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Predicting mothers' decisions to introduce complementary feeding at 6 months. An investigation using an extended theory of planned behaviour

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Abstract

In Australia and other developed countries there is poor adherence to guidelines recommending the introduction of complementary feeding to infants at 6 months of age. We aimed to investigate, via adopting a theory of planned behaviour framework and incorporating additional normative and demographic influences, mothers' complementary feeding intentions and behaviour. Participants were 375 primiparas who completed an initial questionnaire (infant age 13 ± 3 weeks) that assessed the theory of planned behaviour constructs of attitude, subjective norm, and perceived behavioural control, as well as group norm and additional maternal and infant variables of mothers' age, education level, weight status perception, current maternal feeding practices, and infant birth weight. Approximately, 3 months after completion of the main questionnaire, mothers completed a follow-up questionnaire that assessed the age in months at which the infant was first introduced to solids. The theory of planned behaviour variables of attitude and subjective norm, along with group norm, predicted intentions, with intention, mothers' age (older more likely), and weight status perception (overweight less likely) predicting behaviour. Overall, the results highlight the importance of attitudes, normative influences, and individual characteristics in complementary feeding decision-making which should be considered when designing interventions aimed at improving adherence to current maternal feeding guidelines.

Key words: complementary feeding, introduction to solids, theory of planned behaviour, group norms

Introduction

Currently in Australia and other developed countries there is a lack of research examining the decision-making processes of complementary feeding practices (otherwise termed introduction of solids). The theory of planned behaviour (TPB; Ajzen, 1991) is a well-validated behavioural decision-making model that has been used to predict social and health behaviours (Armitage & Conner, 2001), including maternal breastfeeding practices (e.g., McMillan et al., 2008). The aim of the current study was to investigate, using a TPB framework, mothers' complementary feeding intentions and behaviour.

A key developmental and nutritional milestone for infants is commencement of complementary feeding, whereby an infant previously fed only breast milk or formula is introduced to a wide variety of foods (National Health and Medical Research Council, 2003). In 2003 the World Health Organisation adopted a '*global public health recommendation [that] infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development and health*'. Exclusive breastfeeding is defined as no other fluids including water or food (World Health Organisation, 2003). Australian guidelines were modified accordingly to also recommend exclusive breastfeeding for the first 6 months of life (National Health and Medical Research Council, 2003). Following from this recommendation is the reciprocal guideline that the introduction of complementary foods (i.e. any solid or liquid food additional to breast milk or formula; Agostoni et al., 2008), should be delayed until 6 months of age (National Health and Medical Research Council, 2003). Given that the introduction of complementary feeding prior to 6 months precludes adherence to the recommendation to exclusive breastfeeding for 6 months, it is difficult to independently verify outcomes and, hence, establish evidence separately for either of these recommendations. Generally, the evidence for the complementary feeding guidelines focuses on the benefits of exclusive breastfeeding rather than potential independent negative

outcomes of introduction of solids between 4 and 6 months (Arden, 2010). Although the benefits of exclusive breast feeding are well established, particularly in developing countries, there are few studies that have examined independent outcomes of delaying introduction of solids to 6 months in formula fed infants who, by definition, are not exclusively breastfed.

Australian guidelines recommend the introduction of solids '*at around*' 6 months to meet the increased nutritional and developmental needs of infants (National Health and Medical Research Council, 2003). It is argued that earlier solid introduction shows no benefits and, particularly prior to 4 months, may be associated with negative outcomes such as inadequate nutrient and energy intake due to displacement of breast milk and formula and stress on immature gastrointestinal, immune, and renal systems (Arden, 2010; Kaye, Patterson, Croaker, Norton, & Lewis, 2008; Naylor & Morrow, 2001). Despite these clear recommendations to the contrary, many mothers introduce solids before their child reaches 6 months of age. A 2003 telephone survey of 1201 children under 5 years in Queensland, Australia reported that 18% and 67% of infants started complementary foods before the ages of 4 and 6 months, respectively (Gabriel, Pollard, Suleman, Coyne, & Vidgen, 2005). A recent representative United States study reported 51% of mothers had introduced solids by 4 months (Grummer-Strawn, Scanlon & Fein, 2008). Similar prevalence rates have been found in other developed countries (Bolling, Grant, Hamlyn, & Thornton, 2007; Hetzner, Razza, & Brooks-Gunn, 2009).

Despite the importance of timely introduction of solids and the widespread poor adherence to the guidelines, studies examining the potentially modifiable behavioural factors influencing complementary feeding decisions in developed countries are scarce. Most studies (e.g., Alder et al., 2007; Scott, Binns, Graham, & Oddy, 2009; Wright, Parkinson & Drewett, 2004) have examined factors associated with weaning prior to 4 months of age which was consistent with the old guidelines. Only a single recent study ($N=140$ well educated mothers)

