

Measuring eating behaviour: a review of methodologies

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Obesity has dramatically increased during the last decades and is currently one of the most serious global health problems. The consequences of obesity for physical health are well established. The development of human obesity is attributed to overeating. Studying eating behaviour is an important approach in tackling obesity. Eating behaviours influence energy intake through choices about when and where to eat, and the types and amounts of foods chosen, including decisions about starting and stopping eating. This paper summarizes the measurement tools and methods in analyzing eating behaviour. The aim of this paper was to find the correct questionnaire for future research, which is the Dutch Eating Behaviour Questionnaire in this case.

Keywords: eating behaviour, measuring tools, DEBQ

1. Introduction

The data related to healthcare expenses indicate that households spend increasing amounts of money for that purpose, on medicines, medical appliances, and other goods of medical use in particular (KSH 2017). The factors affecting a person's health can be divided into two groups. The uncontrollable risk factors include innate genetic attributes, characteristics gained over the years, gender, and age. The factor we can control is lifestyle. Health is determined in largest measure by lifestyle (43%), followed by genetic factors (27%), environmental effects (19%) and healthcare (11%) (Varga-Hatos–Karner 2008).

Among lifestyle factors, nutrition is crucial from the perspective of our health. Our eating habits develop as early as our childhood, and they influence our later state of health. Malnutrition may affect our whole life and even shorten it. Therefore, it is important to pay attention to instilling proper eating habits in children from an early age (Huszka–Dernóczy 2015). The current environment is obesogenic, which means food is easily available (larger portions, highly advertised), physical activity has declined, and in interaction with genetic susceptibility, our body is encouraged to positive energy balance and to weight gain (Swinburn et al. 1999, Young–Nestle, 2002).

Malnutrition can be the source of several illnesses, such as cancer or cardiovascular diseases especially if it is accompanied by an unhealthy lifestyle. Children malnourished at an early age will be more susceptible to these illnesses in the longer term. Young people from lower income layers, eating food with low nutrient contents, are particularly prone to this. Parents are forced to put cheap and quickly prepared dishes on the table, which are often high in calories and fat. The spread of nutrient-poor fast foods has contributed to the increasing rate of obesity starting in childhood, and its treatment is a growing challenge all over the world (Khatoon et al. 2017, Vázquez–Torres 2012). Comparing the current data and the data

from two decades ago, it can be seen that the number of obese children has doubled, while the number of obese adolescents has tripled (Vázquez–Torres 2012). The first signs of several chronic diseases (such as cardiovascular diseases, diabetes, and obesity) are already detectable in childhood (Black et al. 2017). In addition, psychological illnesses, such as depression also accompany obesity, which means an even worse quality of life for the individual (Vázquez–Torres 2012).

Based on this, it can be claimed that it is extremely important to deal with nutrition. The purpose of this study is to present the internationally recognized eating behaviour questionnaires on obesity, to learn about their criticisms, and to select the questionnaire that will form the basis for subsequent primary research on self-control and eating behaviour.

2. Eating behaviour

Eating behaviour is considered to be the most important factor regarding the treatment and prevention of obesity and related illnesses (Danielsen et al. 2013). Before examining eating behaviour, it is very important to note that food is not a medication, so it is not suitable for self-medication (Lockwood 2007). Individual foods are not healthy or unhealthy. To achieve their positive or negative effects, we need to consume them regularly. We will not experience an immediate effect, as with medicines. The same is true for obesity. There are no “fattening” or fat-burning foods, weight gain is the result of a very simple formula: if you put more calories into your body than you burn, you will gain weight in the long term (Dovey 2010).

Another misconception is that there are addictive foods. Eating is part of our lives, it is a condition of our survival, so it cannot be addictive, as is the case with air, for example. The addiction to food can be explained by eating disorders, which is a diagnosed disease. Thus, the vast majority of society does not fall into this category (Baicy 2005). However, there are people who, under the influence of emotional stress, consume too much food. Although this is not a disease, it is a normal phenomenon, but it can lead to obesity in the long term, so it must be addressed (Dovey 2010).

