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University of Glasgow

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Chapter 1: Systematic Review

The Impact of Breast Feeding on Cognitive Development

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Abstract

Aim The aim was to conduct a systematic review to evaluate whether there is a difference in cognitive development, as assessed by tests of cognitive function, between breast and formula fed infants.

Methods Three databases were searched from 2001 to 2014. Eligible studies were evaluated using a purpose-designed rating tool which assessed study design, sample size, target population, quality of feeding data, control for confounding variables, blinding, outcome measures, and analysis and results.

Results Fifteen relevant studies were identified with the majority (75%) concluding that breastfeeding does not enhance cognitive development once confounding variables are controlled for.

Conclusions The majority of studies concluded that breastfeeding does not promote intelligence. Further studies are needed to evaluate the impact of breastfeeding on vulnerable infants whilst controlling for pertinent confounders.

Key words Breastfeeding, formula feeding, cognitive development.

1. Introduction

The World Health Organisation (WHO; 2001)[1] and United Nations Children's Fund (UNICEF; 1989)[2] recommend exclusive breastfeeding for the first six months of an infant's life, with continuation for up to two years or longer. This is due to the convincing evidence of health benefits; review articles have associated breastfeeding with reduced risk of a number of neonatal infections including gastrointestinal, diarrhoeal and types of extra-intestinal.[3]. Health benefits occur during and after the termination of breastfeeding with enhanced protection against otitis media[4], respiratory infections[5] and Haemophilius influenza type b (Hib)[6] for the next three, seven and 10 years respectively.

A series of systematic reviews were undertaken by the WHO,[7] in which observational and randomised studies were appraised to ascertain other health benefits of breastfeeding. It was found that breastfed subjects had lower blood pressure, lower cholesterol levels, were less likely to be considered overweight and/or obese and were less likely to present with type-2 diabetes. While these were assessed through the life-span, the majority of measurements were taken when subjects were aged between one and nine years of age. These benefits were evident after controlling for confounding factors such as sex, age and parental factors.

The claim of other developmental benefits, including enhanced cognitive development, is less well established, despite the link between breastfeeding and higher IQ scores being suggested in the first part of the twentieth century[8]. Conflicting results have been presented in past research, with a meta-analysis of 20 studies concluding that breastfeeding

was associated with significantly higher scores of cognition compared with formula-fed counterparts[9]. Human milk has a rich supply of the essential fatty acids (EFA) that support growth and development. It is hypothesised that it is the increase in EFA that leads to cognitive benefits[10].

Demographic differences have been found between women who breastfeed and those who do not. Infants are more likely to be breastfed if they are born to white, older, wealthier, better educated women who have worked at least part-time during pregnancy[11,12]. Conversely, being young, working class and poor are factors associated with women who formula-feed from birth[13]. These confounding variables could be impacting on differences in research. Indeed, a critical review of 40 studies argued that the cognitive benefits of breastfeeding have been overstated. They attributed this to confounding variables such as socio-economic status (SES) and stimulation of the child often not being accounted for[14]. Only 7 of the 40 studies included in the review controlled for these critical factors, which are related both to feeding method and determinants of intelligence[15]. It is of note that all the studies in the meta-analysis[9] were included in the critical review[14], with the latter concluding that convincing evidence does not exist for the cognitive advantage of breastfeeding, in high quality studies.

The benefits of breastfeeding play a pivotal role in the development of social policy aimed at increasing the initiation and continuation of breastfeeding. The health benefits of breastfeeding are not denied, however, cognitive enhancements of breastfeeding are reported less consistently in the literature. Two reviews have found for and against the

hypothesis that breastfeeding can result in improved cognitive development. Although both reviews did account for confounding variables, it is argued that not all relevant covariates were controlled for. A further review is warranted to evaluate recent studies whilst considering the most pertinent confounders.

1.1. Research Aims

Numerous studies have been undertaken comparing the cognitive development of children depending on how they were fed as infants. This is a complex issue to disentangle due to confounding variables being associated with both feeding method and cognition. The aim of this systematic review was to evaluate studies published after Jain and colleagues review,[14] to quantify whether there is a difference in cognitive development, as assessed by tests of cognitive function, between breast and formula-fed infants.

Research Questions:

1. *Do breastfed infants show cognitive enhancement compared to formula-fed counterparts, as evidenced by higher scores on tests of cognitive function?*
2. *Does a longer duration of breastfeeding result in higher scores on tests of cognitive function?*

1.2. Method

Search Strategy

An electronic search of the following databases was conducted: OVID - Medline; EBSCOhost - PsycARTICLES and PsycINFO. The search range was limited from January 2001 to July 2014. The following search terms were used:

- Breastfeeding AND intelligence; IQ; Infant Cognition; Cognition & Infant Development.
- *Infant feeding AND intelligence; IQ; Infant Cognition; Cognition & Infant Development.*

The following inclusion and exclusion criteria were applied to identified papers:

Inclusion

- Comparison between breastfeeding and formula-feeding
- Primary outcome measure is a widely applied and validated test of cognitive development
- Cognitive development tested at age 2 years or older
- Prospective/longitudinal study design
- Published in a peer reviewed journal
- Written in English

Exclusion

- Reviews and discussions papers
- Retrospective studies

Screening and Data Extraction

Following removal of duplicates the electronic search identified 128 studies. A two-step process was used to evaluate the studies identified: 1) titles and available abstracts were reviewed and 2) full-texts were reviewed. Eighty-five articles were excluded following the initial screening process. Of the 43 articles in which the full-text was reviewed, a further 28 were excluded due to not meeting the eligibility criteria. This resulted in 15 studies which fitted inclusion criteria for the current review (Figure 1). The references of the 15 included papers were then searched for additional studies, which did not yield anything further. An independent reviewer assessed the search strategy, by reviewing 25% of papers in steps one

and two respectively (32 titles and abstracts were screened, and 10 full text articles were reviewed). Any disagreements about eligibility were resolved through discussion.

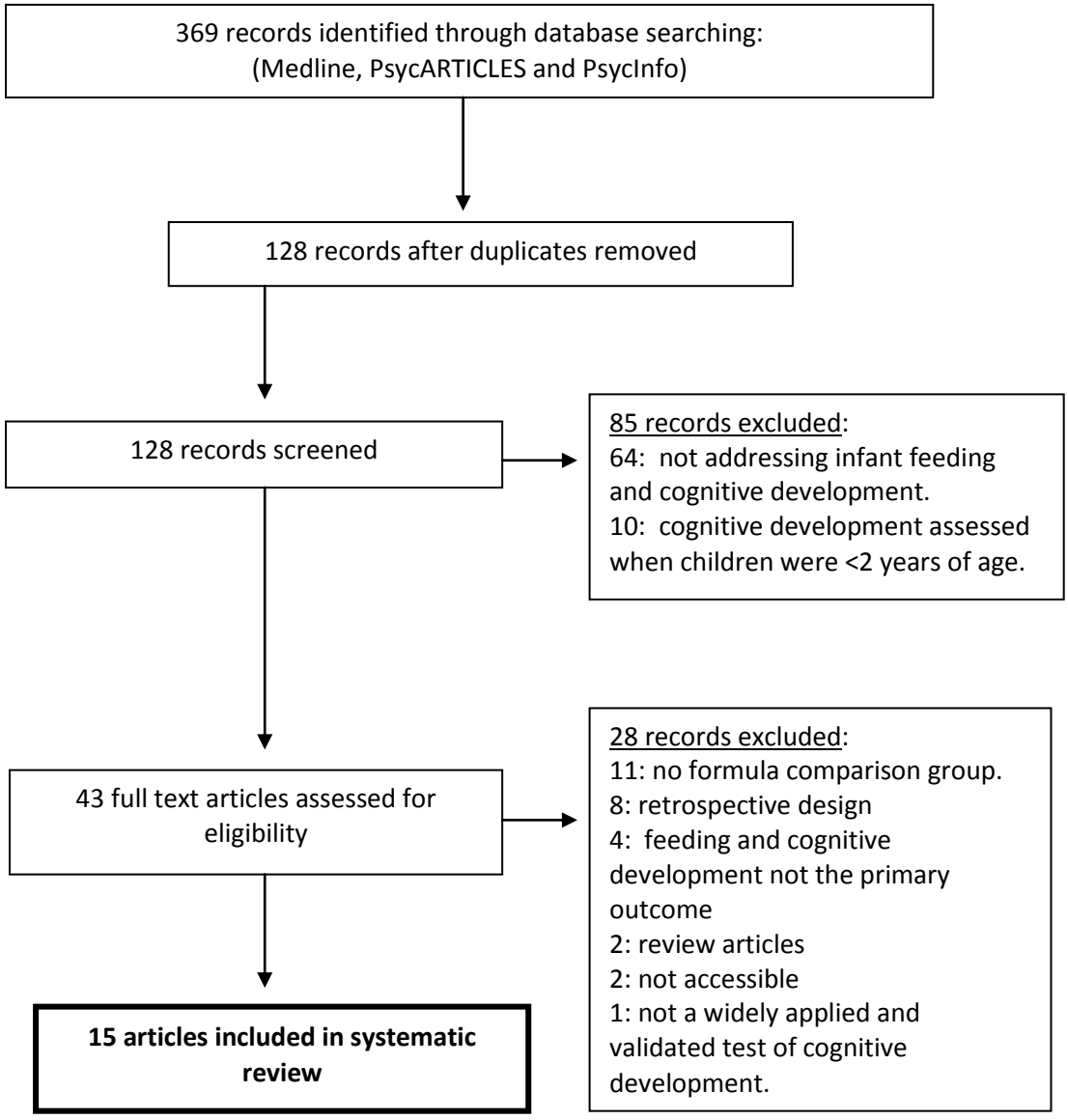

FIGURE 1: FLOW DIAGRAM INDICATING ELECTRONIC SEARCH PROCESS

1.3. Quality Assessment Protocol

The quality of included studies was assessed using a purpose-designed rating protocol. The protocol was adapted from existing guidelines, such as the revised version of the Scottish Intercollegiate Network 'SIGN 50: A guideline developer's handbook'[17] but were

predominately based on the criteria set out by Jain and colleagues[14] in their critical review. The 23 questions in the Quality Rating Tool (Appendix 1.2) can be grouped into 8 different topic areas which address the overall methods of the study and other important methodological considerations, namely, study design, sample size, target population, quality of feeding data, control for confounding variables, blinding, outcome measures, analysis and results:

1. *Study Design*

In line with the inclusion criteria, all studies were prospective and/or longitudinal. Infants in these studies were recruited around the time of birth or when predominant milk feeding was occurring, with the infants being followed forward to when cognitive outcomes were assessed. It was considered that this type of study would allow for an accurate depiction of baseline information and for a better assessment of possible confounding variables. It has been noted that even when studies use a prospective design, they often fail to gather all data prospectively, including infant feeding and relevant covariates[18]. These methodological issues will be evaluated by the quality rating tool.

2. *Sample Size*

It is important that studies were adequately powered to find a clinically meaningful difference between feeding groups. Therefore, studies were assessed to see if justification for their sample size was given.

3. *Target Population*

Knowing the target population is important to ascertain to what degree results can be generalised. Preterm infants have increased nutritional requirements and distinct developmental outcomes compared with term infants[10]; therefore it is unclear to what extent the results from preterm infants can be applied to term infants and vice versa.

4. *Quality of Feeding Data*

An ideal study would provide information on four components of feeding:

a. **Definition of breastfeeding**: whether breastfeeding was exclusive or partial.

b. **Timing of data collection**: feeding data should be obtained whilst feeding was occurring, instead of after, to avoid errors of recall. Additionally, feeding data should not be solely obtained within the first few weeks after birth, when women are likely to change feeding method[19].

c. **Source of feeding data**: obtained from the mother or from health records, rather than from another relative or breastfeeding consultant.

d. **Duration of breastfeeding**: How long breastfeeding occurred, to determine if a longer duration results in higher scores on tests of cognitive function.

5. *Control for Confounding Variables*

The links between breastfeeding and enhanced cognitive ability are influenced by confounding variables; there are fundamental differences between mothers who breastfeed compared to those who do not[11,12,13]. If studies do not control for confounding variables

this may inflate the extent to which breastfeeding impacts on cognition. Anderson et al.'s[9] meta-analysis identified 15 key cofactors that were desirable to control for: breastfeeding duration, infant gender, maternal smoking history, maternal age, maternal intelligence, maternal education, maternal training, paternal education, race or ethnicity, socioeconomic status, family size, birth order, birth weight, gestational age, and childhood experiences. A study that controlled for at least five cofactors was considered covariate-adjusted[9].

Some variables have been singled out as particularly important, including socioeconomic status[20], quality and quantity of stimulation of the child[14] and maternal intelligence[21]. Studies were evaluated to see if they controlled for these three critical factors.

6. Blinding

To prevent rater bias, those administering the cognitive assessments should be blind to feeding status.

7. Outcome Measures

For cognitive measures to be considered appropriate they need to be a standardised individual measure of general intelligence. The cognitive assessment should have been administered when the child was at least two years of age, as differences may not be evident in early infancy, but emerge later. For instance, when the cognitive development of formula and breastfed infants was assessed there were no differences between the groups at age one, whereas breastfed infants' scored significantly higher at the age of two[22].

8. Analysis & Results

Studies should be clear how data were analysed and clearly present the results.

Evaluation of Studies

Responses for 22 items were rated 0 (no) or 1 (yes). One further item was scored 0, 1 or 2; guidance was provided on the protocol for scoring items. The protocol had a possible score of 24 and was then converted into a percentage score for ease of comparison. Using an arbitrary rating system, studies were classified as high quality if they scored ≥70%, moderate if they scored 40-69% and low if they scored ≤39%.

Each study was evaluated individually by the author and an independent reviewer, and then evaluated again together. If there was a disagreement between either reviewers evaluation, the particular article was discussed until agreement was reached. Quality ratings for the 15 studies ranged from 50% to 83%. Twelve studies were rated as high quality and three were rated as moderate (Table 1, Appendix 1.3).

1.4. Results

Included studies in the systematic review will now be reviewed according to each area evaluated by the quality rating protocol.

Study Design

Of the 15 included studies 11 (73%) were prospective birth cohorts[18,21,23,25-27,29,31,32,34,35], three (20%) were longitudinal[24,28,30] and one (7%) was a randomised control trial (RCT)[33] (Table 2). The longitudinal designs collected data not from birth but within the infancy and toddler stage, with enrolment taking place when the babies were aged between nine and 15

months old. It is generally considered unethical to assign infants to feeding groups, which leads to research in this area being observational in nature. In the RCT, infants were randomised to two kinds of supplemented infant formula after mothers' had already elected to formula-feed and were compared to a "gold standard" breastfeeding group[27].