from the United Kingdom (UK) has explicitly examined a range of factors important to the decision to introduce solids at 6 months of age (see Arden, 2010). Even fewer studies have used an established theoretical framework to explore maternal enablers and barriers to timely solid introduction (Brophy-Herb, Silk, Horodynski, Mercer, & Olson, 2009) or considered potential infant and maternal covariates. A systematic review of 33 studies, 7 of which were from developed countries, identified a range of interrelated social factors such as young maternal age, lower socioeconomic status, lower educational achievement, ethnicity, and formula feeding that are associated with early complementary feeding (see Lanigan, Bishop, Kimber, & Morgan, 2001). While these largely demographic maternal and infant characteristics are important, the majority is not readily modifiable and do not explain the complexity of social and psychological influences that underpin decisions about complementary feeding. Given the reciprocal relationship between the breastfeeding and complementary feeding guidelines, understanding these factors is also important in improving duration of exclusive breastfeeding. Understanding psychosocial predictors will allow us to assess if current messages accurately target the beliefs and behaviours that contribute to poor adherence to both the breastfeeding and complementary feeding guidelines.

Theory of planned behaviour

The theory of planned behaviour (TPB; Ajzen, 1991) is a well-validated behavioural decision-making model, widely employed to examine the psychosocial influences on behaviour. The TPB proposes the most proximal determinant of behavioural outcomes is intention to perform a given behaviour which is, in turn, predicted by three belief-based constructs: attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). Attitudes are the positive or negative evaluations by an individual about the consequences of performing a particular behaviour. Subjective norms refer to the perceived pressure from important others to perform or not to perform an action. Perceived behavioural control, which

is similar to the concept of self-efficacy, refers to one's perceived ease of performing a given behaviour and is also proposed to influence behaviour directly. The TPB has been used to examine a wide range of behaviours, including nutritional and dietary practices (e.g., Blanchard et al., 2009; Verbeke & Vackier, 2005). A meta-analysis (Armitage & Conner, 2001) found that the TPB accounted for an average of 39% of the variance in people's intentions and 27% of the variance in behaviour.

Theory of planned behaviour and the prediction of maternal feeding behaviours

A small number of studies have applied the TPB to examine maternal feeding practices, most of which are related to breastfeeding behaviours. McMillan et al. (2008) investigated breastfeeding uptake in primiparas ($N=248$) experiencing material hardship. Consistent with the specifications of the TPB, attitudes, subjective norm, and perceived behavioural control were all significant predictors of mothers' intentions to breastfeed (explaining 56% of the variance after controlling for age, ethnicity, education, and deprivation), with intention and perceived behavioural control predicting breastfeeding behaviour 6-weeks later (explaining 44% of the variance after controlling for age, ethnicity, education, and deprivation). Other researchers (e.g., Khoury, Moazzem, Jarjoura, Carothers, & Hinton, 2005; Swanson & Power, 2005) have found attitudes and subjective norms, but not perceived behavioural control, to predict breastfeeding initiation and continuation. Given the success of the TPB model in predicting other maternal feeding behaviours, it is plausible that this framework would be useful in examining complementary feeding practices.

One of the few studies to use TPB to explore complementary feeding behaviour is from Horodyski et al. (2007) who used the TPB framework in a qualitative thematic analysis from six focus groups ($N=23$) with low income mothers in the United States. The aim was to examine knowledge and attitudes regarding introduction of solids in the context of the recommendation of introduction no earlier than 4-6 months. Mothers knew and approved of

the recommendation but infant factors such as sleep patterns and satiety weakened their intention to delay introduction. They also identified subjective norms based on social pressure from families, avoiding negative effects of early solid introduction (rather than positive outcomes of later introduction), and low perceived behavioural control (e.g., diagnosis of acid reflux) as important influences on complementary feeding behaviour. However, these conclusions were based on qualitative rather than quantitative analyses.

Despite the success of the TPB in predicting maternal breastfeeding behaviours, as is the case for most studies using the TPB as a predictive model, there still remains a proportion of unaccounted variance. Ajzen (1991) supports the inclusion of additional predictors to the model to improve its prediction of people's intentions and/or behaviour. However, there should be a strong theoretical justification for inclusion of additional predictors and they should capture a significant portion of unique variance in intentions or behaviour.

Increasingly, researchers have recognized the importance of normative influences from relevant referent social groups and have included an assessment of group norms in the model (see e.g., Hamilton & White, 2008; White, Smith, Terry, Greenslade, & McKimmie, 2009), including in studies investigating food choice behaviours (e.g., Carrus, Nenci, & Caddeo, 2009; Louis, Davies, Smith, & Terry, 2007). Given the popularity of both formal and informal mothers' support groups (Campbell et al., 2008), social influences and contexts might be especially salient for mothers of young children. Several studies have identified family and friends as a key influence on complementary feeding practices (see Alder et al., 2007; Crocetti, Dudas, & Krugman, 2004; Horodyski et al., 2007; Olson, Horodyski, Brophy-Herb, & Iwanski, 2008). Thus, the current study included an assessment of group norms within the TPB.

Group norms and social identity influence

The subjective norm construct within the TPB reflects injunctive norms as the focus is on people's perceptions of social pressure from important others to perform the behaviour (Ajzen, 1991). Group norms refer to the explicit or implicit prescriptions regarding one's appropriate attitudes and behaviours as a member of a specific reference group in a given context (White, Hogg & Terry, 2002). Thus, where subjective norm infers that perceptions of social approval from important others influence people's intentions, group norm infers that normative support from a relevant group (i.e., other mothers) for performing the behaviour (e.g., perceptions about whether other group members perform the behaviour themselves; similar to the concept of the descriptive norm component of the TPB, see Ravis & Sheeran, 2003) influence people's intentions.