Eating behaviours could be divided into three groups. Emotional eating, dietary restraint, and disinhibition. According to the psychosomatic theory, those who eat triggered by emotions (fear, anger, anxiety) do not recognise this stimulus, and therefore they take too many calories in their body. They are emotional eaters (Kaplan–Kaplan 1957). Emotional eaters have an additional component according to food (Dovey 2010). 75% of overweight people are struggling with this problem. Emotional eaters often choose food high in fat and sugar, and therefore tend to be at higher risk of diabetes and heart disease (Frayn–Knäuper 2018). Although eating under the influence of emotions is mainly related to negative emotions, in some cases it is caused by positive emotions (Ganley 1989). Therefore, it is difficult to predict the eating behaviour supposing of emotions by a normal eater. According to Macht (2008) there are five different types of emotional eating. The first and easiest type to define is when emotions cause an individual to change their dietary preference and choose a food richer in energy. In the second case, under the influence of overly intense emotions, the opposite occurs and the individual reduces consumption. The third and

fourth types are related to cognitive eating. Restrained eaters will not be able to follow their own rules under the sway of strong emotions and will consume more. And emotional eaters will eat even more sweet and high-fat foods to control their emotional state.

The theory of restraint is also related to eating behaviour, saying that during diet the individual consciously restrains food consumption to reduce or maintain weight, which leads to metabolic processes slowing down and reducing the feeling of hunger. However, as soon as self-control decreases (for example, as a result of alcohol or negative emotions), cognitive restraint decreases and eating behaviour turns in the opposite direction, leading to excessive food intake. Furthermore, as a result of restrained eating, the individual may lose control over the feeling of hunger and the feeling of satiety, which leads to eating based on emotional or external effects (Herman–Polivy 1975).

Disinhibition, the loss of inhibition indicates an eating behaviour where the individual loses control for some reason, is disturbed by something, so he eats more of that food. One classic example is when we eat a lot more snacks than we really need while watching a movie, and we drink as much as a litre of soft drinks during the movie. This is because the action (in this case, watching the film) distracts us, so we don't realize how much we are eating.

External eating is a specific form of disinhibition. External theory has a similar position, claiming that the external environment determines eating behaviour and the vision and smell of food generate an overly strong reaction in overweight people (Schachter–Rodin 1974). This theory is often linked to obesity (Herman et al. 1980).

3. Measuring eating behaviour

The measurement of dietary behaviour can be carried out by a number of methods. Qualitative research methods have been used in many studies. Among them was focus group interviews (Kubik et al. 2005), in-depth interviews (Krall–Lohse 2009). The problem with these methods and research is that their results cannot be generalized to the entire population. According to Smith (2009), in qualitative research, approach, and hypotheses are based on preliminary assumptions that influence the results. Case studies are also worth mentioning when examining methods of research on food, but this method is used more in medical research, where a group of a small number of individuals is examined. These studies focusing mainly on eating disorders and their therapy (Vansteelandt et al. 2004).

Another method of measuring dietary behaviour is experiments or laboratory tests. Research often requires looking at real dietary patterns, i.e. when and how much they ate (Dovey 2010). However, experience has shown that it is very difficult for those who are surveyed to remember the foods they have consumed in the last 24 hours, and their quantity is even more difficult to guess. They almost always forget about snacks (Hébert et al. 2001; Blake et al. 1989). Two methods are used to eliminate these problems: observing and measuring the dietary diary and the meal. In the former case, the interviewees are meant to describe all the details of the meals. It is not enough to name the food itself, researchers need an accurate description and

quantity. For example, it is not enough to know that the person ate a slice of pizza, but they need to know what topping was on the pizza, even what flour it was made from. The downside of the food diary may be that the filler pays more attention to what he eats, or simply forgets to type something, so that the real picture doesn't emerge from the research (Dovey 2010). Food is observed and measured under laboratory conditions. Here they try to imitate the environment of a real-life situation, and the participants have to choose between dishes. They also monitor the amount of food consumed, weighing before and after a meal, thus calculating the amount consumed. Of course, this method does not guarantee that participants will not be affected by the circumstances (Dovey 2010).

Psychometric (questionnaire-based) measurement methods are most common when examining dietary behaviour (Carnell–Wardle 2007). The best-edited questionnaires also have weaknesses. Although the leading questions are much more effective than simply asking someone if they eat under the influence of emotions, fillers often get tired of asking questions and do not pay enough attention to the quality of the filling (Dovey 2010).

A great number of research questionnaires into eating behaviour and attitudes ha been developed to examine this topic. In the table below (Table 1), we look at the measuring instruments that measure eating behaviour from the body weight management aspect.