Target Sample

Six (40%) studies recruited full-term infants [21,23,25,26,28,33]. One study included two groups of term infants; a group of infants medically considered to be small for gestational age (SGA; birth-weight ≤10th percentile for sex and gestation using New Zealand norms) and a group that were appropriate for gestation age (AGA; birth-weights >10th percentile for sex and gestation)[26]. Six (40%) studies had samples of mixed full-term and pre-term infants[18,24,27,29-31], although one paper excluded the pre-term sample in the analysis due to small numbers[18]. One (7%) paper considered pre-term infants only[35] and two (13%) failed to state the gestational age of the infants[32,34].

Table 2 - Studies linking breastfeeding and intelligence: Sample Size, Quality of Feeding Data; Covariate Adjusted and Control for 3 Critical Factors that Reduce Susceptibility Bias.

First Author Year Location	Design	Sample size	Sample Studied	Collection of Feeding Data	Source of Feeding Data	Breast-Feeding Definition	Dose Response Considered	Number of Covariates	SES*	Stimulation of Child Assessed	Maternal IQ Assessed
High Quality Studies											
Gale, 2010[23] UK	Prospective Birth Cohort	1973 Follow-up: 241	Term	6 months	Mother	Not stated	No	8	Yes	Yes	Yes
Quigley, 2012[24] UK	Longitudinal	11 879	Mixed (Term 11 101) (Pre-term)	9 months – 3 years	Parents	Mixed	Yes	7	Yes	No	No
Quinn, 2001[25] Australia	Prospective Birth Cohort	3880	Term	6 months	Mother	Mixed	Yes	8	Yes	Yes	No
Slykerman, 2005[26] New Zealand	Prospective birth cohort	531: 223 SGA‡ 308APA‡	Term	3.5 years	Mother	Mixed	Yes	7	Yes	No	No
Zhou, 2007[27] Australia	Prospective birth cohort	302	Mixed	6 weeks-6 months	Mother	Mixed	Yes	7	No	Yes	No
Gomez-Sanchiz, 2004[28] Spain	Longitudinal	238	Term	Not stated	Medical Records	Mixed	Yes	11	Yes	No	Yes
Silva, 2006[29] UK	Prospective Birth Cohort	11,004	Mixed	5 years	Mother	Mixed	Yes	7	Yes	No	No
Jiang, 2011[30] USA	Longitudinal	3271	Mixed	0-13 years	Primary Care-giver	Not stated	Yes	9	Yes	Yes	Yes
Steer, 2010[31] UK	Prospective birth cohort	5934	Mixed	1 month	Mother	Mixed	No	5	Yes	Yes	No

First Author Year Location	Design	Sample size	Sample Studied	Collection of Feeding Data	Source of Feeding Data	Breast-Feeding Definition	Dose Response Considered	Number of Covariates	SES*	Stimulation of Child Assessed	Maternal IQ Assessed
Der, 2006[21] USA	Prospective Birth cohort	5475	Term	Within a year	Mother	Mixed	Yes	12	Yes	Yes	Yes
Gibson-Davis, 2006[32] USA	Prospective Birth Cohort	1645	Not stated	1 year	Mother	Not stated	Yes	9	Yes	Yes	Yes
Oddy, 2003[18] Australia	Prospective Birth Cohort	2393	Mixed (Term only for analysis)	12 months for 80%. 2-3 years after this.	Parents	Exclusive	Yes	10	Yes	No	No
Moderate Quality Studies											
Birch, 2007[33] USA	Randomised Control Trial	84	Term	Not stated	Not stated	Not stated	No	0	Yes	No	No
Boutwell, 2012[34] USA	Prospective Birth cohort	3700	Not stated	9 months	Mother	Not stated	Yes	5	No	No	No
Tanaka, 2009[35] Japan	Prospective birth cohort	18	Pre-term	Not stated	Health records	Mixed	No	0	No	No	No

Abbreviations: *SES: Socioeconomic Status; ǂSGA: Small for gestational age; ŧAGA: Appropriate for gestational age

Sample Size

The total sample size for each study is reported in Table 2. Sample sizes reported are based on numbers of participants who completed the cognitive assessments. The sample sizes ranged from 18 to > 11,000, with a median of 2393.

Feeding data

The quality of feeding data varied in the studies. Only two (13%) meet all 4 criteria regarding the quality of feeding data[25,27]. For example, Quinn et al. (2001) collected data when it was occurring, defined the type of breastfeeding, gathered the information from the mother, which included duration, to determine if this was associated with higher scores on tests of cognitive functioning.

1. *Definition of breastfeeding*

Breastfeeding definition was provided in 10 (67%) studies; for the majority (N=9) of the studies this definition was consistent with exclusive and partial breastfeeding grouped together[21,24-29,31,35] while only one study evaluated exclusive breastfeeding[18]. Five (33%) papers failed to provide a definition of breastfeeding[23,30,32-34].

2. *Time when feeding data were collected*

Only four (27%) studies collected feeding data when it was occurring (defined as when infants were aged ≤ 6 months) [23,25,27,31], three (20%) were slightly outwith this limit but did gather the information within the first year of the infants life[21,32,34]. Five (33%) studies collected feeding data retrospectively[18,24,26,29,30], with feeding information being gathered as long as 13 years after birth in one study[30]. Employing retrospective data collection may

result in erroneous information being provided. Three (20%) studies did not indicate when the feeding data were collected[28,33,35] making it difficult to determine if the time-frame would impact on the accuracy of the data provided.

3. Source of feeding data

Only one (7%) study did not provide details for the source of feeding data[33]. The most common source for feeding data came from the mother, with this method being used in nine (60%) of the studies[23,25-27,29,31,32,34]. Two (13%) studies gathered information from the parents[18,24]; one (7%) from the primary caregiver (but did not state who this was) [30], whilst two (13%) studies used information from medical records to determine the feeding method[28,35].

4. *Dose Response*

The majority (N=11) of studies (73%) provided duration of breastfeeding[18,21,24,25-30,32,34]. Three did not provide an overall cognitive score, therefore were not considered when evaluating if longer duration of breastfeeding increased cognition[18,24,30]. From Table 3 it can be seen that six of the eight studies demonstrated a positive association between length of breastfeeding and cognitive development, in that the longer an infant was breastfed the higher their scores were on assessments of cognition[21,25,26,28,32,34].

Table 3 - Duration of Breastfeeding and Impact on Cognitive Scores

First Author, Year and Location	Categorisation of Breastfeeding Duration	Cognitive Test	Increase in IQ	Sample in Analysis	Significance Level
Quinn[25] 2001 UK	< 3 weeks 3-7 weeks 7 weeks – 4 months 4 – 6 months >6 months	Peabody Picture Vocabulary Test Revised	Females: 8.2 point increase if fed for ≥ 6 months Males: 5.8 point increase if fed for ≥ 6 months	Breast and non-breast fed	P=0.00*
Slykerman[26] 2005 New Zealand	<6 months 6-12 months >12 months	Stanford Binet Intelligence Scale	6 points increase if fed for > 12 months	Breast and non-breast fed	P=0.05*
Zhou[27] 2007 Australia	<6 months ≥6 months	Stanford Binet Intelligence Scale	0.2 point increase if fed for 6 months	Breast and non-breast fed	95% CI 0.8 - 1.2
Gomez-Sanchiz[28] 2004 Spain	< 4 months >4 months	Bayley Infant Development Scale	4.3 point increase if fed for > 4 months	Breast-fed only	95% confidence interval 0.2 - 8.6*
Silva[29] 2006 UK	<1 month 1-3 months ≥3 months	British Ability Scales	0.02 SD increase for 1 SD increase in duration of breast feeding	Not stated	Not stated
Der[21] 2006 USA	1-5 weeks; 6-12 weeks; 13-28 weeks; ≥ 29 weeks	The Peabody individual achievement test.	1.5 point increase if fed ≥ 29 weeks	Breast fed only	P =0.011*

First Author,Year and Location	Categorisation of Breastfeeding Duration	Cognitive Test	Increase in IQ	Sample in Analysis	Significance Level
Gibson-Davis[32] 2006 USA	1 month; 2-5 months; ≥6 months	Peabody Picture Vocabulary Test-Third Edition	0.27 point increase if fed for ≥ 6 months but in the sub-sample of children whose mothers had post-secondary education	Breast and non-breast fed	P < 0.01*
Boutwell[34] 2012 USA	<6 months or ≥ 6 months < 9 months or ≥ 9 months	Bayley Short Form–Research Edition	2 point increase if fed for ≥ 6 months	Breast fed only	Not stated*

Abbreviations: SGA – Small for Gestational Age; * statistically significant p value found by research authors.

Susceptibility Bias

To be considered covariate adjusted, studies needed to control for a minimum of 5 variables; this was done by the majority of studies (n=13, 87%)[21-32,34]. Two (13%) studies did not control for any confounding variables (both studies had small sample sizes of 84 and 18 respectively)[33,35]. The most commonly controlled for variables included gender, gestational age, maternal education and socioeconomic status.

Of the three critical confounding variables, four (27%) studies controlled adequately for all[21,23,30,32]. Socioeconomic status was controlled for the most (n=8, 53%)[18,24-26,28,29,31,33], six (40%) controlled for stimulation of the child[23,25,27,30-32], and five (33%) controlled for maternal intelligence[21,23,28,30,32].

Blinding

Only four (27%) of the 15 studies stated that assessors administering the cognitive assessments were blind to feeding status (Tables 4 & 5) [26-28,33]. There may have been a higher incidence as 11 (73%) studies did not state if assessors were blind to feeding status[18,21,23,25,28-32,34,35].

Outcome Measures

Ten (67%) of the 15 studies used an appropriate measure of cognition, that is, a widely applied and validated test of cognitive development, which was undertaken when the child was two years of age or older[23,24,26-29,31,33-35]. Of the studies that did not meet the criteria for an appropriate measure of cognition, two (13%) used measures that are considered as assessments of achievement rather than general intelligence[21,30]. These tests tend to be

closely related to scholastic ability rather than intelligence[36]. The other three (20%) studies assessed cognitive development using a picture vocabulary test[18,25,32], which is also considered a poor assessment of general intelligence[37.]

Analysis

As shown in Tables 4 & 5, the most common statistical analysis undertaken was regression analysis, with nine (60%) of the 15 studies analysing data in this manner[18,23-28,31,32]. Other methods used include propensity score matching[30,34], ANOVA[33], random effects[21], structural equation modelling[29], and Mann-Whitney[35], with this analysis being used for the study with the smallest sample (N=18).

Results

Three papers did not provide a full-scale IQ[18,24,30], therefore were excluded from evaluating breastfeeding and cognitive enhancement. Among the 12 studies evaluated for the impact of breastfeeding and cognition, nine (75%) reported no causal link between breastfeeding and cognitive ability (Table 4) [21,23,26-29,32,33,35]. The majority of these papers found the effect for breastfeeding and enhanced cognition statistically significant in unadjusted analysis, which became non-significant when controlling for covariates such as maternal intelligence, education and demographic characteristics[21,23,27,28,29,32] (adjusted analysis were not undertaken by two of the studies[33,35]). When one paper considered the sub-samples in their study, they found no statistically significant results for the whole sample, but found a link in infants who were SGA[26].

Table 4 - Blinding, Outcome Measures, Age at Assessment, Analysis, and Results for Full-Scale IQs.

First Author, Year, Location	Blinding	Appropriate Cognitive Development Test	Primary Outcome Measure	Age at Cognitive Assessment (years)	Analysis	Cognitive Scores for Breastfed compared to Formula-Fed Infants	P Value
Gale, 2010[23] UK	Not Stated	Yes	Wechsler Preschool and Primary Scale of Intelligence	4	Linear Regression	5.29 points higher	Not stated
Quinn, 2001[25] Australia	Not stated	No	Peabody Picture Vocabulary Test-Revised	5	Multiple Linear Regression	Females: 1.51 points higher Males: 1.2 points higher	Not stated
Slykerman, 2005[26] New Zealand	Yes	Yes	Stanford-Binet Intelligence Scale (4th edition)	3.5-4	Regression analysis	Total sample: 4.9 points higher SGA^{+} sample: 6 points higher	P = 0.50 P = 0.05*
Zhou, 2007[27] Australia	Yes	Yes	Stanford-Binet Intelligence Scale (4th edition)	4	Multivariable regression analysis	0.2 points higher	P = 0.656
Gomez-Sanchiz, 2004[28] Spain	Yes	Yes	Bayley Scales of Infant Development	2	Multiple Linear Regression	3.8 points higher	Not stated
Silva, 2006[29] UK	Not stated	Yes	British Ability Scale	10	Structural Equation Modeling	0.02 points higher	Not stated
Steer, 2010[31] UK	Not stated	Yes	Wechsler Intelligence Scale for Children (Short form)	8	Linear Regression	3 points higher	P < .0001*
Der, 2006[21] USA	Not stated	No	Peabody Individual Achievement Test	5-14	Random Effects Models	0.52 points higher	P = 0.149
Gibson-Davis, 2006[32] USA	Not stated	No	Peabody Picture Vocabulary Test-Third Edition	3	Hierarchical Multivariate Regression	1.72 points higher	P = 0.060

First Author, Year, Location	Blinding	Appropriate Cognitive Development Test	Primary Outcome Measure	Age at Cognitive Assessment (years)	Analysis	Cognitive Scores for Breastfed compared to Formula-Fed Infants	P Value
Birch, 2007[33] USA#	Yes	Yes	Wechsler Preschool and Primary Scale of Intelligence	4	ANOVA	5-7 points higher	Not stated
Boutwell, 2012[34] USA	Not stated	Yes	Bayley Short Form–Research Edition	2	Propensity Score Matching	1.92 points higher	P ≤0.05*
Tanaka, 2009[35] Japan#	Not stated	Yes	Kaufman Assessment Battery for Children	5	Mann-Whitney	6.4 points higher	Not stated

+ SGA: Small for Gestational Age; #:Analysis not covariate adjusted; * statistically significant p value found by research authors.

Table 5 - Blinding, Outcome Measures, Age at Assessment, Analysis, and Results for Domains/subtests of Cognitive Assessments.