The influence of social identity on the intention-behaviour relationship can be explained using a social identity (Hogg & Abrams, 1988) and self-categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987) perspective. According to these theories, when social identity is salient, the individual constructs context-specific group norms based on shared intra-group information and assimilate themselves to these group norms (Turner et al., 1987). Behavioural performance, therefore, is more likely to occur when there is support from a relevant ingroup endorsing the behaviour as a good thing to do and performance of the behaviour than without such ingroup support (e.g., Terry & Hogg, 1996). Accordingly, group norms influence behavioural performance as the individual, based on their observations of group members, seeks to act in a manner similar with their ingroup, therefore achieving categorization as a group member (Hogg & Abrams, 1988; Turner et al., 1987).

More recent evidence suggests that group norms predict behavioural intentions irrespective of level of identification (e.g., Johnson & White, 2003). The normative influences of family and friends have been identified by several studies as a key determinant of complementary feeding practices (Alder et al., 2007; Crocetti et al., 2004; Horodyski et al.,

2007; Olson et al., 2008). Hence, in the current study, the influence of the perceived action of an important referent group (i.e., most mothers I know) was specifically examined.

The present study

This study aimed to use the theoretical framework of the TPB, incorporating additional demographic factors and group norms, to determine predictors of mothers' intentions and behaviours related to introduction of solids at 6 months of age. The target behaviour (introducing solids for the first time at 6 months of age) was chosen based on current national and international guidelines (National Health and Medical Research Council, 2003; World Health Organisation, 2003).

From a TPB perspective, it was hypothesised that attitude, subjective norm, and perceived behavioural control would predict mothers' intention to introduce complementary feeding at 6 months (Hypothesis 1), and intention and perceived behavioural control would predict the actual introduction of solids at 6 months (Hypothesis 2). In relation to the normative influence variable, it was expected that group norms would be identified as an additional predictor of mothers' intentions to introduce complementary feeding at 6 months (Hypothesis 3). Furthermore, in an exploratory manner, maternal demographic variables of age, pre-pregnancy weight status, education level, and current maternal feeding practices, as well as the infant characteristic of birth weight, were examined to determine if they contributed to the prediction of intention and behaviour related to the introduction of solids at 6 months (Hypothesis 4).

Method

Participants and procedure

Participants were recruited in 2008 from a consecutive sample of first-time mothers, aged 18 years or older, who delivered healthy term infants in seven hospitals in the capital cities (Brisbane and Adelaide) of two Australian states. Eligible mothers were approached

postnatally and gave consent to be contacted once their infants were aged 4-7 months regarding enrolment in NOURISH, an early feeding randomized controlled trial (Daniels et al., 2009). At the first postnatal contact they provided brief demographic data and also indicated if they were willing to be contacted regarding other related studies. Mothers consenting to the latter formed the sampling frame for the study described here and were contacted separately when their infant was aged 2 months.

The study used a prospective design with two waves of data collection. The main questionnaire (infant aged approximately 3 months) assessed the standard TPB predictors (i.e., attitude, subjective norm, perceived behavioural control, and intentions), along with group norm, feeding mode, and the additional demographic measures. The follow-up questionnaire (infant aged approximately 7 months) assessed the age (in months) at which mothers first introduced solids.

A letter of invitation explaining the study, the main questionnaire, and a reply paid envelope were mailed to eligible participants. The invitation letter advised mothers that a follow-up questionnaire would be sent in 3 to 4 months. Mothers who did not wish to participate were asked to return the blank questionnaire. A reminder letter was sent at two weeks with a second reminder letter and replacement questionnaire sent at three weeks.

For the first recruitment cohort of NOURISH, 85% ($N=1932$) of eligible mothers were approached on the postnatal wards, 74% ($N=1422$) of whom provided contact details. Of those who declined to provide contact details, 44% ($N=510$) agreed to provide brief demographic data. These data indicated those agreeing to later contact were more likely to have a university education (41% vs. 22%). There were few differences in other key demographic variables: birth weight 3.48 vs. 3.46 kg; age 27 vs. 26 years, and 17% in both groups self-reported themselves as overweight prior to their pregnancy. Of the participants consenting to be re-contacted for enrolment in the NOURISH trial, 75% ($N=1062$) also

provided consent (either active or passive) to be contacted regarding other related studies. Of these 379 were excluded as their infant turned 3 months prior to finalisation of the questionnaire and the mail out commencing in June 2008. Thus, the main questionnaire was sent to the remaining 683 mothers (43% in Adelaide) when their infant was approximately 3 months old. It was estimated that a sample size of $N=370$ was needed to provide 95% confidence that results in the sample will be the same as the population within a 5% error range, assuming a 40/60 split on any variable (de Vaus, 2002) and we assumed a 55% response rate. In the TPB study reported here, 375 (55% response rate) first-time mothers completed the main questionnaire.