For the purposes of this study, food consumption questionnaires are relevant. Pudel and his fellow researchers (1975) created the concept of *latent obesity* and developed a test. We call *latent obese* individuals who have normal body weight, yet they body is biologically programmed to be obese because of their rate of eating. However, they can limit their calorie intake in the long term. They constructed a 40 item questionnaire to measure latent obesity. However, it has limitations both theoretically and practically. Stunkard and Messick (1985) stated that “the concept of restrained eating implies two independently varying dimensions of restraint vs nonrestraint and obesity vs nonobesity; whereas the concept of latent obesity implies either an intermediate range on the obesity–nonobesity dimension or a confounding of the two dimensions. The latent obesity questionnaire thus cannot address the important group of restrained obese. Furthermore, the questionnaire has not been applied beyond the narrow limits of one form of laboratory experiment” (Stunkard–Messick 1985, p. 72).

Table 1 Measuring instruments for weight management

<i>Examined area</i>	<i>Name</i>	<i>Source</i>
Food consumption	Latent Obesity Questionnaire	Pudel et al. (1975)
	Eating Attitude Test (EAT)	Garner and Garfinkel (1979)
	Restraint Scale, RS	Herman and Polivy (1980)
	Eating Disorder Inventory (EDI)	Garner et al. (1983)
	Dutch Eating Behaviour Questionnaire (DEBQ)	Van Strien et al. (1986)
	Three Factor Eating Questionnaire (TFEQ)	Stunkard and Messick (1985), Karlsson et al. (2000) HRQL Group (2002) Tholin et al. (2005)
Body Image	Children's Eating Behaviour Questionnaire (CEBQ)	Carnell and Wardle (2007)
	Body Attitude Test (BAT)	Probst et al. (2008)
Physical Activity	Fallon and Rozin Test	Stunkard and Messick (1985) Fallon and Rozin (1985)
	Exercise: Stages of Change	Marcus et al. (1992)
	State-Trait Anxiety Inventory; STAI	Spielberger (1970)

Source: Probst et al. (2008), Czeglédi et al. (2010), Czeglédi et al. (2011), Soós (2014)

Garner and Garfinkel's (1979) *Eating Attitude Test* (EAT) is mainly used to study eating disorders. Originally, it had 40 items and measured anorexia on a 6 point Likert scale. EAT has been used in several studies and achieved good psychometric properties of reliability, validity, and sensitivity, but it is useful only in discovering eating disorders in general (Richter et al. 2016).

Herman and Polivy's (1980) *Restraint Scale* uses 10 items to measure how consciously an individual restrains food intake in order to restrain their weight. According to their concept, obese characteristics of people arise from their dieting and not from their obesity. Restraint eating is more common among obese individuals, because they diet often (Hibschler–Herman 1977). Further studies revealed problems with the scale, and it does not predict the obese people's behaviour. Moreover, obese people, whose score was high on the scale did not overeat (Stunkard–Messick 1985).

The Eating Disorder Inventory is a widely used measurement tool for eating disorders like bulimia and anorexia. The test has 64 items on eight subscales (drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, and maturity fears) (Garner et al. 1983).

Restraint Scale provided the basis for the *Three Factor Eating Questionnaire* (TFEQ) (Stunkard and Messick 1985) and the *Dutch Eating Behaviour Questionnaire* (DEBQ) (Van Strien et al. 1986). Both analyse three eating behaviours: the TFEQ

distinguishes between uncontrolled eating, cognitive restraint and emotional eating, and the DEBQ differentiates restrained eating, emotional eating and external eating.

The *Three Factor Eating Questionnaire* has two parts, and 51 items in all. The first part has true or false items, for example “*I usually eat too much at social occasions, like parties and picnics*”. The second part has a 4-point scale with questions like “*How often are you dieting in a conscious effort to control your weight?*” TFEQ measures uncontrolled eating such as the degree of cognitive control in food intake, cognitive restraint such as the loss of control in food consumption, and emotional eating such as the susceptibility for internal or external hunger signs (Löffler et al. 2015).

The *Dutch Eating Behaviour Questionnaire* examines eating behaviour with the help of three subscales. The *external eating* scale studies the consumption affected by external stimuli related to food regardless of the individual’s feeling of hunger. The *restrained eating* scale measures whether the individual restrains food consumption intentionally in order to reduce weight or prevent overweight. The third, *emotional eating* scale analyses the effect of emotions (such as anger, tension, and anxiety) on nutrition (Van Strien et al. 1986).

4. Dutch Eating Behaviour Questionnaire and Three-Factor Eating Questionnaire

Dutch Eating Behaviour Questionnaire and Three-Factor Eating Questionnaire are the most commonly used eating behaviour questionnaires in business studies, because they combine the main scales invented for eating behaviour measurement. They measure almost the same eating behaviour types but with different scales and questions.