First Author Year Location	Blinding	Appropriate Test	Primary Outcome Measure	Age at Cognitive Assessment	Analysis	Cognitive Scores for Breastfeeding	P Value	Findings
Jiang, 2011[30] USA	Not stated	No	Woodcock Johnson-Revised (4 subtests) Wechsler Intelligence Scale for Children – Revised (1 subtest)	3-6	Propensity Score Matching	3.43 points higher on letter word subtest 3.43 points higher on applied problem subtest 3.58 points higher on broad reading subtest	P < .001 P < .001 P < .01	Statistical significance for 3 out of 5 subtests
Oddy, 2003[18] Australia	Not stated	No	Peabody Picture Vocabulary Test-Revised Wechsler Intelligence Scale for Children – 3rd Edition (1 subtest)	6 & 8	Multiple Linear Regression	Verbal IQ: 3.56 points higher Performance IQ: 0.39 points higher	P = .003 P = 0.223	Statistical significance for verbal IQ only

First Author Year Location	Blinding	Appropriate Test	Primary Outcome Measure	Age at Cognitive Assessment	Analysis	Cognitive Scores for Breastfeeding	P Value	Findings
Quigley, 2012[24] UK	Not stated	Yes	British Ability Scale	5	Linear Regression	<u>Term</u> 2 points higher in naming vocabulary 2 points higher in picture similarities <u>Preterm</u> 4 points higher in naming vocabulary 4 points higher in picture similarities 6 points higher in pattern construction	Not stated	<u>Term</u> Statistical significance in 2 out of 3 subtests <u>Preterm</u> Statistical significance in 3 out of 3 subtests

1.5. Discussion

Does breastfeeding result in cognitive enhancement?

Nine of the 12 studies which included a full-scale IQ, reported breastfeeding does not enhance cognitive development. This is in keeping with a previous review,[14] which evaluated 40 (different) studies linking breastfeeding and intelligence, whilst controlling for two critical factors (SES and stimulation of the child), related to both feeding method and intelligence. The authors concluded that there was no convincing evidence for the effects of breastfeeding on intelligence, when drawing from higher quality studies.

This current review tried to strengthen the previous[14] by accounting for maternal intelligence, as more recently, this has been found to be of particular importance[21]. Once maternal intelligence is controlled for, it appears to greatly reduce the effect of breastfeeding on cognitive scores compared to other confounders[23,32]. A reviewed article[32] found that even after adjusting for demographic characteristics, health behaviours and stimulation of the child, those breastfed scored significantly higher than non-breast fed on tests of cognition; differences in the feeding groups only became non-significant once adjusted for maternal intelligence. Another reviewed paper[21] made this point as well; to show the importance of controlling for maternal intelligence, the analysis was re-run without adjusting for maternal intelligence, which doubled the effect of breastfeeding on cognitive scores, making the results statistically significant.

Three[25,31,34] papers that were reviewed did conclude that breastfeeding resulted in cognitive enhancement, as evidenced by higher scores on cognitive tests. Two[25, 31] of these studies did adjust for SES and stimulation of the child, and the other[34] adjusted for 12 other covariates, yet they all failed to control for maternal intelligence. This indicates that these

studies may have reported a type I error, by not controlling for a variable that has a large effect on the outcome measure. Controlling for susceptibility bias needs to be adhered to more stringently in studies; the advice given by Gibson-Davis and colleagues, that measures of maternal ability must be included, needs to be implemented in future research to avoid spurious correlations being found[32].

It was found that a number of studies included a mix of pre and full term infants in their study. This can be problematic when generalising the results and when trying to make conclusions on how beneficial breast milk is for cognitive development, as sub-samples appear to respond differently. For example, a study that was rated highly in this review[26], found that there was no benefit on cognition for the breastfed group when analysing theirwhole sample, however, the SGA sample whom were breastfed, did have a statistically significant advantage on cognitive scores. SGA babies have a greater incidence of perinatal complications than normal birth weight babies[38], which may detrimentally affect their subsequent development[39]. This is also the case for premature infants, who are at greater risk of developmental problems[40].

From this review, it appears that these vulnerable sub-samples benefit most from breast milk. Scores for full-scale IQ[31] and specific domains[30] of cognitive assessment have produced significant results for breast milk with mixed samples (pre and full term infants), as well as analysis that were separated for the pre-terms only[24]. A paper in this review, which although did not find a statistical advantage on overall intelligence in very low birth weight (VLBW) infants, did find statistical significance on specific domains of cognition and tests of executive functioning[35], for infants receiving breast compared to formula milk. Two [27,29] other studies did contain mixed samples but found no statistical significance for breast

milk; however, they did not conduct analysis separately for the sub-sample of pre-term infants. The sample size of preterm infants in these studies, tends to be a lot smaller than term groups (in keeping with the general population); if grouped together, results for this small and vulnerable sub-sample (who may actually benefit more from breast milk compared to term infants) may be prone to type II errors. Additionally, some authors failed to report the gestational age of infants making it difficult to ascertain how generalisable the results were.

A further issue is the definition of breastfeeding; of the 15 studies, five did not give a definition, which limits the extent to which results can be generalised. Within the UK, at 6 weeks after birth, it is of note that 23% of mothers exclusively breastfeed, 55% mix feed and 22% formula feed[41]. Only one[18] paper examined exclusive breastfeeding (EBF), whilst the others grouped any type of breastfeeding together. In the study with EBF, an overall score for cognitive ability was not reported, but scores on specific cognitive domains were provided. A statistical advantage on verbal IQ for those breastfed exclusively for more than six months was found[18]. This is in keeping with a study outwith this review, which evaluated exclusive and partial breastfeeding and demonstrated that those EBF for at least three months had significantly higher full-scale IQ[42]. This suggests that EBF may be more beneficial than mixed feeding; indeed, of the nine mixed feeding studies examined in this review only two demonstrated a cognitive advantage.

As previously stated breast milk has a rich supply of essential fatty acids (EFA), which are hypothesised to lead to cognitive benefits[10]. It would make sense then, that infants who are EBF, would have a higher consumption of EFA compared to those only receiving part breast milk, and in turn would then have higher scores on tests of cognitive development.

Research addressing the impact of breast milk on other areas of development has also found a difference between exclusive and partial feeders. When the immunological benefits of breastfeeding were considered, it was found that at four months of age, infants who were EBF had significantly larger thymus glands, than those who were partially breast or formula fed only. The implication is that a larger thymus may provide a better environment for T cell differentiation and maturation, which is essential for the development of the immune system[43].

Is there a dose/duration response for breastfeeding and cognitive enhancement?

Six of the eight studies which included duration of breastfeeding information and a full-scale IQ, reported longer duration resulted in higher scores on cognitive outcome measures. For these positive associations to be seen, the length of breastfeeding ranged from four to 12 months, with most studies reporting that breastfeeding for at least six months or more resulted in greater cognitive enhancement. Limitations of the studies design may have impacted upon the accuracy of measuring the duration of breastfeeding. While a prospective birth cohort was adopted by the majority of these studies, they often failed to gather all data in a prospective manner. A study that, although used a prospective birth cohort, reported no benefit of longer duration of breastfeeding, but failed to collect all information prospectively[29]. Duration of feeding data were collected retrospectively at five years after birth, which may have led to erroneous recall, thus reducing confidence in the findings.

Suggestions for Future Research

A large number of studies have already been undertaken examining the association between breastfeeding and intelligence. In order to gain robust conclusions to inform policy, research needs to be methodologically stringent. Future research needs to: (i) employ a prospective design, collecting all data prospectively, (ii) separate distinct populations in analysis, e.g. term, pre-term, SGA; (iii) differentiate between different feeding practices, e.g. exclusive or partial feeding; (iv) gather information on duration of feeding, so that a dose response can be determined and (v) account for confounding variables, including SES, stimulation of the child and maternal intelligence.

Conclusions

Breastfeeding has confirmed physical health benefits for the infant[3]. In relation to other benefits of breastfeeding, the link with higher IQ scores emerged in the first part of the 20th century[8]. Currently intellectual gain for the infant is still promoted as a benefit of breastfeeding. This link was refuted by the majority of studies in this review (who included full-scale IQs), with no difference being found between infants' breast or formula fed on tests of cognition. Statistical significance was often found in unadjusted analysis, but once confounding factors (such as SES, stimulation of the child and maternal intelligence) were taken into consideration, most results became non-significant. Therefore, further research is needed which controls better for confounding variables, correct for other methodological weaknesses of past research, and addresses vulnerable sub-samples in more detail to confirm if they do benefit from breast milk.

This information for vulnerable sub-samples is needed; on an individual level there may only be a small effect for breastfeeding, but the population level most also be considered. It has been noted that even minor increases in the mean IQ of a population would remove some children from a learning disability range[44]. Reductions in the prevalence of developmental disabilities in a population would in turn reduce educational costs. These implications warrant further methodologically robust studies being conducted in this important research area.

* Studies included in the current review are identified by an asterisk.

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Chapter 2: Major Research Project

Infant Feeding Methods and Mothers Psychological Well-Being

Prepared in accordance with guidelines for submission to:

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(Appendix 2.1)

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Plain English Summary

Background: Postnatal depression (PND) is thought to affect 13% of new mothers (O'Hara & Swain, 1996). Feeding a young infant is a large role undertaken by a new mother. Differences in maternal emotional wellbeing have been reported depending on how the infant is fed. Generally studies have reported inconsistent findings as to whether breast, formula or weaned onto formula feeding is associated with emotional distress.

Aims: This study aimed to develop a better understanding of how different feeding methods impact upon the psychological health of mothers.

Methods: This study involved 58 mothers: 26 breastfeeding exclusively, 10 formula-feeding exclusively, and 22 formula-feeding after weaning from breast. Mothers completed six questionnaires when their babies were aged between eight weeks and six months, measuring psychological wellbeing and distress, demographic and birth characteristics.

Results: Mothers who had weaned onto formula after trying to breastfeed had higher psychological distress compared to mothers who exclusively formula-fed. Mothers who breastfed did not show any differences when compared with the other groups.

Conclusions: The results suggest that if a mother is not able to feed as intended this can have a negative impact on her mood. These women may need support, as they appear to be more psychologically vulnerable than women who are feeding as intended.

Reference

O'HARA M, & SWAIN A. (1996). Rates and risks of postpartum depression: a meta-analysis. International Reviews in Psychiatry, 8: 37–54.

Abstract

Objective: The present study aims to develop a better understanding of how different feeding methods impact upon the psychological health of mothers.

Background: Initiation of breastfeeding in Scotland is 74% (exclusive or partial) with prevalence of breastfeeding falling to 47% at 10 days and to 37% at six weeks. The chosen feeding method a mother uses for feeding her infant can impact upon her psychologically but studies have reported inconsistently as to whether breastfeeding or formula-feeding is associated with psychological distress. Methodological limitations, including classification of feeding method, the use of unsuitable measures and assessing psychological health at wide ranging time-points preclude any definite conclusions being made.

Methods: This cross-sectional study recruited 58 mothers with a biological child aged between eight weeks and six months. Twenty-six mothers were self-reported as breastfeeding exclusively, 10 formula-feeding exclusively and 22 formula-feeding following weaning from breast. Participants completed five self-reported psychological health and distress measures, with scores being compared between feeding groups.

Results & Conclusions: Mothers who weaned onto formula, after initially trying to breastfeed, experienced higher depression and negative affect compared to mothers who exclusively formula-fed. Mothers who were unable to feed as intended appeared to be more psychologically vulnerable. This has implications for clinicians and policy makers who need to be aware that support may be needed for this group.

Key Words: Breastfeeding; Formula-Feeding; Psychological Health; Depression; Anxiety.

2. Introduction

Initiation of breastfeeding

Quantitative and qualitative studies have found that the majority of women make feeding decisions either before falling pregnant or very early on in their pregnancy (Dix, 1991; Earle, 2000). More recently, 292 pregnant women from Eastern Scotland, completed a 13-item antenatal survey on feeding attitudes and intention. Four questions were summed to form an intention sub-scale. Results from these showed a bi-modal distribution creating three distinct categories: 'High intention to breastfeed', 'No intention to breastfeed', and 'Undecided'. This found that almost half were undecided on their feeding intention, 34% had high intentions to breastfeed and 21% had no intention to breastfeed (Symon, Whitford & Dalzell, 2013). Initiation and maintenance rates of breastfeeding vary greatly internationally, with the rate of exclusive breastfeeding among infants under 6 months of age ranging from 1% to 89% (World Health Organization, 2012). In 2011 the initiation incidence of breastfeeding in Scotland was 74% (exclusive or partial), with prevalence of breastfeeding falling to 47% at 10 days and to 37% at six weeks (ISD, 2011).

Differences have been observed in women who intend to breastfeed compared to those who formula-feed. Responses from questionnaires, of a geographically diverse UK sample of 30,760 births, found that the highest incidence of breastfeeding were among mothers aged 30 or over, those from minority ethnic groups, those who left education aged over 18, those in managerial and professional occupations, and those living in the least deprived areas (McAndrew, Thompson, Fellows, Large, Speed et al. 2012). Conversely, a cross-sectional UK study of 483 expectant mothers found that being young, already having a child and not being in a stable relationship were factors associated with formula-feeding (Stein,

Cooper, Day & Bond, 1987). In addition to this, there are also biomedical factors that may affect the infant's ability to suckle, such as congenital lip, mouth and oesophageal defects, and prematurity (Ford & Laccok, 1990). In these cases, even if women desired to breastfeed they may not be able to; however, these complications do not prevent the use of a breast pump to express milk.

Health psychology models, such as the Theory of Planned Behaviour (Ajzen, 1991) may help to explain why there is a significant decrease in the initial rates of breastfeeding; the model can also account for why differences are observed in who decides to breastfeed. The theory proposes that behavioural intention is a function of three main constructs, namely, attitudes, subjective norms, and perceived behavioural control. Giles and colleagues (Giles, Connor, McClenahan, Mallet, Stewart-Knox, et al. 2007) reported variables such as health factors (attitudes), other people's opinions, such as breastfeeding not being fashionable (normative beliefs), and the mother's health following the birth (control beliefs), all impacted on young people's attitudes towards breastfeeding.

Early termination of breastfeeding has been associated with depressive disorders, low social class, being young, and lower educational attainment (Cooper, Murray & Stein, 1993; Hauck, Fenwick, Dhaliwal, & Butt, 2011). Other physical, social and infant related factors linked to early termination include sore nipples, inadequate milk supply, perception of unsatisfied infant, latching difficulties (Ahluwalia, Morrow & Hsia, 2005; Hauck et al. 2011), and returning to work within three months of giving birth (Bick, MacArthur, & Lancashire, 1998). Qualitative research has demonstrated mixed findings on the subjective maternal experience of breastfeeding and weaning. Some mothers describe breastfeeding as a rewarding and pleasurable experience, while others find it distressing and unpleasant

(Schmeid & Barclay, 1999). In other qualitative research, when mothers weaned their babies from breast to formula, they expressed feelings of disappointment, guilt, failure, and that they were a 'bad mother' (Schmeid, Sheehan & Barclay, 2001).