Fifty-four percent of those who returned the main questionnaire subsequently enrolled in the NOURISH trial (Daniels et al., 2009). Comparison on age of introduction of solids and key covariates revealed no differences between those in the larger study and those who consented for the TPB study. Approval for recruitment to the larger study was obtained from the relevant hospital human research ethics committees with the ethics committees for both Queensland University of Technology and Flinders University approving the TPB study reported here.

Measures

Target behaviour

The target behaviour of introducing solids was defined as, “any foods or drinks given to your baby in addition to breast milk, formula, or water”, and introducing solids for the first time at 6 months of age was the defined timeframe. Examples of solids were presented and included: homemade foods that are easy to eat such as mashed fruits or vegetables; commercial baby foods such as rice cereal, tins or jars of baby foods; and drinks like cow’s milk or juice. To maximise congruence between the prediction and criterion variables, the TPB variables were measured at the same level of specificity in terms of action, target, and time (Ajzen &

Fishbein, 1970). In this study we only examined attitudes and beliefs that were directly and uniquely related to the specific target behaviour and defined time frame (i.e., solid introduction at age 6 months). The TPB items were constructed in line with recommendations (Ajzen, 1991) and were each scored on a 7-point Likert scale, except for attitude, which was scored on 7-point semantic-differential scales.

Intention. Three items assessed the strength of intention to perform the target behaviour (e.g., “I intend to introduce solids when my baby is 6 months old”, scored *strongly disagree* [1] to *strongly agree* [7]).

Attitude. Attitude towards introducing solids at 6 months was assessed by three, 7-point semantic differential scales (e.g., “For me, introducing solids (for the first time) when my baby is 6 months of age would be... *unimportant* [1] to *important* [7]).

Subjective norm. Subjective norm was assessed by two items (e.g., “Most people who are important to me think that I should introduce solids when my baby is 6 months of age”, scored *strongly disagree* [1] to *strongly agree* [7]).

Perceived behavioural control. Perceived behavioural control was measured by three items reflecting the mother’s sense of control about performing the target behaviour (e.g., “I have complete control over whether or not I introduce solids when my baby is 6 months of age”, scored *strongly disagree* [1] to *strongly agree* [7]).

Group norm. Group norm was measured by one item, (e.g., “Most mothers I know introduce solids when their babies are 6 months of age”, scored *strongly disagree* [1] to *strongly agree* [7]). This reference group was based on outcomes of a small elicitation study with primiparas.

Demographics variables. A number of demographic details were collected at the first postnatal contact including: (i) mothers’ age at the birth of the infant in years; (ii) mother’s self-reported weight status, (“How would you describe your weight status before

pregnancy”), coded as 1 = *not overweight* and 2 = *overweight*; and (iii) education levels coded as 1 = *non-university* and 2 = *university*.

Current feeding practices at approximate age of 3 months were assessed in the main questionnaire using 1 of 6 responses (exclusive breastfeeding [1], mainly breastfeeding with other drinks occasionally [2], breastfeeding and solids [3], formula feeding [4], formula feeding and solids [5], breastfeeding and formula feeding [6]). Responses from 1 to 3, indicating the individual is primarily breastfeeding (that is not using formula), were coded as 1 = *breastfeeding* and mothers who responded 4 to 6, indicating they were using formula, were coded as 2 = *formula feeding*. Finally, infants’ birth weight (kilograms) was recorded from hospital records.

Reported behaviour. Approximately 3 months after completion of the main questionnaire, mothers were sent a follow-up questionnaire that included the question “At what age was your baby first given solid foods? ____ months”.

Results

Participant characteristics

Three hundred and seventy-five (55% response rate) first-time mothers, mean age of 29.2 (± 5.5) years at the birth of their baby, completed the main questionnaire. One hundred and sixty-nine of the mothers (45%) had university degree qualifications with 61 (16%) mothers perceiving themselves as overweight prior to pregnancy. Infants had a mean birth weight of 3.47(± 0.50) kg. At completion of the main questionnaire, babies were aged 13(± 3) weeks and 32 (9%) had been given solid foods. Two hundred and nine (56%) of the mothers were currently breastfeeding (i.e., exclusive breastfeeding, $n = 190$, 51%; and breastfeeding with small amounts of other drinks or solids, $n = 19$, 5%). One hundred and sixty-five (44%) of the mothers were using formula (i.e., exclusive formula, $n = 93$, 25%; formula and solids, $n = 13$, 3%; and breastfeeding and formula, $n = 59$, 15.7%). Of those who returned the main

questionnaire, 69% (257) returned the follow-up questionnaire which provided the age of solid introduction data. The mean age of the babies at this time point was 31($\pm$ 2) weeks. Compared to participants who failed to return the follow up questionnaire, mothers who completed both questionnaires were more likely to have a university education (52% vs. 33%, $p=0.001$) and be older (29.9 years vs. 28.0 years, $p=0.002$), and were less likely to report themselves as overweight prior to pregnancy (14% vs. 22%, $p=0.055$) and to be using formula at the time they responded to the first questionnaire (43% vs. 61%, $p=0.001$). There was no significant difference in infant birth weight. Only those providing complete data for all the demographic and TPB construct and criterion variables were included in the regression models.