Dutch Eating Behaviour Questionnaire (DEBQ) is an internationally well recognised measuring tool for eating behaviour. The questionnaire intended to measure eating behaviour was developed by Van Strien and co. in 1986. The questionnaire originally including 46 items was later reduced to 33 questions, which since then has been validated in many countries (including Brazil, China, Spain and France) (Moreira et al. 2017, Wu et al. 2017, Cebolla et al. 2013, Bailly et al. 2012). Over time, it has been modified, improved and validated several times (Van Strien et al. 1986, Evers et al. 2011, Bailly et al. 2012, Nolan et al. 2010, Schembre et al. 2011, Bozan et al. 2011).

The questionnaire examines eating behaviour with the help of three subscales (Table 2). The *external eating* scale studies the consumption affected by external stimuli related to food regardless of the individual’s feeling of hunger. The *restrained eating* scale measures whether the individual restrains food consumption intentionally in order to reduce weight or prevent overweight. The third, *emotional eating* scale analyses the effect of emotions (such as anger, tension and anxiety) on nutrition. These three scales have high internal consistency and factorial validity (Van Strien et al. 1986).

Table 2 The original questions of Dutch Eating Behaviour Questionnaire

<i>The original questions</i>	<i>Scale</i>
Do you have the desire to eat when you are irritated?	<i>emotional eating</i>
If food tastes good to you, do you eat more than usual?	<i>external eating</i>
Do you have a desire to eat when you have nothing to do?	<i>emotional eating</i>
If you have put on weight, do you eat less than you usually do?	<i>restrained eating</i>
Do you have a desire to eat when you are depressed or discouraged?	<i>emotional eating</i>
If food smells and looks good, do you eat more than usual?	<i>external eating</i>
How often do you refuse food or drink offered because you are concerned about your weight?	<i>restrained eating</i>
Do you have a desire to eat when you are feeling lonely?	<i>emotional eating</i>
If you see or smell something delicious, do you have a desire to eat it?	<i>external eating</i>
Do you have a desire to eat when somebody lets you down?	<i>emotional eating</i>
Do you try to eat less at mealtimes than you would like to eat?	<i>restrained eating</i>
If you have something delicious to eat, do you eat it straight away?	<i>external eating</i>
Do you have a desire to eat when you are cross?	<i>emotional eating</i>
Do you watch exactly what you eat?	<i>restrained eating</i>
If you walk past the baker do you have the desire to buy something delicious?	<i>external eating</i>
Do you have a desire to eat when you are approaching something unpleasant to happen?	<i>emotional eating</i>
Do you deliberately eat foods that are slimming?	<i>restrained eating</i>
If you see others eating, do you also have the desire to eat?	<i>external eating</i>
When you have eaten too much, do you eat less than usual the following days?	<i>restrained eating</i>
Do you get the desire to eat when you are anxious, worried or tense?	<i>emotional eating</i>
Do you find it hard to resist eating delicious foods?	<i>external eating</i>
Do you deliberately eat less in order not to become heavier?	<i>restrained eating</i>
Do you have a desire to eat when things are going against you or when things have gone wrong?	<i>emotional eating</i>
If you walk past a snack bar or a café, do you have the desire to buy something delicious?	<i>external eating</i>
Do you have the desire to eat when you are emotionally upset?	<i>emotional eating</i>
How often do you try not to eat between meals because you are watching your weight?	<i>restrained eating</i>
Do you eat more than usual, when you see others eating?	<i>external eating</i>
Do you have a desire to eat when you are bored or restless?	<i>emotional eating</i>
How often in the evening do you try not to eat because you are watching your weight?	<i>restrained eating</i>
Do you have a desire to eat when you are frightened?	<i>emotional eating</i>
Do you take into account your weight with what you eat?	<i>restrained eating</i>
Do you have a desire to eat when you are disappointed?	<i>emotional eating</i>
When you are preparing a meal are you inclined to eat something?	<i>external eating</i>

Source: Van Strien et al. (1986)