Psychological Health

A systematic review of 28 prospective studies (sample sizes ranged from 54 to 4,964; median N=202) found as many as 19% of new mothers had major/minor depression in the first three months postpartum (estimates given were with wide confidence intervals therefore uncertainty of true levels still remains) (Gavin, Gaynes, Lohr, Meltzer-Brody, Gartlehner et al. 2005). In a meta-analysis (total sample n = 12,810), the average prevalence for postnatal depression (PND) was found to be 13% (O'Hara & Swain, 1996). Risk factors for PND appear to be the same as depression; systematic reviews identified a past history of psychopathology during pregnancy, lack of social support, poor partner relationship, recent life events and the 'baby blues' (a common temporary psychological state after childbirth when a new mother may have sudden mood swings, cry for no apparent reason, feel impatient, unusually irritable, restless, anxious, lonely and sad; which may last only a few hours or as long as 1 to 2 weeks after delivery) as having moderate to strong associations with PND (O'Hara et al., 1996; & Wilson, Reid, Midmer, Biringer, Carroll, et al. 1996).

It can be seen that the aetiology of PND is multifaceted; an often overlooked variable is maternal sleep deprivation. Studies investigating sleep suggest that infant sleep patterns and maternal fatigue are strongly associated with an onset of depressive symptoms in the postnatal period. It has been found that women who scored >12 (cut-off for major postpartum depression; Cox, Holden, & Sagovsky, 1987) on the Edinburgh Postnatal

Depression Scale (EPDS) were significantly more likely to report that their baby woke up three times or more between 10 PM and 6 AM and that they received less than six hours of sleep in a 24 hour period over the past week (Dennis & Ross, 2005).

Feeding Method

The psychological wellbeing of breast and formula-feeding mothers has been inconsistently reported in the literature. In a between-subjects study, breastfeeding mothers (n=28) reported less perceived stress than their formula-feeding counterparts (n=27) (Mezzacappa & Katkin, 2002). A within-subjects design assessed self-reported maternal mood of mothers who mixed fed (breast and formula) and found breastfeeding buffered against negative affect whilst formula-feeding diminished positive affect (Mezzacappa et al. 2002). Cross-sectional research has indicated higher levels of depression in breastfeeding mothers than those who have weaned their baby (e.g. Alder & Cox, 1983, Cooper, Murray, & Stein, 1993). This finding has been refuted by four case studies, who found that weaning was associated with increases in symptoms and occurrences of panic, anxiety, depression, and psychosis in mothers (Susman & Katz, 1988), which were severe enough to meet clinical diagnosis. Self-reported measures have also found women who have weaned from breastfeeding had worse mood, stress and greater numbers of psychological symptoms compared to women currently breastfeeding (Mezzacappa, Guethlein, Nelson-Vaz & Bagiella, 2000). However, self-reported screening tools of PND yield higher rates of possible cases than clinical interview methods (O'Hara et al., 1996).

Wilkinson and Scherl (2006) attempted to correct for methodological flaws of previous studies, by differentiating between current and past breast-feeders and using a smaller time

period to measure psychological health (4-6 months postnatally). They found no differences in psychological health and distress between breast (n=36) and formula-feeding (n=24) mothers. However, in Wilkinson and colleagues (2006) study breastfeeding mothers included those who breastfed exclusively or partially, therefore, as there was an overlap within the group, perhaps this contributed to no differences being found in relation to their psychological wellbeing.

The inconclusive findings are owing to methodological limitations of the studies undertaken. Many studies group exclusive and partial breast-feeders together (e.g. Mezzacappa et al., 2002), which may result in measurement bias, which could reduce statistical power. The psychological health of mothers has been measured at very different time periods after birth, ranging from four to 104 weeks (Alder & Cox, 1983; Alder & Bancroft, 1988; Romito, 1988; Mezzacappa, 2000; Mezzacappa et al. 2002; Virden, 1988; Wilkinson et al. 2006), where an infant will go through many developmental milestones, with the mother facing many different tasks of motherhood. Some studies have used unsuitable measures for postnatal mothers. For instance, the Beck Depression Inventory (Beck, Steer, & Brown, 1996) is a widely used instrument for measuring the severity of depression; however, normal postnatal changes such as sleep disturbance may be misinterpreted as depression and consequently inflate the actual amount of psychological distress in samples. In Scotland the detection of PND is undertaken in the course of a routine assessment interview or by using the EPDS (Scottish Executive, 1999). It is recommended that the EPDS is administered between approximately six weeks and three months postnatally, by health visitors or other health professionals (SIGN 127, 2012).

2.1. Aims and Hypothesis

The current study aimed to develop a better understanding of psychological health in relation to maternal feeding practices, including i) exclusive breastfeeding (EBF) , ii) exclusive formula-feeding (EFF), and iii) formula-feeding after weaning from breast. It was hypothesised that differences would be found between the three groups. Whilst past findings have been contradictory, using the Theory of Planned Behaviour (TPB; Ajzen, 1991), it was expected that mothers who weaned onto formula would experience more distress. The TPB emphasises the importance of social norms in determining behaviour. As there are strong social-cultural beliefs that 'breast is best,' women who are unable to feed their infant in this way may be more conscious of their failed intention.

2.2 Methods

Design

This cross-sectional study investigated psychological health between three groups of mothers using different feeding methods.

Ethical Approval

Ethical approval was granted from the West of Scotland Ethics Committee on the 17th July 2013 and was supported by the local NHS Research and Development Department (appendix 2.2).

Participants & Procedures

Participants were recruited through health visitor drop-in clinics (various locations within Glasgow city), poster advertisements (appendix 2.3) at mother and baby groups (Glasgow and Renfrewshire), online groups (e.g. Baby Centre Community) and through snowball

sampling. Participation was voluntary with no remuneration offered. Potential participants were provided with written information (appendix2.4) about the study and were required to give written consent (appendix 2.5) before participation could take place. As part of the consent process, participants had to provide their GP contact details, and agree to their GP being informed if mental health concerns were identified (scores of ≥10 on the EPDS). Participation involved completing questionnaires on psychological health and distress which were either returned directly to the researcher or via post.

Inclusion Criteria

- Mothers, aged 18 or over (the minimum age limit was set to make issues around consent straight forward).
- Mothers with a biological full-term infant (born between 37-42 weeks; as feeding difficulties are more common amongst premature infants).
- Mothers with an infant between the ages of eight weeks (this minimum age limit was set as a means of managing risk, as this would have given health visitors the opportunity to complete the EPDS already) to approximately six months (before weaning onto solid food had occurred).

Exclusion Criteria

- Mothers who breastfeed and supplemented with formula feeds.
- Premature infants or infants with congenital deficits (such as lip, mouth, or oesophageal abnormalities) as they may have been more prone to feeding difficulties.

- Infants who had been weaned onto solid food.
- Mothers who had a current diagnosis of depression or postnatal depression, as the study wished to examine the impact of feeding methods and psychological health within the general population.

Measures

Data was collected via a questionnaire booklet (appendix 2.6), which consisted of five self-report questionnaires measuring psychological health and distress. Psychological health and wellbeing was operationalised through measures of general life satisfactions, happiness, and positive affect, while psychological distress was operationalised via measures of anxiety, depression and negative affect. Participants also completed a questionnaire gathering demographic and perinatal information (appendix 2.7).

Psychological Health and Wellbeing

Global life satisfaction was measured with the five-item Satisfaction with Life Scale (SWLS) (Diener, Emmons, Larson & Griffin 1985); (e.g. 'In most ways my life is close to my ideal') on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). A total life satisfaction score is created by summing responses on items and can range from 5 to 35; with higher scores indicating more satisfaction. Satisfaction is categorised as very high (30-35), high (25-29), average (20-24), slightly below average (15-19), dissatisfied (10-14) and extremely dissatisfied (5-9). Diener et al. (1985) report good internal consistency (co-efficient $\alpha = 0.87$) and test-retest reliability ($r=0.82$) for the scale.

Happiness was assessed through the Happiness Thermometer (Fordyce, 1988). This single-item measure asks for a subjective judgement of happiness over the past week on a 10-point thermometer ranging from 1 (extremely unhappy: utterly depressed, completely down) though to 10 (extremely happy: feeling ecstatic, joyous, fantastic). Previous research has shown good stability over time (test-retest r=0.81 for a one month period) for this measure and a high degree of construct validity (Fordyce, 1988).

Positive and negative affect was measured with the Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988). Ten items represent positive affect (PA; e.g. interested, excited, strong) and 10 items represent negative affect (NA; e.g. distressed, upset, guilt). Respondents rate the extent to which they have felt each feeling or emotion within the past week on a 5-point scale from 1 (very slightly or not at all) though to 5 (extremely). Totals are created by summing scores on defined items and range from 10 to 50; with higher scores indicating higher levels of positive and negative affect respectively. There are no cut-off scores for the PANAS but normative data is available for a UK non-clinical sample; mean PA was 30.62 (7.89) and mean NA 16.68 (6.37) for the sub-group of females (Crawford & Henry, 2004). This normative data was used to categorise PA and NA in the current study. Watson et al. (1988) have reported sound internal reliability for both scales (PA: coefficient $\alpha = 0.86$; NA coefficient $\alpha = 0.84$.

Psychological Distress

Anxiety was assessed with the state anxiety scale of the State-Trait Anxiety Inventory Form (STAI) (Spielberger, 1983). This 20-item scale asks respondents to indicate how they feel 'right now' (e.g. calm, tense) on a 4-point scale ranging from 1 (not at all) to 4 (very much

so). Summing responses creates a total score that can range from 20 to 80. A cut-point of 39–40 is normally used for clinically significant symptoms of state anxiety (Knight, Waal-Manning, & Spears, 1983; Addolorato, Ancona, Capristo, Graziosetto & Gasbarrini, 1999). In a non-clinical sample mean state anxiety was 34.47 (10.18) in a sub-group of females (Knight et al., 1983), with this normative data being used to categorise anxiety in the current study. The STAI has been reported as being internally consistent in previous research (coefficient α = 0.87) (Spielberger, 1983).

Depression was assessed using the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987). This 10-item measure asks women to indicate the response that most closely represents how they have felt in the past week. Responses to statements (e.g. 'I have been able to laugh and see the funny side of things') are scored on a 4-point scale from 0 (as much as I always could) to 3 (not at all). A total depression score is created by summing responses on items (seven of which are reverse scored) and can range from 0 to 30, with higher scores indicating higher levels of depression. A score of 10 or more is used to screen for minor depression (Cox et al., 1987). Cox et al. (1987) report good internal consistency (coefficient α = 0.87) for the scale.

The EPDS (Cox et al., 1987) and the PANAS (Watson et al. 1988) have been used previously in research investigating psychological health in breastfeeding mothers (Cooper et al. 1993; Mezzacapa et al. 2002).

Demographic and Perinatal Information

This questionnaire contained the following:

Demographic information: maternal age, age of baby (when completing the questionnaire), marital status, ethnicity, working status, education level, house-hold income, smoking status, number of children.

Perinatal information: pregnancy (un/complicated); birth (un/complicated).

Feeding information: Past feeding behaviour (participants were asked whether they had previous children, and if so how they were fed); feeding intention (women reported retrospectively how they had intended to feed their baby before birth: breast, bottle or combined feeding); feeding behaviour at birth (women were asked how they fed at birth and were classified as EBF, EFF or combined feeding); current feeding behaviour (feeding at the time of completing the questionnaire was classified as EBF, EFF, or weaned onto formula); age at weaning (if the infant was weaned onto formula mothers were asked to record the babies age in weeks when this happened); reasons for weaning.

Sleep information: night time wakening (mothers were asked to record how many times their baby woke during the night); maternal sleep (how much sleep mothers achieved in a 24 hour period); rating of tiredness (never, rarely, occasionally, often, very often).

Power Calculation

Required sample size was derived after a consultation with a statistician. Power analysis indicated that samples of n=21 per group (EBF, EFF, and weaned onto formula) would be required to detect a difference in the Edinburgh Postnatal Depression Scale with a two-sided 5% Type I error rate and 80% power with a standard deviation of 4 points.

Data Analysis

Statistical analysis was performed using IBM SPSS Statistics (Version 21). Descriptive statistics were used to examine the demographic characteristics of the data. Data was assessed for normality (Kolmogorov-Smirnov; Appendix 2.8), with some variables being significantly non-normal. Owing to this and the small sample size a cautious approach was adopted, therefore non-parametric tests were used. The analysis assessed for differences in feeding groups in relation to demographic characteristics, perinatal factors and psychological wellbeing and distress respectively. The Kruskal-Wallis was used for continuous data and the Fisher's Exact Test was used for categorical variables. The Fisher's Exact Test was chosen as seven out of ten variables did not conform to the assumptions of the Chi-Square test ("no more than 20% of the expected counts are less than five and all individual expected counts are one or greater." Yates, Moore & McCabe, 1999, p734). It is acknowledged that factors such as single parenting, multiparous, and coming from a low socio-economic background, may impact on psychological wellbeing rather than just feeding practices. It was aimed to include these factors as covariates in the analysis, however, due to the non-parametric tests used to analyse the data, it was not possible to do so.

2.3 Results

Fifty eight females were recruited from July 2013 to August 2014; 26 mothers were classified as EBF, ten were EFF and 22 had weaned onto formula after previously breastfeeding, according to their self-reported feeding status (Figure 1).