Descriptive statistics

The means, standard deviations, correlations, and reliabilities of the variables are reported in Table 1. Low to moderate correlations were found amongst the TPB predictors (attitude, subjective norm, and perceived behavioural control), all of which correlated with intention. Attitude and subjective norm, but not perceived behavioural control, were correlated with behaviour, with intention emerging as the strongest behavioural correlate. Group norm showed low to moderate correlations with attitude, perceived behavioural control, and the TPB criterion variables of intention and behaviour, and a strong association with subjective norm. Similarly, low to moderate correlations were found between the demographic variables of maternal age and current feeding practices and intention, and maternal pre-pregnancy self-reported weight status, education, age, and current feeding practices and behaviour. The average age at which infants were first introduced to solids was 5 ($\pm$ 0.84) months. All of the measures were reliable, with a slightly lower reliability evidenced for perceived behavioural control.

Regression analysis predicting intentions

A hierarchical multiple regression analysis examined the proposed predictors of mothers' intentions to introduce solids at 6 months. The demographic factors were entered at step 1, with the standard TPB variables being entered at step 2 and group norm at step 3. The step 1 variables accounted for 4% of the variance in intentions, $F(5, 352) = 2.75, p = .019$, with mothers' age (older more likely to intend) and current feeding practices (breastfeeding more likely to intend) revealed as significant. The step 2 variables significantly accounted for an additional 61% of the variance in intentions, $F(3, 349) = 15.65, p < .001$. The TPB variables of attitudes and subjective norms, but not perceived behavioural control, were found to be significantly related to intentions. Inclusion of the TPB variables at step 2 revealed the demographic factors of mothers' age and current feeding practices as no longer significant predictors of intention. Group norm entered at step 3 accounted for a further 0.5% of the variance in intentions, $F(1, 348) = 4.90, p = .027$. When all the variables were entered into the equation at step 3, the significant predictors explaining 65% of the variance in intentions were attitude, subjective norms, and group norms (see Table 2).

Regression analysis predicting behaviour

An additional hierarchical multiple regression analysis examined the proposed predictors of introducing solids at 6 months. The demographic factors were entered at step 1, with intention and perceived behavioural control entered at step 2, and attitude, subjective norm, and group norm at step 3. As shown in Table 3, step 1 explained 15% of the variance, $F(5, 230) = 8.15, p < .001$, with maternal age (older more likely to introduce solids later), current feeding practices (formula feeders more likely to introduce solids earlier), and mothers' perceived weight status (overweight more likely to introduce solids earlier) reported as significant. The addition of step 2 accounted for a further 17% of the variance in behaviour, $F(2, 228) = 28.23, p < .001$. Mothers' age and weight status perception, but not current feeding practices, remained significant predictors of behaviour, with intention also found to be

associated with mothers' introduction of solids at 6 months. Attitude, subjective norm, and group norm entered at step 3 did not significantly account for an additional amount of the variance in behaviour, $F(3, 225) = 1.51, p = .212$. In the overall model, mothers' age, perceived weight status, and intentions were the significant predictors and accounted for 33% of the variance of later solid introduction.

Discussion

This is one of the first studies to use an established theoretical framework, the TPB, to inform a quantitative examination of psycho-social and demographic factors associated with mothers' adherence to the current guidelines to introduce solids to their infant at 6 months of age. The results provide partial support for the TPB in that attitude and subjective norms predicted intentions with intentions, in turn, predicting mothers' actual behaviour of introducing solids at 6 months. Contrary to TPB, perceived behavioural control did not predict either intention or behaviour. As expected, the additional normative construct of group norm was associated with intention. In the final models there was no association between intention and any of the demographic variables, including current feeding and education, and only intention, maternal self-reported weight status, and age predicted behaviour. Overall, our results indicate that older mothers with self-reported normal weight status and strong intentions at 3 months were more likely to comply with guidelines to introduce solids at 6 months of age.

In partial support of Hypothesis 1, and consistent with the TPB in general (Armitage & Conner, 2001) and its specific application to investigating breastfeeding behaviours (e.g., McMillan et al., 2008), attitude and subjective norm predicted mothers' intentions to introduce solids at 6 months. These findings suggest that mothers who more favorably evaluate and perceive pressure from important others to introduce solids at 6 months will have stronger intentions to do so. In the current study, subjective norm was found to be a stronger

predictor than attitudes which is contrary to many TPB studies that find subjective norms to be the weakest predictor of people's intentions (Armitage & Conner, 2001). Thus, our results highlight the important contribution of positive attitudes and especially social approval to mothers' intentions to introduce solids at 6 months.