Table 3 Questions of Three-Factor Eating Questionnaire

<i>The question</i>	<i>Answers</i>	<i>Scale</i>
I deliberately take small helpings as a means of controlling my weight.	definitely true/ mostly true/ mostly false /definitely false	cognitive
I consciously hold back at meals in order not to gain weight.	definitely true/ mostly true/ mostly false /definitely false	cognitive
I do not eat some foods because they make me fat.	definitely true/ mostly true/ mostly false /definitely false	cognitive
How frequently do you avoid 'stocking up' on tempting foods?	almost never/ seldom /usually/ almost always	cognitive
How likely are you to consciously eat less than you want?	unlikely /slightly likely/ moderately likely/ very likely	cognitive
On a scale of 1 to 8, where 1 means no restraint in eating (eating whatever you want, whenever you want it) and 8 means total restraint (constantly limiting food intake and never 'giving in'), what number would you give yourself?	eat whatever I want, whenever I want it/ constantly limiting food intake, never 'giving in'	cognitive
When I smell a sizzling steak or a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.	definitely true/ mostly true/ mostly false /definitely false	uncontrolled
Sometimes when I start eating, I just can't seem to stop.	definitely true/ mostly true/ mostly false /definitely false	uncontrolled
Being with someone who is eating often makes me hungry enough to eat also.	definitely true/ mostly true/ mostly false /definitely false	uncontrolled
When I see a real delicacy, I often get so hungry that I have to eat right away.	definitely true/ mostly true/ mostly false /definitely false	uncontrolled
I get so hungry that my stomach often seems like a bottomless pit.	definitely true/ mostly true/ mostly false /definitely false	uncontrolled
I am always hungry so it is hard for me to stop eating before I finish the food on my plate.	definitely true/ mostly true/ mostly false /definitely false	uncontrolled
I am always hungry enough to eat at any time.	definitely true/ mostly true/ mostly false /definitely false	uncontrolled
How often do you feel hungry?	only at mealtimes/ sometimes between meals/ often between meals/ almost always	uncontrolled
Do you go on eating binges though you are not hungry?	never/ rarely/ sometimes/ at least once a week	uncontrolled
When I feel anxious, I find myself eating.	definitely true/ mostly true/ mostly false /definitely false	emotional
When I feel blue, I often overeat.	definitely true/ mostly true/ mostly false /definitely false	emotional
When I feel lonely, I console myself by eating.	definitely true/ mostly true/ mostly false /definitely false	emotional

Source: Karlsson et al. (2000)

The second most popular eating behaviour questionnaire is TFEQ (Three-Factor Eating Questionnaire), developed by Stunkard and Messick (1985). Originally, it consists of two parts and a total of 51 items. Each of the items is measured on a yes-to-no scale. Of the 51 questions, 21 examined cognitive limitations, 16 were for disinhibition, and 14 for predisposition to hunger. There are three categories within the three eating behaviours: low, high, clinical case (Dernóczy-Polyák et al. 2017). The 21-item (TFEQ-R21) most commonly used in current researches (Table 3) was developed by Karlsson et al. (2000) and the 18-item (TFEQ-R18) form by Tholin et al. (2005). The questionnaire examines eating behaviour with the help of three components: restraint eating, disinhibition, and hunger. Disinhibition examines eating on the basis of external effect (smells, appearance of food) and eating under the influence of emotions. This scale is most correlated with obesity and high calorie intake (Bryant et al. 2007). In addition to testing the strength of the restraint scale of the DEBQ restraint scale, body image is also considered.

TFEQ and DEBQ are highly similar constructions and used in many international studies. According to Google Scholar DEBQ has 5.530 records, TFEQ has 5.220. But DEBQ provides results that are easier to apply and identify in business science (Dernóczy-Polyák-Keller 2017). However, for our future research about self-control and eating behaviour, DEBQ is more relevant because of the scales, which can be easily paired with self-control measurement.

5. Conclusion

Obesity is associated with increased health care cost, which is why it is important to examine eating behaviour. Obesity is attributed to overeating. Measuring eating behaviour is important to understand obese eating patterns (Van Strien et al. 1986). In the past decades a great number of measurement tools into eating behaviour and attitudes has been developed. In this study we presented the aspects of eating behaviour and introduced the internationally acknowledged measuring methods. The aim of this study was to find the best eating behaviour measurement tool for future research. We found that TFEQ and DEBQ are the most commonly used questionnaires for this topic, but DEBQ is easier to apply and identify in business studies. The main difference between the questionnaires are the measured scales. TFEQ measures disinhibition, but DEBQ only measures one specific form of disinhibition, external eating. For the future research, which examines eating behaviour in the context of self-control, Dutch Eating Behavior Questionnaire is the right choice, because the scales (external eating, restrained eating, and emotional eating) can be drawn parallel with self-control measuring methods.

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