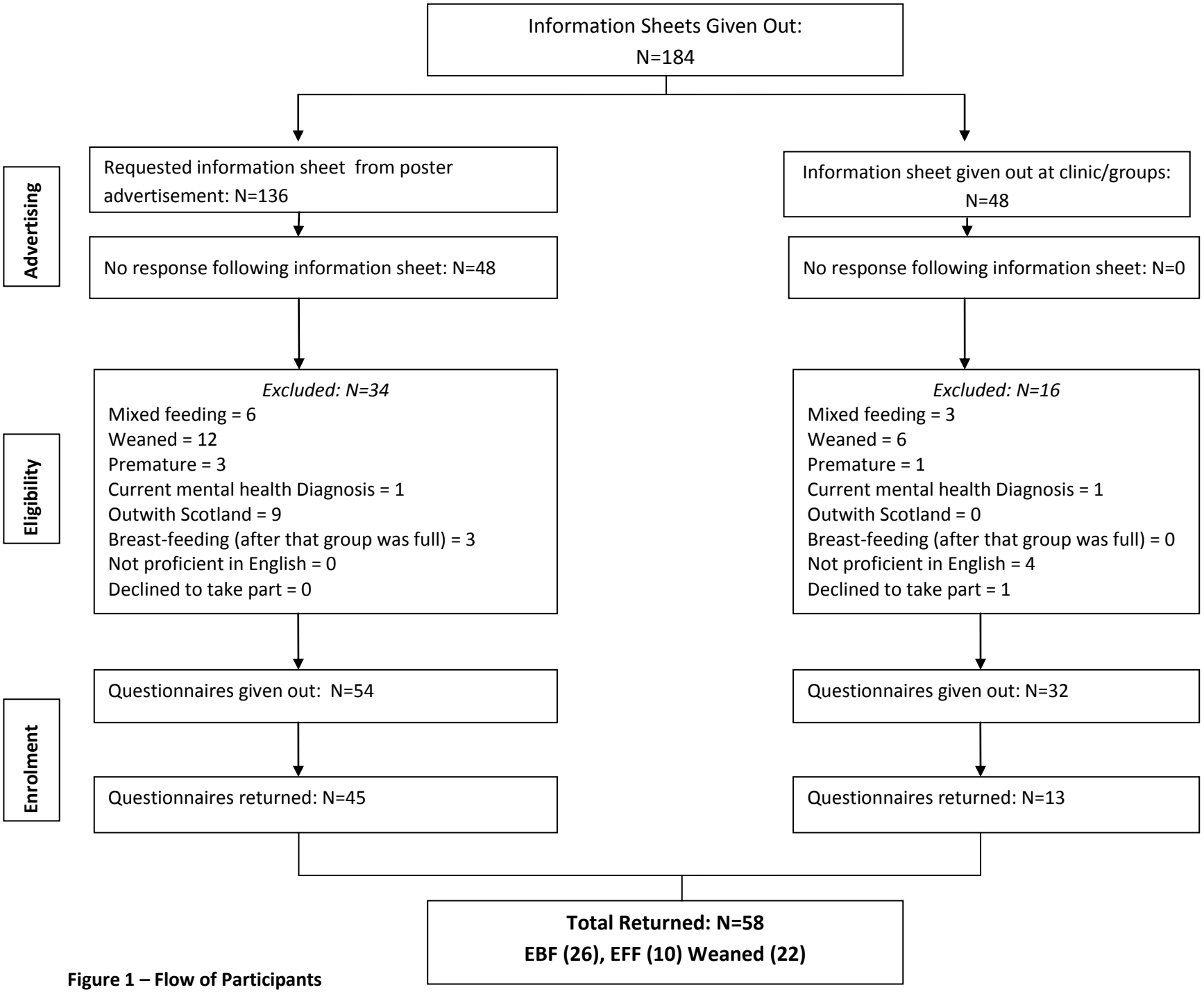

Figure 1 – Flow of Participants

A number of analyses were carried out on the demographic data; this was to determine if differences existed on these variables. As can be seen from Tables 1 and 2 EBF, EFF and weaned onto formula mothers did not differ on most demographic characteristics, therefore these variables did not need to be controlled for in the main analyses. A significant difference was found in the marital status depending on feeding method used (p = 0.032), with fewer formula feeding mothers being in a married relationship.

Table 1: Demographic characteristics – maternal age, baby age, number of children, and income.

Demographic	**Exclusive Breast Feeding (N=25)**	**Exclusive Formula Feeding (N=10)**	**Weaned (onto formula) Feeding (N=22)**	**Kruskal-Wallis H(df)**	**P**
Age of mother (years)					
Median	32	31	29.5		
Interquartile Range	5	12	7	2.003(2)	0.367
Age of baby (weeks)					
Median	14	17	16		
Interquartile Range	9	8	7	1.063(2)	0.588
Number of children					
Median	1	2	1		
Interquartile Range	1	1	1	3.018(2)	0.221
Combined Household Income (£)	**N=22**	**N=7**	**N=18**		
Median	50,500	45,000	58,000		
Interquartile Range	30,250	24,000	43,500	2.321(2)	0.313

Table 2: Demographic characteristics – relationship, employment, education, deprivation and smoking status.

Characteristic	Exclusive Breast-Feeding (N=26)	Exclusive Formula Feeding (N=10)	Weaned (onto formula) Feeding (N=22)	Fisher's Exact P
Relationship Description				
Married	81% (21)	40% (4)	82% (18)	0.032*
Co-habiting	19% (5)	50% (5)	14% (3)	
Single	0% (0)	0% (0)	4% (1)	
Other	0% (0)	10% (1)	0 (0)	
Working Status Description				
Full-time	65% (17)	50% (5)	64% (14)	0.912
Part-time	30% (7)	40% (4)	27% (6)	
Unemployed	5% (2)	10% (1)	9% (2)	
Highest Educational Qualification				
Post-graduate	42% (11)	20% (2)	43% (9)	0.098
Undergraduate	50% (13)	30% (3)	43% (9)	
Secondary school	8% (2)	50% (5)	14% (3)	
SIMD Quintiles				
First	15% (4)	20% (2)	18% (4)	0.502
Second	15% (4)	40% (4)	18% (4)	
Third	19% (5)	20% (2)	14% (3)	
Fourth	15% (4)	20% (2)	27% (6)	
Fifth	36% (9)	0% (0)	23% (5)	
Smoking status	**N=26**	**N=9)**	**N=22**	0.147
Smoker	0% (0)	11% (1)	5% (1)	

* Significant at $p<0.05$ level of significance.

Table 3 summarises perinatal characteristics of mothers in the different feeding groups. As can be seen no differences were found in terms of planned pregnancy and complications with pregnancy/birth. A significant difference was found for EBF, EFF and weaned onto formula mothers on how many times their baby was waking during the night ($p = 0.000$), with EBF babies waking most often. For babies who were weaned onto formula, this mostly occurred within the first week after birth, with a 12% change in feeding method occurring at this time. Ten percent were weaned within the second week, 3% between weeks three and four, 9% between five and eight weeks and 3% between nine and 12 weeks.

Table 3: Perinatal Characteristics

Characteristic	**Exclusive Breast-Feeding (N=25)**	**Exclusive Formula Feeding (N=10)**	**Weaned (onto formula) Feeding (N=22)**	**p (Fisher's Exact)**
Planned pregnancy	22 (88%)	8 (80%)	20 (91%)	0.756
Complicated pregnancy	8 (31%)	3 (30%)	6 (27%)	1.000
Complicated birth	12 (46%)	3 (30%)	12 (55%)	0.447
Mothers sleep in a 24 hour period (hours)				
>8	12% (3)	4 (40%)	4 (18%)	0.554
6-8	68% (17)	5 (50%)	13 (59%)	
4-6	16% (4)	1 (10%)	5 (23%)	
0-4	4% (1)	0 (0%)	0 (0%)	
How often mothers feel fatigued				
Rarely	4 (16%)	4 (40%)	4 (18%)	0.247
Occasionally	8 (32%)	4 (40%)	8 (36%)	
Often	10 (40%)	1 (10%)	10 (46%)	
Very often	3 (12%)	1 (10%)	0 (0%)	
Baby's night awakenings (no. of times)				
Never	4% (1)	80% (8)	41% (9)	0.000*
Once	28% (7)	10% (1)	50% (11)	
Twice	56% (14)	10% (1)	9% (2)	
Three times or more	12% (3)	0% (0)	0% (0)	

* Significant at $p<0.05$ level of significance.

Psychological Outcomes

The Kruskal-Wallis test was conducted to assess differences between infant feeding methods on measures of psychological health and distress. There was no significant difference for feeding method across the psychological wellbeing variables (Table 4).

Table 4: Group differences on psychological wellbeing variables

	Exclusive Breast-Feeding (N=26)		**Exclusive Formula Feeding (N=8)**		**Weaned (onto formula) Feeding (N=21)**		**Kruskal Wallis**	
	Median	**IQR**	**Median**	**IQR**	**Median**	**IQR**	**H(df)**	**P**
Happiness Thermometer								
	8	1	8	1	8	1	0.073(2)	0.964
Category	Pretty happy		Pretty happy		Pretty happy			
Satisfaction with Life Scale								
	30	3	30.5	3	31	3	4.65(2)	0.098
Category	Very High		Very High		Very High			
Positive and Negative Affect Schedule (positive component)								
	35	6	38.5	9	38	9	3.82(2)	0.148
Category	Average		Average		Average			

As can be seen in Table 5, with regards to psychological distress a significant difference of feeding method was found for two of the variables: scores on the EPDS, H(2) = 8.88, p = .012, and scores of negative affect (PANAS), H(2) = 6.69, p =.035.

Table 5: Group differences on psychological distress scales

	Exclusive Breastfeeding (N=26)		**Exclusive Formula-Feeding (N=8)**		**Weaned (onto formula) Feeding (N=21)**		**Kruskal Wallis**	
Variable	**Median**	**IQR**	**Median**	**IQR**	**Median**	**IQR**	**H(df)**	**P**
Edinburgh Postnatal Depression Scale								
	3.5	4	0	4	4	5	8.88(2)	0.012*
Category	Non-clinical		Non-clinical		Non-clinical			
State Trait Anxiety Inventory								
	30	10	25.5	9	30	9	3.643(2)	0.162
Category	Non-clinical		Non-clinical		Non-clinical			
Positive and Negative Affect Schedule (Negative component)								
	14	5	11	5	16	6	6.69(2)	0.035*
Category	Average		Average		Average			

* Significant at p<0.05 level of significance.

As the Kruskal-Wallis only stated there was a difference but not specifically where this difference lay, post-hoc analyses were required. Pairwise Mann-Whitney tests with Bonferroni correction were carried out, which compared each group against each other group, in pairs, whilst correcting the resulting p-value, so that the overall error rate remained at 5%.

EPDS

A significant difference was found, with mothers who weaned onto formula having higher scores of depression compared to those who EFF (p=0.009, r = -0.395). There were no significant differences between mothers who EFF compared to those who EBF (p = 0.099, r = 0.282). There were no significant differences between mothers who EBF compared to those who weaned onto formula (p = 0.690, r = -0.159).

PANAS (negative affect)

A significant difference was found, mothers who weaned onto formula had higher scores of negative affect compared to those who EFF (p=0.031, r = -0.336). There were no significant differences between mothers who EFF compared to those who EBF (p = 0.124, r = 0.131). There were no significant differences between mothers who EBF compared to those who weaned onto formula (p = 1.00, r = -0.099).

2.4 Discussion

The present study aimed to develop a better understanding of maternal psychological health depending upon infant feeding method. No differences were found on any of the psychological wellbeing variables between the feeding groups. In the present study, the median score for happiness was 8 (IQR=1), which was similar to a previous study on infant

feeding and maternal mood, with mean scores for the breastfeeding sample being 7.28 (1.81), and 7.96 (1.83) for the formula-feeding sample (Wilkinson et al. 2006). Published SWLS scores for postpartum women include M=26.58 (SD=5.53) and M=28.17 (SD=3.96) for breast and formula feeding mothers respectively (Wilkinson et al. 2006); and M=28.9 for first time mothers (Aasheim, Walkenstrom, Rasmussen, Espehaug & Schytt, 2014). In the present study, median scores were 30 (3), 30.5 (3) and 31 (3) for EBF, EFF and weaned to formula mothers. In relation to positive affect the median scores in the present study were 35 (6; EBF), 38.5 (9; EFF) and 38 (9; weaned to formula), which appears comparable to scores observed in recent mothers, M=38.64 (9.32) (Tuohy & McVey, 2008).

Women who weaned onto formula after initially trying to breastfeed, reported more psychological distress compared to mothers who EFF, with higher self-reported depression and negative affect. This is in keeping with case studies undertaken by Susman et al. (1988), who reported that weaning was associated with maternal panic, anxiety, depression, and psychosis.

Within Scotland, a cut-off of 10 or above on the EPDS, is suggested for screening postpartum depression by national guidelines (SIGN 60, 2002). Given this, it can be seen that the mothers who weaned onto formula had higher scores on the EPDS compared to mothers who EFF, but their scores were not indicative of clinical depression. Published mean EPDS scores have been observed as 6.92 (3.23) and 5.92 (2.76) for breast and formula feeders respectively (Wilkinson & Schrel, 2006) and 9.42 (5.72) for recent mothers (Tuohy & McVey, 2008). These appear disparate to those observed in the current study, with median scores being 3.5 (4), 0 (4) and 4(5) for EBF, EFF and weaned onto formula respectively. Research has demonstrated that respondents tend to give more positive and socially

desirable responses in interview surveys compared to self-administration (Tourangeau & Smith, 1996). This seems at odds to what was found by this self-administered questionnaire, however, it is often the greater perceived anonymity and weak social presence of self-administration that allows for more accurate reporting (Siemiatycki, 1979). Participants were informed that their responses would be confidential and anonymised in the current study, but they were also informed that their GP would be contacted if their mood was low. As a result, socially desirable responses may have been provided.

In regards to the PANAS, higher scores indicate higher levels of positive and negative affect respectively, with scores ranging from 10-50. In a similar study, mean negative affect was observed as 15.14 (4.19) and 14.54 (4.42) for breast and formula feeding mothers (Wilkinson et al. 2006); and 19.48 (10.09) for new mothers (Tuohy et al. 2006). Median scores in the current study were 14 (5; EBF), 11 (5; EFF) and 16 (6; weaned onto formula). As with the EPDS, it is possible that some of the present deflated scores may reflect a limit of confidentiality.

The present study extended the work of Wilkinson and colleague (2006). They reported no differences between their sample of breast (which included partial and exclusive feeders) and formula-feeding mothers (who had weaned from breast), however, they originally aimed to recruit mothers who formula-feed from birth, but were unable to do so. When this sample was included in the present study, it was found that differences did exist between the EFF and those who weaned onto formula. In line with this, a mixed-methods study found that feelings of failure were most marked in women who had intended to breastfeed exclusively or mostly, but did not succeed in doing so (Lee & Furedi, 2005). Similarly, in a large longitudinal study (n= >8,000), which in part assessed feeding intentions on PND, it

was found that not being able to breastfeed as intended increased the risk of PND, as measured by self-reported EPDS scores (Borra, Iacovou & Sevilla, 2015).

What this and other research (Lee et al. 2005; Borra et al., 2014) imply is that it is not the feeding method per se that results in psychological distress, but not being able to feed as intended. Thomson and colleagues (Thomson, Ebisch-Burton & Flacking, 2014) qualitatively explored mother's experiences of infant feeding and found that when the feeding method was not experienced as intended, this could lead to feelings of incompetence, inadequacy and inferiority. This may be because breastfeeding is important to the identity of a new mother (Schmeid et al. 1999) and has become synonymous with being a 'good mother' (Murphy 1999; 2000).