The importance of perceived benefits of solid introduction at 6 months (i.e., attitudes), although not as strong as the effect of perceived social pressures (i.e., subjective norms), in informing mothers' decisions about complementary feeding is supported somewhat by prior research. In their qualitative study, Horodynski et al. (2007) concluded that avoiding potential negative effects of early introduction was a more important predictor than the positive outcomes of later introduction. In Horodynski et al.'s study, the definition of early introduction was prior to 4 months and the findings may realistically reflect the relative strength of the evidence for detrimental outcomes related to introduction prior to 4 rather than 6 months. Arden (2010) administered an electronic questionnaire to 140 well-educated UK mothers (67% with a university degree) to assess the importance (7 points; 'not at all' to 'extremely' important) of 23 items in making the decision to introduce solid foods to their baby at 6 months. The target children had a mean age 18.5 (6-36) months and hence participants were providing a retrospective recall of their decision making. Regression analysis identified that the perceived importance of the current WHO guidelines to introduce solids at 6 months was by far the strongest predictor of age at which solids were first introduced in this sample of very well educated mothers. Together, these data imply that positive evaluations about the guidelines are very important in establishing intention to introduce solids at age 6 months which, in turn, was the only TPB construct that predicted actual behaviour.

For the additional normative influence measure included in the present study, group norm (along with subjective norm) emerged as a significant predictor of mothers' intentions

to introduce solids at 6 months, supporting Hypothesis 3. The significant influence of group norms suggests that mothers' intentions to introduce complementary feeding at 6 months are stronger if they perceive that other mothers they know perform the behaviour. Overall, these results highlight the impact of the relationship between normative influences and behavioural intentions and emphasize the importance of direct social pressures from important referents (subjective norms) and to some extent groups and other mothers (group norms), in providing normative information that mothers consider when deciding how to behave in this context. These findings concur with research that suggest normative influences are important determinants of introducing solids early (Crocetti et al., 2004; Horodyski et al., 2007).

In their TPB qualitative study, Horodyski et al. (2007) also identified social pressure from family members as an important influence on complementary feeding behaviour. Wright et al. (2004) found that mothers in their Millennium Baby Study returning questionnaire data on weaning ($N=707$, 77%) who started solids early (<13 weeks) were more likely than those starting later (> 17 weeks) to cite the influence of family and friends as a reason for starting solids (40% vs 25%, $p = \chi^2 0.024$). Furthermore, Olson et al. (2008) found that health professionals ($N=36$) participating in focus groups ($N=5$) reported that female relatives, in particular mothers, were the strongest influence infant feeding practices. A recent pilot intervention effectively incorporated explicit content and role playing designed to enhance mothers' self efficacy in defining their feeding intentions and discussing these with, and dealing with conflicting advice from, social groups (Brophy-Herb et al., 2009). Participants were 31 low income mothers (16 African Americans) and the intervention was delivered during six home visits over 6 weeks in the context of other support programs for disadvantaged mothers. In Arden's (2010) UK study, support from family members emerged as a theme in the qualitative analysis, but was not confirmed as predictor of introduction of solids at 6 months in the quantitative analysis. In our study, and as expected within the TPB

framework (Ajzen, 1991), social norms (i.e., subjective norm and group norm) predicted intentions. Thus, it may be important to provide anticipatory guidance for both mothers and their significant others as early as possible to define and support mothers' intentions to introduce solids at 6 months and hence adherence to the current guidelines.

Consistent with Hypothesis 2, strong intentions to introduce solids at 6 months predicted self-reported behavioural performance. Contrary to Hypothesis 1 and 2, perceived behavioural control did not emerge as a predictor of intention or behaviour. This finding is inconsistent with results from a study of breastfeeding behaviour in disadvantaged primiparas where support for the predictive ability of perceived behavioural control for both intention and behaviour performance was found (McMillan et al., 2008). Although our slightly lower reliability of the perceived behavioural control scale suggests the need for cautious interpretation, others investigating breastfeeding practices have found similar results to our study (e.g., Swanson & Power, 2005).

According to Ajzen (1991), the strength of perceived behavioural control in determining behaviour is dependent on perceptions of control matching actual control. Thus our results, which show no association between perceived behavioural control and behaviour or intention, suggest that mothers might not have been accurate in estimating their control over their intentions and behavioural performance (see Sheeran, Trafimow, & Armitage, 2003). A plausible alternate interpretation is that mothers may be encouraged to respond to their infants needs and, hence, perceived control lies more with the infant than themselves. Several studies have identified the influence of signs of readiness from the infant, including weight and hunger, as an important influence in the decision to introduce solids (Arden, 2010; Olsen et al., 2008; Wright et al., 2004). Arden (2010) discusses the contradiction implicit in the need to be responsive to their infants needs in order to meet recommendations to demand breast or formula feed and yet potentially ignore signs of readiness in order to adhere to

introduction of solids guidelines. Arden (2010) and others (Olson et al., 2008) further highlight the lack of evidence and clarity regarding which are true signs of readiness. Beliefs regarding infant readiness were considered to potentially influence introduction of solids at any age and, thus, were not uniquely relevant to the specific target behaviour in our study. Hence, items addressing readiness beliefs were not included in our TPB constructs. Future research should examine the influence of beliefs about infant readiness and perceptions of infant needs on intentions and its role in the introduction of complementary feeding at 6 months of age.

