intervention research could particularly focus on people who identify themselves as less connected to their social group to enhance their connectedness with the norm group. The result from the present thesis could have implications for how intervention studies are designed and implemented. In a pre-intervention stage, perceived eating norms in a particular social group could be investigated and compared to actual eating norms (e.g. self-reported dietary patterns) to ascertain where their misperceptions might lie. In the intervention stage, well-designed social norm campaigns that are targeted to correct misperceptions and designed to enhance identification with the norm should be evaluated. According to suggestions from Moran et al. (2013), narrative communication, which has the ability to increase norm viewers' identification with story characters may influence the degree of relevance of perceived the norm, and have an impact on social norm campaigns. Farrow et al. (2016) also suggested that it would be beneficial to develop effective ways to promote group identification to support health by facilitating a sense of shared

identity and establishing a common group-goal, to foster health behaviours. In the post-intervention stage, self-reported eating behaviour or intentions to conduct relevant eating behaviour, as well as the strength of identity should be tracked. In that case, it should be possible to test whether identification with the norm moderates the norm effects, and whether misperceived baseline norm was successfully corrected through the intervention.

6.9. Conclusion

This thesis investigated the importance of social identity as a moderator in the relationship between social norm and adults' eating behaviour. Overall, the results provide further evidence for the strong effects of social norms on eating behaviours. Moreover, it was clear that identification with norm referent group has a role to play in moderating the effect of social norms on eating behaviours, although the specific conditions under which these moderating effects are most likely to occur requires further investigation. Further work should identify these boundary conditions and feed the results into the development of social identity norm-based interventions.

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APPENDICES

Appendix 1: Participant Information Sheet/ Consent Form (example from Chapter 4)

Appendix 2: Demographic Questionnaire (example from Chapter 5)

Appendix 3: Medical History Questionnaire

Appendix 4: Visual Analogue Scales (example from Chapter 6)

Appendix 5: Food Liking Questionnaire (FLQ) (example from Chapter 5)

Appendix 6: Three Factor Eating Questionnaire (TFEQ)

Appendix 7: Habitual Food Intake Questionnaire (example from Chapter 2)

Appendix 8: Language Preference Questionnaire (example from Chapter 2)

Appendix 9: Norm Perception Questionnaire (example from Chapter 2)

Appendix 10: International Physical Activity Questionnaire (IPAQ) (example from Chapter 3)

Appendix 11: Self-Identification toward Eating Vegetables (example from Chapter 3)

Appendix 12: Attitude toward Vegetable Consumption (example from Chapter 3)

Appendix 13: Self-Efficacy for Eating Sufficient Vegetables (example from Chapter 3)

Appendix 14: Ten-Item Personality Inventory (TIPI) (example from Chapter 3)

Appendix 15: Vegetable Eating and Exercise Intentions (example from Chapter 3)

Appendix 16: Priming and Non-Priming Questionnaire (example from Chapter 5)

Appendix 17: Poster Evaluation Questionnaire (example from Chapter 5)

Appendix 18: Debrief (example from Chapter 4)

Appendix 19: Multi-Component Identification Scales (example from Chapter 4)

Appendix 20: Table: The association between Injunctive norm and food consumption

(Chapter 2)

Appendix 21: Posters and Flyers (example from Chapter 3 and Chapter 5)