The Theory of Planned Behaviour (TPB; Ajzen, 1991) can be used to help explain further why not feeding as intended can produce more distress. It is posited that attitudes influence behaviour, with research finding that maternal attitudes are a dominant predictor in infant feeding intentions and initiation (Manstead, Proffitt & Smart, 1983; Wambach, 1997). It has also been found that subjective norms are important determinants in the initiation and continuation of infant feeding (Swanson & Power, 2004) but the influence of social referents is stronger for women who initiate breastfeeding (Kaufman & Hall, 1989; Manstead et al.,1983). One could hypothesise, that the discrepancy between actual and intended feeding method in unsuccessful breast-feeders, may result in attentional bias, whereby they become more aware of the perceived social pressure to breastfeed and ruminate on their original attitudes towards wanting to breastfeed.

Following birth the decrease in progesterone triggers the onset of milk synthesis; infant suckling stimulates production of oxytocin and prolactin (Uvnas-Moberg & Eriksson, 1996). These lactogenic hormones may also have a role to play in maternal mood. Progesterone has been implicated in the baby blues, while lower oxytocin levels have been associated with higher anxiety and depression (Stuebe, Grewen & Meltzer-Brody, 2013). It is possible then, that disruption in oxytocin due to weaning, may result in mood difficulties, which would explain why the women who weaned in the current study had higher levels of depression and negative affect.

Strengths and Limitations

In the UK, the majority of mothers initiate breastfeeding (including mothers who breastfeed on one occasion only), with only a fifth (19%) of mothers EFF from birth (McAndrew et al. 2012). To the authors knowledge, this is the first study to include a sample of mothers who EFF from birth. A further strength of this study is that each group was kept as distinct as possible in terms of feeding method, to make the groups as independent as possible. To further correct for methodological flaws of past studies, data were collected within a restricted time range, to try and better capture the tasks of motherhood when only milk feeding was occurring.

There are a number of limitations with this study: while a sample of mothers who EFF were included, it is noted that the participants in this sub-sample did not reach the numbers indicated by the power calculation. This is in keeping with other research, in which EFF mothers were unable to be recruited (Wilkinson et al. 2006). According to qualitative

research, women who formula-feed experience perceptions of inadequate mothering from others (Thomson et al. 2014), which may deter them from participating in research.

It is also acknowledged that the study intended to control for confounding factors that may have impacted on maternal mood and not just feeding practice alone. Of the covariates collected, significant differences were found between the groups in terms of their marital status and the number of times their babies woke during the night. Due to differences being found they should have been included in the main analyses, however, some of the data did not follow normal distribution. Given the small sample size and that normality could not be assumed a cautious approach was adopted, with analyses being conducted using non-parametric tests. This prevented covariates being controlled for. It is therefore recommended that future research recruit a larger sample size to increase the chance of obtaining Gaussian distribution.

Within the wider literature, infant sleep problems in particular are reliably associated with increased depressive symptoms for mothers (Bayer, Hiscock, Hampton, & Wake, 2007). Other research has found that women with elevated EPDS scores are more likely to report that their baby woke up three times or more during the night (Dennis et al. 2005). In this study, infants who were EBF woke up significantly more compared to the other groups. While this was not controlled for, it is noted that maternal mood was not impacted by this. EBF mothers did not report higher levels of fatigue compared to their formula feeding counterparts (exclusive or weaned). As there was no difference in the subjective reporting of fatigue, this may explain why higher levels of depression were not observed by the breastfeeding sample in the current study.

All participants recruited were of white ethnic background which does not match the ethnic profile of Scotland, with 4% of the population being made up of ethnic minority groups (National Records of Scotland, 2011); this limits the generalisability of the results to white mothers. There are potential sources of bias within the study; poster advertising was used to recruit participants, which could have led to sampling bias. Recall bias may have been present as participants were categorised into their feeding group via self-reports, however, participants did have to complete screening questions before they were eligible to take part in the study. In future studies, feeding method could be corroborated through examination of health records.

Clinical Implications

The study's findings indicate that feeding methods can have a negative impact on mothers' psychological wellbeing. In particular, if a mother is not able to feed as intended this makes her more vulnerable to psychological distress, which is concordant with quantitative (Borra et al., 2014) qualitative (Thomson et al., 2014) and mixed-methods research (Lee et al. 2005). In the UK in 2010, there had been an increase in EBF at birth (from 65% in 2005 to 69% in 2010), however, maintenance rates continue to drop-off, whereby at one week only 46% are EBF, 23% at six weeks and only 1% at six months (McAndrew et al. 2012). This indicates that very few mothers are able to follow recommendations to EBF for approximately six months (WHO, 2003), with the majority finding long-term breastfeeding unattainable and therefore are not feeding as intended.

A US study investigated factors associated with early discontinuation of breastfeeding. Women who did not breastfed as long as intended had more reasons for early

discontinuation compared to women who met their desired duration. The reasons for stopping were related to feeding difficulties, infant nutrition (including weight), maternal or child health, and expressing milk concerns (Odom, 2013). The latter worries may be more apparent when a mother needs to return to work, with research from Greece (N=1049), Australia (N=587) and the US (N=1163), evidencing this as a risk for early weaning (Ladomenou, Kafatos & Galanakis, 2007; Scott, Binns, Oddy, & Graham, 2006; Taveras, Capra, Braveman, Jensvold, Escobar et al. 2003). Despite this, in a UK sample of 10,768 mothers, it appeared that the return to work did not hold as much influence, as no clear relationship was found between the age of the baby when the mother returned to work and length of breastfeeding (McAndrew et al. 2012). This indicates that mothers' decisions to discontinue breastfeeding are multifaceted. Policy is still needed to promote breastfeeding but other policy should be established to support mothers who do not achieve their intended feeding method.

Women who had weaned onto formula in this study were found to experience more psychological distress compared to their formula-feeding counterparts. A review article noted that PND can impact the infant negatively with regards to cognitive, social and physical development (Parsons, Young, Rochat, Kringelbach & Stein, 2011). Due to adverse consequences for both mother and child, it is important that during postnatal checks, mood is routinely enquired about, particularly with mothers who change their feeding method, so that those at risk of developing problems with mood are identified early. In Scotland currently, the EPDS is administered by health visitors to women between six and 12 weeks postnatally. While women in this study who weaned onto formula did report more psychological distress, it was not clinically significant. It must be remembered that the EPDS

was used as a cross-sectional self-administered measure with no subsequent clinical validation of distress. Other informal assessment methods may be needed to determine if women are having difficulty in adjusting to their new feeding method.

Conclusions and Future Research

The present study found that infant feeding methods have an impact on maternal mood, yet further, larger scale studies are required to increase the likelihood of a normal distribution, so the impact on feeding method can be investigated whilst controlling for confounding variables. These studies should include discreet feeding groups, including mothers who EFF. If possible, a group of mothers who use mixed feeding should be recruited, as 10.6% of infants are fed this way in Scotland at six to eight weeks postnatally (ISD, 2012). Future studies could use a longitudinal design to assess whether psychological wellbeing and distress is more vulnerable at different time points.

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Appendix 1.1 - Guidelines for Submission

Instructions for Authors for Submission to *Acta Paediatrica*

SUBMISSION

Manuscript Layout

Please use these simple guidelines when preparing your electronic manuscript.

(i) Key elements consistently throughout. (ii) Do not break words at the ends of lines. Use a hyphen only to hyphenate compound words. (iii) Use one space only at the ends of sentences. (iv) Do not use underlining; use the italics feature instead. (v) Leave the right-hand margin unjustified. (vi) Use a double hyphen to indicate a dash. (vii) Do not use the lower case 'ell' for 1 (one) or the upper case O for 0 (zero). (viii) When indenting paragraphs or separating columns in tables, use the TAB key, not the spacebar.

Double-space the entire manuscript. Prepare the manuscript with each of the following parts starting on a new page: (1) The title, with authors' names and affiliations (as a rule the number of authors should be limited to six. The names of others who contributed to the article in varying degree should be mentioned under the heading 'Acknowledgements'), the address of the corresponding author and a short running title; (2) the abstract ending with one or two sentences of conclusion, summarizing the message of the article including keywords; (3) the text; (4) the references; (5) tables; (6) figure legends.

Language

Manuscripts must be in English. Authors from non-English speaking countries are requested to have their text thoroughly checked by a competent person whose native language is English. Manuscripts may be rejected on the grounds of poor English. Revision of the language is the responsibility of the author. For English-language editing services see http://authorservices.wiley.com/bauthor/english_language.asp

Notes/Footnotes

Incorporate notes/footnotes in the text, within parentheses, rather than in their usual place at the foot of the page.

Abbreviations

Do not use abbreviations in the title or Abstract, and in the text use only standard abbreviations, i.e. those listed in the latest editions of any recognized medical dictionary (e.g. Dorland's, Butterworth's). The full term for which an abbreviation stands should precede its first use in the text, unless it is a standard unit of measurement. Use the SI system of notation. Redefine abbreviations used in the figure legends.

Illustrations

In manuscripts that contain photographs of patients, we require a certificate by the author

that consent to publish such a photograph has been given by the patient, a child's parent or a caretaker.

All figures should be cited in the text in numerical order. Figure legends must be typed on a separate page at the end of the manuscript. When submitting artwork electronically, please read the information on the Wiley-Blackwell website at http://authorservices.wiley.com/prep_illust.asp. Vector graphics (e.g. line artwork) should be saved in Encapsulated Postscript Format (EPS), and bitmap files (e.g. photographs) in Tagged Image File Format (TIFF). Line art must be scanned at a minimum of 800 dpi, photographs at a minimum of 300 dpi.

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PO22 9NQ
United Kingdom

Tables
Number tables with Arabic numerals.

Title Page
Example of a title page showing content and spacing. Leave 7-8 cm at top of page.

Mechanics of breathing in the newborn (title)

L Andersson and K Pettersson (authors)
Department of Paediatrics, University Hospital, Lund, Sweden

Short title: Neonatal breathing

Corresponding author: K. Pettersson, Department of Paediatrics, University Hospital, S-221 85 Lund, Sweden. Tel +00 0 000 00 00. Fax +00 0 000 00 00.

Abstract

The abstract of a regular article should not exceed 200 words for regular articles and should be structured with the following headings: Aim, Methods, Results and Conclusion. Where appropriate, use Design, Setting, Subjects, Interventions and Main outcome measures. The abstract should be followed by a maximum of five keywords, listed alphabetically. Type as illustrated below:

ABSTRACT
Huppke P, Roth C, Christen HJ, Brockmann K, Hanefeld F. Endocrinological study on growth retardation in Rett syndrome. *Acta Paediatrica* 2001;90:1257-61. Stockholm. ISSN 0803-5253

Aim: To determine whether primary or secondary growth hormone … (text) **Methods**: In 38 patients with Rett syndrome... **Results**: … **Conclusion**: ... Keywords: Endocrinology, growth hormone, growth retardation …

Please note that clear, descriptive and search-optimized titles and abstracts are important considerations to the journal. Guidelines available here.

Key Notes

In Regular Articles and Review Articles, after the Abstract, please sum up your article in three short sentences of max. 70 words in total, with the aim of creating an easy digestible take home message for the reader.

Text Pages

Leave a left-hand margin of about 4 cm. Number the pages in the top right-hand corner, beginning with the title page. Headings (left-hand margin): Patients and Methods, Results, Discussion, Acknowledgements, References.

References

Number the references consecutively in the order in which they are first mentioned in the text. Identify references in the text, tables and legends by Arabic numerals (in parentheses). Type list of references as illustrated. Observe the punctuation carefully. The number of references should not exceed 30 in regular articles. (When more than six authors, list first six and add et al).

Abbreviations of journal titles; please consult the List of Journals Indexed in Index Medicus, published annually as a list in the January issue of Index Medicus, also accessible at **www.nlm.nih.gov**

References (example)

1. Kühl C, Andersen GE, Hertel J, Mölsted-Pedersen L. Metabolic events in infants of diabetic mothers during the first 24 hours after birth. *Acta Paediatr* 1982; 71:19-25.

2. Feigin RD. Bacterial meningitis beyond the neonatal period. In: Feigin RD, Cherry JD, eds. *Textbook of pediatric infectious diseases*. 2nd ed. Philadelphia: WB Saunders, 1987.

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4. D'Hondt E, Berge E, Colinet G. Production and quality control of the Oka strain live varicella vaccine. *Postgrad Med J* 1985; 61 Suppl 4:53-6.

For a journal article in electronic format use the following style:

5. Morse SS. Factors in the emergence of infectious diseases. *Emerg Infect Dis* [serial online] 1995 Jan-Mar [cited 1996 Jun 5]; 1(1): [24 screens]. Available from: URL: **www.cdc.gov\ncidod\EID\eid.htm**

Appendix 1.2 – Quality Rating Tool

<u>Study Identification</u> (author, year of publication, title, journal title, pages):			
Rated by:			
Topic	**Item**	**Descriptor**	**Score**
Sample	1	**Target population defined (e.g. term, pre, mixed)**	0,1
	2	**Breastfeeding type is sufficiently described (exclusive, partial).**	0,1
	3	**The inclusion criteria are stated.**	0,1
	4	**The exclusion criteria are stated.**	0,1
	5	**The sample size is justified.**	0,1
Design	6	**The study design is appropriate to answer the study question.** **(Birth cohort = 1; longitudinal, but not from birth = 0).**	0,1
Feeding Data	7	**Feeding data was gathered when feeding was occurring.** **(Whilst occurring = 1; gathered retrospectively = 0).**	0,1
	8	**Feeding data came from a reliable source.** **(Mother/health records = 1; another relative or a lactation consultant = 0).**	0,1
	9	**Duration of breastfeeding was stated.** **(Dose response considered = 1; dose response not considered= 0)**	0,1
Confounding Variables	10	**The study was covariate adjusted.** **(Does the study control statistically for a minimum of 5 characteristics in models to estimate effects of breastfeeding compared with those of formula feeding on cognitive development.)** **1) duration of breastfeeding, 2) sex, 3) maternal smoking history, 4) maternal age, 5) maternal intelligence, 6) maternal education, 7) maternal training, 8) paternal education, 9) race or ethnicity, 10) socioeconomic status, 11) family size, 12) birth order, 13) birth weight, 14) gestational age, and 15) childhood experiences.**	0,1

	11	**Socioeconomic status was recorded.**	0,1
	12	**Stimulation of the child was assessed.**	0,1
	13	**Maternal IQ was assessed.**	0,1
Blinding	14	**Assessors blind to feeding status**	0,1
Outcomes	15	**Appropriate Cognitive Assessment Tool. (Measure of general intelligence=1; measure of achievement/picture vocabulary=0)**	0,1
	16	**Full IQ score provided. (Full IQ=1; Verbal/Performance only=0)**	0,1
	17	**Cognitive assessments were undertaken when the child was ≥ 2 years of age.**	0,1
Analysis	18	**The analyses used were clearly described.**	0,1
	19	**The analyses used were appropriate to answer the study question.**	0,1
Results	20	**Attrition rates and reasons are recorded. (Attrition rate & reasons =2; Attrition rates only = 1; no stated = 0).**	0,1,2
	21	**Results are clearly presented.**	0,1
	22	**The results are accurately interpreted**	0,1
	23	**The discussion and conclusions are in keeping with the results obtained.**	0,1
		Total	/24

Appendix 1.3 – Table 1 - Quality of Studies.