In consideration of previous literature supporting a role of demographic factors in predicting early complementary feeding (Lanigan et al., 2001), in an exploratory manner, we investigated the impact of infant and maternal demographic factors, within the TPB, on intention and behaviour to introduce solids at 6 months (Hypothesis 4). The demographic variables had minimal predictive value for intention but maternal age, pre-pregnancy weight status, and current feeding mode accounted for 15% of the variance in reported behaviour. However, after the inclusion of the social-cognitive factors, only maternal age and self-reported weight status perception remained significant predictors of the actual introduction of solids at 6 months. Older mothers who did not perceive themselves to be overweight were more likely to introduce solids at 6 months. Although gestational obesity has been associated with reduced initiation and duration of breastfeeding (Amir & Donath, 2007; Rasmussen & Kjolhede, 2007), we are unaware of other studies that have shown maternal weight status to be an independent predictor of early solid introduction. A number of studies, however, have identified young maternal age as an important risk factor for early solid introduction (Bolling et al., 2007; Coleman et al., 2009; Scott et al., 2009; Wright et al., 2004).

In contrast to our study, where current feeding mode (at 3 months of age) was not an independent predictor of introduction of solids at 6 months, others have shown not

breastfeeding at 4 months (Crocetti et al., 2004; Wright et al., 2004) and not exclusively breastfeeding at 4 weeks (Scott et al., 2009) predicted early (prior to 4 months) solid introduction. These differences may relate to the comparatively high rate of breastfeeding and low rate (9%) of early solid introduction (prior to 3-4 months) in our sample and/or the target age of solid introduction being 6 rather than 4 months. The lack of predictive association of educational achievement (tertiary vs less than tertiary) with introduction of complementary feeding later than 4 months is consistent with two recent Australian studies (Gabriel et al., 2005; Scott et al., 2009). In contrast, a recent five-country European study (Schiess et al., 2010) reported that low maternal education was positively associated with introduction of solids by 3 and 4 completed months of age. These data are from a randomised controlled trial evaluating protein content of infant formula which included twice the number of formula-fed infants compared to breastfed infants. Given the strong and well established relationships between maternal education, socioeconomic status, and formula use and early solid introduction (Alder et al., 2007; Bolling et al., 2007; Scott et al., 2009), the relatively high prevalence of breastfeeding in our sample, the target age of solid introduction being 6 months, and the reporting of university vs. no university education as opposed to reporting on years of education may explain the disparity with our results.

The research has a number of strengths including the prospective examination of a unique and specifically defined behaviour within a TPB framework, the examination of the impact of a range of covariates, and a relatively large sample size with an acceptable response rate. The current study also has a number of limitations. The use of self-report data may facilitate socially desirable responses. The sample was predominately Caucasian and, hence, the relevance of the findings to mothers from other cultural backgrounds is uncertain. In addition, the sample consisted of only primiparous women. Although previous research suggests that feeding behaviours applied to the first child are strongly predictive of feeding

choices with subsequent children (Bolling et al., 2007; De Vanzo, Starbird, & Leibowitz, 1990), future research could examine the efficacy of the TPB for women having their second and subsequent children. Furthermore, conclusions about the results for group norm should be interpreted with caution given assessment used a 1-item self-report measure which was highly correlated with subjective norm. Future research should employ a multi-item scale of group norm to confirm the current findings. Finally, although the models in the current study explained a substantial amount of variance in both intentions and behaviour, two thirds of the variance in the target behaviour, age of solid introduction, remains unexplained. Future research needs to consider other variables which might predict the introduction of complementary feeding at 6 months. For example, future studies should examine how social support factors (e.g., advice from family members, friends, or healthcare professionals), caregiver knowledge (see Crocetti et al., 2004; Horodyski et al., 2007), and concepts of baby readiness (Arden, 2010), within a TPB framework, might influence the introduction of solids at 6 months of age and, hence, adherence to the guidelines.

Despite the limitations of this study, the results highlight some important considerations when designing interventions aimed at improving adherence to current infant feeding guidelines. Specifically, the results point to the importance of attitudes, normative influences, and individual characteristics in complementary feeding decision-making. In particular, our results indicate that believing that introducing solids at age 6 months is important and that this belief is shared by significant others in the mother's life are the principal modifiable predictors of intention to complementary feeding introduction. These findings imply that strategies that focus on improving the understanding of the rationale underlying the current guidelines in mothers and their families are important. Given that this intention at infant age 3 months is the only modifiable factor that predicts actual behaviour, it is important that mothers and significant family members are encouraged as early as possible

to consider and plan the timing of solid introduction. Our data suggest that anticipatory guidance in both antenatal and postnatal settings should specifically promote timely introduction of solids in conjunction with initiation and maintenance of breastfeeding. This strategy is particularly relevant given the interdependence of guidelines concerning the duration of exclusive breastfeeding and timing of introduction of solids. Mothers choosing to formula feed also require early support to foster the intention to introduce solids at 6 months of age. Furthermore, it may be useful to explicitly target other members of the mother's network, including other mothers they know, to help frame the introduction of solids at 6 months as a normative behaviour. The results also suggest younger mothers and those who are overweight should particularly be targeted for this advice. These strategies are likely to support mothers in their intention to introduce solids at 6 months.

In conclusion, the current study, via adopting a TPB framework, provides a basis for understanding complementary feeding practices and important applied information that can be used in developing strategies that inform mothers and their families on the benefits of and support adherence to current guidelines recommending introducing solids no earlier than at 6 months of age. Specifically, the findings suggest that attention to establishing positive attitudes toward introducing solids at 6 months and considering the normative influences of others, such as the approval from important referents and the behavioural practices of other mothers, may assist in improving mothers' decision-making to adhere to recommended national guidelines, thus maximising the benefits to the health and well-being of the infant.

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Table 1

Means, standard deviations, and bivariate correlations for maternal and infant demographic variables, the TPB variables (attitude, subjective norm, perceived behavioural control), intention ($N=375$) and reported behaviour ($N=257$) among first-time mothers.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Mother's weight	1.16	0.37	-	-.05	.02	.08	.13*	.09	.00	.01	-.02	-.04	-.24***
2. Mother's education	1.45	0.50		-	.32***	-.26***	.04	-.03	.03	-.01	.04	.07	.16*
3. Mother's age	29.19	5.52			-	-.10*	-.01	-.01	.06	.07	.07	.13*	.24***
4. Current feeding	1.44	0.50				-	-.06	.03	-.12*	-.03	-.10	-.16***	-.22***
5. Infant birth weight	3.47	0.50					-	.07	-.04	.07	-.03	.03	-.01
6. Attitude	6.10	1.17						(.92)	.55***	.28***	.46***	.61***	.19**
7. Subjective norm	5.26	1.70							(.87**)	.55***	.73***	.77***	.34***
8. PBC	6.07	1.36								(.64)	.19***	.22***	.07
9. Group norm	5.24	1.77									-	.63***	.28***
10. Intention	5.64	1.85										(.96)	.47***
11. Behaviour	5.00	0.84											-

* $p<.05$, ** $p<.01$, *** $p<.001$

Note. Mean scores on 7-point scales (1-7; higher scores stronger agreement, more important) except for mother's self-reported pre-pregnancy weight (1 = not overweight, 2 = overweight); mother's education (1 = non-University, 2 = University); mother's age at birth of infant (in years); current infant feeding (1= breastfeeding, 2 = formula feeding at completion of first questionnaire, average infant age 13 weeks); infant birth weight (in kilograms); and behaviour (age solid introduction, months). *Note.* The figures in brackets on the diagonal are alpha coefficients. Where a construct was measured with two items, Pearson's r (and significance) is reported. *Note.* PBC = perceived behavioural control.

Table 2. Hierarchical regression predicting first-time mothers' intention to introduce solids at 6 months ($N=358$)

	B	SE	β	F
Step 1				2.748*
Mother's weight	-.158	.267	-0.032	
Mother's education	.032	.208	0.009	
Mother's age	.038	.018	0.115*	
Current feeding	-.490	.2000	-0.133*	
Infant birth weight	.121	.218	0.029	
Step 2				80.219***
Mother's weight	-.192	.163	-0.038	
Mother's education	.058	.127	0.016	
Mother's age	.021	.011	0.064	
Current feeding	-.236	.122	-0.064	
Infant birth weight	.147	.134	0.036	
Attitude	.439	.062	0.281***	
Subjective norm	.638	.042	0.589***	
PBC	.022	.059	0.013	
Step 3				72.647***
Mother's weight	-.187	.162	-0.037	
Mother's education	.050	.126	0.014	
Mother's age	.021	.011	0.063	
Current feeding	-.230	.122	-0.063	
Infant birth weight	.147	.133	0.036	
Attitude	.425	.062	0.272***	
Subjective norm	.564	.054	0.521***	
PBC	.021	.058	0.012	
Group norm	.106	.048	0.102*	

Note. $R^2 = .038$ for step 1; $R^2 = .648$ for step 2; $R^2 = .653$ for step 3.

* $p < .05$. *** $p < .001$.

Table 3. Hierarchical regression predicting first-time mothers' actual behaviour of introducing solids at 6 months ($N=236$)

	B	SE	β	F
Step 1				8.146***
Mother's weight	-.512	.147	-0.216**	
Mother's education	.054	.108	0.033	
Mother's age	.032	.009	0.214**	
Current feeding	-.273	.108	-0.162*	
Infant birth weight	-.069	.119	-0.036	
Step 2				15.262***
Mother's weight	-.482	.132	-0.203***	
Mother's education	.042	.098	0.026	
Mother's age	.024	.009	0.159**	
Current feeding	-.176	.098	-0.105	
Infant birth weight	-.047	.107	-0.024	
Intention	.196	.027	0.429***	
PBC	-.033	0.46	-0.040	
Step 3				11.210***
Mother's weight	-.484	.132	-0.204***	
Mother's education	.017	.098	0.010	
Mother's age	.023	.009	0.152**	
Current feeding	-.184	.098	-0.109	
Infant birth weight	-.034	.108	-0.018	
Intention	.257	.045	0.563***	
PBC	-.017	0.46	-0.021	
Attitude	-.106	.054	-0.147	
Subjective norm	-.027	.048	-0.057	
Group norm	.003	0.38	0.006	

Note. $R^2 = .150$ for step 1; $R^2 = .319$ for step 2; $R^2 = .333$ for step 3.

* $p < .05$. ** $p < .01$. *** $p < .001$.