	Year	Title	Quality Rating	Category
High Quality Studies				
Gale et al.	2010	Breastfeeding, the use of docosahexaenoic acid-fortified formulas in infancy and neuropsychological function in childhood.	83%	High
Quigley et al.	2012	Breastfeeding is associated with improved child cognitive development: a population-based cohort study.	83%	High
Quinn et al.	2001	The effect of breastfeeding on child development at 5 years: A cohort study.	83%	High
Slykerman et al.	2005	Breastfeeding and intelligence of preschool children.	83%	High
Zhou et al.	2007	Home environment, not duration of breast-feeding, predicts intelligence quotient of children at four years.	83%	High
Gomez-Sanchiz et al.	2004	Influence of breast-feeding and parental intelligence on cognitive development in the 24-month-old child.	79%	High
Silva et al.	2006	Duration of breast feeding and cognitive function: Population based cohort study.	79%	High
Jiang et al.	2011	Breastfeeding and the child cognitive outcomes: a propensity score matching approach.	75%	High
Steer et al.	2012	FADS2 polymorphisms modify the effect of breastfeeding on child IQ.	75%	High
Der et al.	2006	Effect of breast feeding on intelligence in children: prospective study, sibling pairs analysis, and meta-analysis.	71%	High

	Year	Title	Quality Rating	Category
Gibson-Davis	2006	Breastfeeding and Verbal Ability of 3-Year-Olds in a Multicity Sample	71%	High
Oddy et al.	2003	Breast feeding and cognitive development in childhood: a prospective birth cohort study.	71%	High
Moderate Quality				
Birch et al.	2007	Visual acuity and cognitive outcomes at 4 years of age in a double-blind, randomized trial of long-chain polyunsaturated fatty acid-supplemented infant formula.	63%	Moderate
Boutwell et al.	2012	Role of breastfeeding in childhood cognitive development: A propensity score matching analysis.	50%	Moderate
Tanaka et al.	2009	Does breastfeeding in the neonatal period influence the cognitive function of very-low-birth-weight infants at 5 years of age?	50%	Moderate

Appendix 2.1 – Guidelines for Submission

Instructions for Authors for Submission to *Journal of Reproductive and Infant Psychology*

Manuscript preparation

- Manuscripts are accepted only in English. Please use single quotation marks, except where 'a quotation is "within" a quotation'. Long quotations of 40 words or more should be indented without quotation marks.
- Use British spelling (e.g. colour, organisation) but note the journal's use of 'fetal' not 'foetal'. Use British punctuation conventions. Initials and acronym (e.g. US, BBC) do not have full points between them.
- Use capitalisation sparingly. Use lower case when using general terms (e.g. committee, council, state/provincial agencies).
- Numbers: spell out one to nine, then use numerals with commas for 10,000 and upwards: 10, 1000, 10,000. Use '%' not 'percent'.
- A typical manuscript will not exceed 3500 words (2500 words for short reports) not including tables/references/figure captions/footnotes/endnotes. Contributions should be as concise as possible. Manuscripts that greatly exceed this will be critically reviewed with respect to length. Authors should include a word count with their manuscript.
- The title should not exceed 15 words and the references should be no more than 50 in number. Section headings should be concise.
- Manuscripts should be compiled in the following order: title page (including Acknowledgements as well as Funding and grant-awarding bodies); abstract; keywords; main text; references; appendices (as appropriate); table(s) with caption(s) (on individual pages); figure caption(s) (as a list).
- Abstracts of no more than 250 words are required for all manuscripts submitted. The abstract should be structured Objective , Background , Methods (to include design and participants), Results , and Conclusion .
- Each manuscript should have 5 or 6 keywords .

- Search engine optimization (SEO) is a means of making your article more visible to anyone who might be looking for it. Please consult our guidance here .
- All authors of a manuscript should include their full names, affiliations, postal addresses, telephone numbers and email addresses on the cover page of the manuscript. One author should be identified as the corresponding author. Please give the affiliation where the research was conducted. If any of the named co-authors moves affiliation during the peer review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after the manuscript is accepted. Please note that the email address of the corresponding author will normally be displayed in the article PDF (depending on the journal style) and the online article.
- All persons who have a reasonable claim to authorship must be named in the manuscript as co-authors; the corresponding author must be authorized by all co-authors to act as an agent on their behalf in all matters pertaining to publication of the manuscript, and the order of names should be agreed by all authors.
- Biographical notes on contributors are not required for this journal.
- Authors must also incorporate a Disclosure Statement which will acknowledge any financial interest or benefit they have arising from the direct applications of their research.
- For all manuscripts non-discriminatory language is mandatory. Sexist or racist terms must not be used.
- Authors must adhere to SI units . Units are not italicised.
- When using a word which is or is asserted to be a proprietary term or trade mark, authors must use the symbol ® or TM.
- Authors must not embed equations or image files within their manuscript.

Appendix 2.2 – WoSRES REC Approval and R&D Approval

NHS
Greater Glasgow and Clyde

WoSRES
West of Scotland Research Ethics Service

West of Scotland REC 3
Ground Floor – The Tennent Institute
Western Infirmary
38 Church Street
Glasgow
G11 6NT

Mrs Ursula O'Donnell
Trainee Clinical Psychologist
NHS Greater Glasgow and Clyde
Mental Health and Well-Being
First Floor, Admin Building
Gartnavel Royal Hospital,
1055 Great Western Road,
Glasgow
G12 0XH

Date 08 July 2013

Direct line 0141 211 6294
Fax 0141 211 1847
E-mail Stephanie.keane@ggc.scot.nhs.uk

Dear Mrs O'Donnell

Study title: **A study examining how infant feeding method's impact on mothers psychological well-being.**
REC reference: **13/WS/0169**
IRAS project ID: **130214**

Thank you for your undated covering letter sent by email on 5 July 2013. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 01 July 2013

Documents received

The documents received were as follows:

Document	*Version*	*Date*
Covering Letter		
Questionnaire: Demographic information	2	05 July 2013

Approved documents

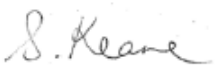
The final list of approved documentation for the study is therefore as follows:

Document	*Version*	*Date*
Advertisement	1	18 January 2013
Covering Letter		11 June 2013
Covering Letter – relating to additional conditions detailed 1 July '13		
GP/Consultant Information Sheets	1	30 April 2013
GP/Consultant Information Sheets	1	30 April 2013
Investigator CV		10 May 2013
Other: Sign posting info	1	18 January 2013
Other: Unfavourable opinion letter		14 March 2013
Other: CV - academic supervisor		17 August 2012
Participant Consent Form	1	20 March 2013
Participant Information Sheet	2	21 March 2013
Protocol	2	14 May 2013
Questionnaire: 4x validated questionnaires: STAI, EPDS, PANAS, Satisfaction with Life		
Questionnaire: Happiness thermometer - Validated		
Questionnaire: Demographic information	2	05 July 2013
REC application		10 June 2013

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

13/WS/0169 **Please quote this number on all correspondence**

Yours sincerely



Stephani Keane
Admin Assistant

Copy to: Joanne McGarry, NHS Greater Glasgow and Clyde

Coordinator/Administrator: JMcG/ LR
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Glasgow
G11 6NT

17th July 2013

Mrs Ursula O'Donnell
Trainee Clinical Psychologist
Mental Health and Well-Being
1st Floor, Admin Building
Gartnavel Royal Hospital
1055 Gt Western Road
Glasgow
G12 0XH

NHS GG&C Board Approval

Dear Mrs O'Donnell

Study Title: A study examining how infant feeding method's impact on mothers psychological well-being.
Chief Investigator: Mrs Ursula O'Donnell
GG&C HB site: Community
Sponsor: NHS GG&C Health Board
R&D Reference: GN13KH343
REC Ref: 13/WS/0169
Protocol no: V2 dated 14.05.2013

I am pleased to confirm that Greater Glasgow & Clyde Health Board is now able to grant **Approval** for the above study.

Conditions of Approval

1. **For Clinical Trials** as defined by the Medicines for Human Use Clinical Trial Regulations, 2004
   a. During the life span of the study GGHB requires the following information related solely to this site
      i. Notification of any potential serious breaches.
      ii. Notification of any regulatory inspections.

It is your responsibility to ensure that all staff involved in the study at this site have the appropriate GCP training according to the GGHB GCP policy (www.nhsggc.org.uk/content/default.asp?page=s1411), evidence of such training to be filed in the site file.

2. **For all studies** the following information is required during their lifespan.
   a. Recruitment Numbers on a monthly basis
   b. Any change of staff named on the original SSI form
   c. Any amendments – Substantial or Non Substantial

d. Notification of Trial/study end including final recruitment figures
e. Final Report & Copies of Publications/Abstracts

Please add this approval to your study file as this letter may be subject to audit and monitoring.

Your personal information will be held on a secure national web-based NHS database.

I wish you every success with this research study

Yours sincerely

Joanne McGarry
Research Co-ordinator

CC: Dr Alison Jackson, Academic Supervisor, GRH, Glasgow

Appendix 2.3 – Recruitment Poster

Recruitment Poster Version 2

May 10, 2013

University of Glasgow

NHS Greater Glasgow and Clyde

We are currently carrying out research which looks at how the feeding method of infants impacts on the mother's psychological well-being. We are looking for women over the age of 18 who have an infant between 8 weeks and 6 months to take part in our research.

The research involves completing short questionnaires.

If you are interested contact:

Ursula O'Donnell

07849030466

u.o'donnell.1@research.gla.ac.uk

Breastfeeding Image by Mothering Touch:
http://www.flickr.com/photos/motheringtouch/5205274432/sizes/m/in/photostream/
Bottle-feeding Image by Nerissa's Ring :
http://www.flickr.com/photos/21524179@N08/3669555322/sizes/m/in/photostream/

Appendix 2.4 – Participant Information Sheet

University of Glasgow

NHS Greater Glasgow and Clyde

Contact Details

Researcher	Ursula O'Donnell	07849030466	u.o'donnell.1@research.gla.ac.uk
Independent Contact	Andrew Gumley	01412113939	Andrew.Gumley@glasgow.ac.uk

Infant Feeding Methods and Mother's Mental Health

My name is Ursula O'Donnell. I am a Trainee Clinical Psychologist from the University of Glasgow. You are invited to take part in a study looking at infant feeding and mothers' mental health. The information gathered is for research only and is part of my training. You will not be identified in the results.

Before deciding to take part or not, you need to know why the research is being carried out and what's involved. Please take your time to read the following information carefully. If anything is unclear or if you would like more information, please let me know. Take your time to decide if you want to take part or not.

What is the purpose of the study?

Mixed findings have been found in past studies of infant feeding and mental health of mothers. Some research found that breastfeeding was linked with distress. Other research found that formula feeding was linked with distress. Other research found no differences. This study wants to gain a better insight into feeding methods and mothers mental health.

Who can take part is this study?

You can take part in this study if you are 18 years or older with a biological infant. Your baby should be between 8 weeks and 6 months old (or who has not been weaned onto solid food). Your baby will have been born full-term (between 37 weeks – 42 weeks). You need to be feeding your baby in one of these ways: 1) breastfeeding only, 2) formula-feeding only, or 3) formula feeding after weaned from breast.

You cannot take part in this study if your baby was born premature (<37 weeks). Or if your baby was born with problems that make feeding hard (i.e. lip or mouth problems). You are unable to take part if you are using mixed feeding (breast and formula feeding). Mothers who have an official diagnosis of depression or postnatal depression cannot take part.

To take part in this study you will need to provide contact details of your GP, so they can be informed about your participation in this research project. **This is required as the researcher has a duty of care to disclose any identified risk (about yourself or your child) to your GP**. For example, if questionnaires indicate that you mood is low, this will be passed on to your GP. You will also be informed about this.

Do I have to take part in this study?

No. It is up to you to decide to take part or not. If you decide to take part you will be given this information sheet and asked to sign a consent form. If you decide to take part you are still free to drop-out at any time without giving a reason.

What does participation in this study involve?

If you decide to take part in this study you will be asked to complete 6 questionnaires. Then return them in the free-post envelope. It takes about 15-30 minutes to answer all the questions. You only need to complete the questionnaires once.

What are the pros and cons of taking part?

For some women, their answers may highlight signs of anxiety or depression. If this happens your GP will be informed who can offer advice. All study packs contain information on common mental health problems after birth. This sheet also has contact numbers for services if you are worried about your mental health. While this may be upsetting, early support will give the best benefit for yourself and your baby.

There are no other benefits from taking part. Information that is collected will give a better understanding on how different feeding methods can impact upon mental health.

What will happen to my information?

All information will be kept private. You will be identified by an ID number only. Your name and address will be removed from any information so you cannot be recognised.

What will happen to the results of the research study?

The results will be written up into my doctoral thesis. A finalised version of this should be complete by October 2014. A summary of the results will be available when the study is finished. If you wish to get a summary of the results please provide your postal address.

Who is supervising this study?

Dr Alison Jackson, University Teacher, at the University of Glasgow, is supervising this research.

Who is paying for this study?

This study is being funded through the University of Glasgow. It has been reviewed by a Research Ethics Committee of the West of Scotland Research Ethics Service. The committee has approved the research as appropriate.

What should I do if I have any questions about this study?

If you would like further details about the study, you can either contact me by phone (07849030466) or email (u.o'donnell.1@research.gla.ac.uk).

I would like to thank you for your time and consideration.

Appendix 2.5 – Participant Consent Form

University of Glasgow

NHS Greater Glasgow and Clyde

Consent Form: A study examining how infant feeding method's impact on mothers psychological wellbeing.

Please Initial Box

1.	I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.	☐
2.	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	☐
3.	I agree to take part in the above study.	☐
4.	I agree to my GP being informed about my participation in this study.	☐
5.	* I agree to my GP being informed if risk is identified for myself or my child.	☐

GP Contact Details

GP Name: _____

GP Practice: _____

Address: _____

Your name: _____

DOB: _____

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of Researcher	Date	Signature

Appendix 2.6 – Questionnaire Booklet

Edinburgh Postnatal Depression Scale[1] (EPDS)

Name: _____ Address: _____

Your Date of Birth: _____ _____

Baby's Date of Birth: _____ Phone: _____

As you are pregnant or have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt **IN THE PAST 7 DAYS**, not just how you feel today.

Here is an example, already completed.

I have felt happy:
- ☐ Yes, all the time
- ☒ Yes, most of the time — This would mean: "I have felt happy most of the time" during the past week.
- ☐ No, not very often — Please complete the other questions in the same way.
- ☐ No, not at all

In the past 7 days:

1. I have been able to laugh and see the funny side of things
   - ☐ As much as I always could
   - ☐ Not quite so much now
   - ☐ Definitely not so much now
   - ☐ Not at all

2. I have looked forward with enjoyment to things
   - ☐ As much as I ever did
   - ☐ Rather less than I used to
   - ☐ Definitely less than I used to
   - ☐ Hardly at all

*3. I have blamed myself unnecessarily when things went wrong
   - ☐ Yes, most of the time
   - ☐ Yes, some of the time
   - ☐ Not very often
   - ☐ No, never

4. I have been anxious or worried for no good reason
   - ☐ No, not at all
   - ☐ Hardly ever
   - ☐ Yes, sometimes
   - ☐ Yes, very often

*5 I have felt scared or panicky for no very good reason
   - ☐ Yes, quite a lot
   - ☐ Yes, sometimes
   - ☐ No, not much
   - ☐ No, not at all

*6. Things have been getting on top of me
   - ☐ Yes, most of the time I haven't been able to cope at all
   - ☐ Yes, sometimes I haven't been coping as well as usual
   - ☐ No, most of the time I have coped quite well
   - ☐ No, I have been coping as well as ever

*7 I have been so unhappy that I have had difficulty sleeping
   - ☐ Yes, most of the time
   - ☐ Yes, sometimes
   - ☐ Not very often
   - ☐ No, not at all

*8 I have felt sad or miserable
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Not very often
   - ☐ No, not at all

*9 I have been so unhappy that I have been crying
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Only occasionally
   - ☐ No, never

*10 The thought of harming myself has occurred to me
   - ☐ Yes, quite often
   - ☐ Sometimes
   - ☐ Hardly ever
   - ☐ Never

Administered/Reviewed by _____ Date _____

[1]Source: Cox, J.L., Holden, J.M., and Sagovsky, R. 1987. Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry* 150:782-786 .

[2]Source: K. L. Wisner, B. L. Parry, C. M. Piontek, Postpartum Depression N Engl J Med vol. 347, No 3, July 18, 2002, 194-199

The Happiness Thermometer

M. Fordyce

Part 1 Directions: Use the list below to answer the following question: IN GENERAL, HOW HAPPY OR UNHAPPY DO YOU USUALLY FEEL? Check the one statement below that best describes your average happiness.

10. Extremely happy (feeling ecstatic, joyous, fantastic!) □
9. Very happy (feeling really good, elated!) □
8. Pretty happy (spirits high, feeling good.)□
7. Mildly happy (feeling fairly good and somewhat cheerful.) □
6. Slightly happy (just a bit above neutral.)□
5. Neutral (not particularly happy or unhappy.) □
4. Slightly unhappy (just a bit below neutral.) □
3. Mildly unhappy (just a little low.) □
2. Pretty unhappy (somewhat “blue”, spirits down.) □
1. Very unhappy (depressed, spirits very low.) □
0. Extremely unhappy (utterly depressed, completely down.) □

The Positive and Negative Affect Schedule

Watson et al., 1988

PANAS Questionnaire
This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what the extent you have felt this way over the past week.**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a bit	Extremely

_____1. Interested

_____2. Distressed

_____3. Excited

_____4. Upset

_____5. Strong

_____6. Guilty

_____7. Scared

_____8. Hostile

_____9. Enthusiastic

_____10. Proud

_____11. Irritable

_____12. Alert

_____13. Ashamed

_____14. Inspired

_____15. Nervous

_____16. Determined

_____17. Attentive

_____18. Jittery

_____19. Active

_____20. Afraid

The Satisfaction with Life Scale
E. Diener

DIRECTIONS: Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number in the line preceding that item. Please be open and honest in your responding.

1 = Strongly Disagree
2 = Disagree
3 = Slightly Disagree
4 = Neither Agree or Disagree
5 = Slightly Agree
6 = Agree
7 = Strongly Agree

_____1. In most ways my life is close to my ideal.
_____2. The conditions of my life are excellent.
_____3. I am satisfied with life.
_____4. So far I have gotten the important things I want in life.
_____5. If I could live my life over, I would change almost nothing.

SELF-EVALUATION QUESTIONNAIRE STAI Form Y-1

Please provide the following information:

Name_____Date_____S_____

Age_____ Gender (*Circle*) **M** **F** T_____

DIRECTIONS:

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

Appendix 2.7 – Demographic Questionnaire

Demographic Information

Fit the inclusion criteria?	Yes No
Allocated Participant Number:	

Part 1

Name: _____

Address: _____

Post Code: _____Phone number: _____

Would you like to receive a copy of the lay summary at the end of the research study?

Yes [ ] No [ ]

Part 2

- Age: ____
- Marital Status (please circle): Single Co-habiting Married Divorced Other

  (please specify): _____
- Ethnic origin (please tick)

White	[ ]	Black or Black British	[ ]
Mixed	[ ]	Chinese or other ethnic group	[ ]
Asian or Asian British	[ ]	Prefer not to say	[ ]

Other (please specify): _____

- Working status prior to maternity leave: (please tick)

Unemployed	[ ]
Employed part-time	[ ]
Employed full-time	[ ]

If employed, please state job title: _____

- Combined house-hold income: _____ Prefer not to say [ ]

- Highest educational attainment (please tick):

No formal qualification [ ]

High school qualifications [ ]

Undergraduate degree [ ]

Post-graduate degree [ ]

Prefer not to say [ ]

- Smoking status (please tick): Smoker [ ] Non-smoker [ ]
- Is this your first child (please tick): Yes [ ] No [ ]
- If no, please state how many biological children you have (excluding the new-born baby):_____
- How did you feed your other children:

N/A: [ ]

Child # 1: _____

Child # 2: _____

Child # 3: _____

- Was the current pregnancy (please tick): Planned [ ] Unplanned [ ]
- Did you have any complications with the most recent pregnancy: No [ ] Yes [ ]

If yes, please describe (e.g. gestational diabetes, preeclampsia, anaemia, foetal problems, etc.)__

_____

_____

- Did you have any complications with the birth: No [ ] Yes [ ]

If yes, please describe (e.g. *meconium aspiration*, *prolapsed cord, C-section* etc.):

_____

_____

- What was your intended feeding method:

Breastfeeding exclusively [ ]

Formula-feeding exclusively [ ]

Breast & formula feeding [ ]

- What was your feeding method at birth:

Breastfeeding exclusively [ ]

Formula-feeding exclusively [ ]

Breast & formula feeding [ ]

- What is your current feeding method (at the time of completing the questionnaire):

Breastfeeding exclusively [ ]

Formula-feeding exclusively [ ]

Breast & formula feeding [ ]

- If you initiated breastfeeding, but then weaned onto , what age was your baby (in weeks) when this happened? _____

- If you initiated breastfeeding, but then weaned onto formula-feeding, what were you reasons for doing this:

Infant not gaining enough weight [ ]

Sore/cracked nipples [ ]

Mastitis [ ]

Latching difficulties [ ]

Time constraints [ ]

Little support from partner/family [ ]

Others (please specify): _____

_____

- How many times does your baby usually wake up between 10 pm and 6 am:

Not at all [ ]

Once [ ]

Twice [ ]

More than 3 times [ ]

- Approximately how many hours of sleep have you had in a typical 24 hour period, over the past week:

8 hours or more [ ]

Between 6 and 8 hours [ ]

Between 4 and 6 hours [ ]

Between 0 and 4 hours [ ]

- In general, how often do you feel fatigued or tired:

Never [ ]

Rarely [ ]

Occasionally [ ]

Often [ ]

Very often [ ]

- Baby's date of birth: _____

- Date when you completed the questionnaires: _____

Appendix 2.8: Summary of Normality Tests

Table 1: Summary of Normality Tests for Demographic and Outcome Variables

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	DF	Significance	Statistic	DF	Significance
Variable	**Feeding Group**						
Income	Breast	0.194	22	0.031*	0.820	22	0.001*
	Formula	0.156	7	0.200	0.963	7	0.842
	Weaned	0.127	18	0.200	0.924	18	0.152
Happiness Thermometer	Breast	0.314	26	0.000*	0.737	26	0.000*
	Formula	0.433	20	0.000*	0.594	10	0.000*
	Weaned	0.452	22	0.000*	0.561	22	0.000*
PANAS (positive)	Breast	0.123	26	0.200	0.968	26	0.569
	Formula	0.170	10	0.200	0.938	10	0.526
	Weaned	0.151	22	0.200	0.933	22	0.145
PANAS (negative)	Breast	0.137	26	0.200	0.925	26	0.059
	Formula	0.327	10	0.003*	0.743	10	0.003*
	Weaned	0.139	22	0.200	0.941	22	0.211
STAI	Breast	0.117	26	0.200	0.938	26	0.122
	Formula	0.166	10	0.200	0.909	10	0.274
	Weaned	0.091	22	0.200	0.953	22	0.367
EPDS	Breast	0.110	26	0.200	0.943	26	0.154
	Formula	0.371	10	0.000*	0.673	10	0.000*
	Weaned	0.169	21	0.122	0.936	21	0.180
SWLS	Breast	0.285	26	0.000*	0.698	26	0.000*
	Formula	0.170	8	0.200	0.969	8	0.893
	Weaned	0.222	22	0.006*	0.860	22	0.005*

Abbreviations: PANAS – Positive and Negative Affect Schedule; STAI – State Trait Anxiety Inventory; EPDS – Edinburgh Post-Natal Depression Scale; SWLS – Satisfactions with Life Scale; *deviation from normality.

DOCTORATE OF CLINICAL PSYCHOLOGY

Major Research Project Proposal

Infant Feeding Methods and Mother's Psychological Well-Being

Abstract

Background: Existing literature has reported inconsistencies on how feeding methods impacts on the psychological wellbeing of mothers. Generally studies have produced three findings: 1) breastfeeding mothers experience more psychological distress, 2) formula feeding mothers experience more psychological distress, and 3) no difference has been found. Methodological limitations, including classification of feeding method, the use of unsuitable measures, assessing psychological health at wide ranging time-points and under-powered studies preclude any definite conclusions being made.

Aim: Due to inconsistencies in the literature the present study aims to develop a better understanding of how different feeding methods impact upon the psychological health of mothers.

Methods: Sixty-three women, with a biological child between eight weeks and six months will be recruited from health visitor clinics and poster advertising. Participants will be assigned to either 1) breastfeeding exclusively, 2) formula feeding exclusively, or 3) formula feeding following weaning from breast group, depending on their feeding method. Participants will complete five questionnaires to assess their psychological health and distress, including the Satisfaction with Life Scale, Happiness Thermometer, Positive and Negative Affect Schedule, State-Trait Anxiety Inventory and the Edinburgh Post-Natal Depression Scale.

Applications: The study will add to the research and make it clearer how feeding methods can impact on the psychological health of mothers. It is important to know if any feeding practice is associated with higher risk of psychological distress as maternal mental illness

can have a negative impact on an infant's development. The information could then be used to develop strategies to help at risk mothers and infants.

Introduction

Initiation of breastfeeding

Studies have found that women make feeding decisions either before falling pregnant or very early on in their pregnancy (Dix, 1991; Bailey and Sherriff, 1993; Earle, 2000). Qualitative research undertaken by Schmied and colleagues (Schmied & Barclay, 1999; Schmied, Sheehan & Barclay 2001) reported that most women report a desire to breastfeed and view it as important to their identity as a new mother. Initiation and maintenance rates of breastfeeding vary greatly internationally (World Health Organisation, 2003). In 2010 the initiation incidence of breastfeeding in the UK was 74.3%, with prevalence of breastfeeding at six to eight weeks dropping to 45.6% (NHS Information Centre, 2011). Breastfeeding rates in Glasgow have been found to be much lower, with only 26.5% of infants in the Greater Glasgow and Clyde (GG&C) health board being exclusively breastfed at six to eight weeks (Breast Feeding Statistics, ISD 2011). Table 1 illustrates the feeding methods of mothers in Greater Glasgow & Clyde at the First Visit appointment and the six to eight week review.

First Visit (approximately 10 days post-partum)			**6-8 Week Review**		
Exclusive Breastfeeding	**Mixed Feeding (breast milk and formula milk)**	**Formula Fed**	**Exclusive Breastfeeding**	**Mixed Feeding (breast milk and formula milk)**	**Formula Fed**
36.3%	10.5%	53.2%	26.5%	10.6%	62.9%

Table 1: Percentage of feeding methods at 10days and 6-8 weeks after birth.

Differences have been observed in women who intend to breastfeed compared to those who bottle feed. Infants are more likely to be breastfed if they are born to white, older, wealthier, more educated women who have worked at least part-time during pregnancy (Arora, McJunkin, Wehrer & Kuhn, 2000; Hendershot, 1984). Conversely, being young, working class and being poor are factors associated with women who bottle feed from birth (Stein, Cooper, Day & Bond, 1987). In addition to this, there are also biomedical factors that may affect the infant's ability to suckle, such as congenital lip, mouth and oesophageal defects, and prematurity (Ford & Laccok, 1990). In these cases, even if the women had desired to breastfeed they may not be able to; however, these complications do not prevent the use of a breastpump to express milk.

Health psychology models, such as the Theory of Planned Behaviour (Ajzen, 1991) may help to explain why there is a significant decrease in the initial rates of breastfeeding; the model can also account for why differences are observed in who decides to breastfeed. The theory proposes that behavioural intention is a function of four independent variables, namely, attitudes, subjective norms, perceived control and self-efficacy. In a study undertaken by Giles and colleagues (2007; Giles, Connor, McClenahan, Mallett, Stewart-Knox & Wright) it was reported that variables such as health factors (attitudes), other people's opinions (normative beliefs) and social factors, such as breastfeeding not being fashionable (control beliefs) all impacted on young people's attitudes towards breastfeeding (for further details see appendix 1).

It has been found that early termination of breastfeeding has been associated with depressive disorders, low social class, being young, and lower educational attainment (Cooper, Murray & Stein, 1993). Other physical, social and psychological reasons for the

cessation of breastfeeding can be found in table 3 (appendix 2). Qualitative research has demonstrated mixed findings on the subjective maternal experience of breastfeeding and weaning. Some mothers describe breastfeeding as a rewarding and pleasurable experience, while others find it distressing and unpleasant (Schmeid et al., 1999). When mothers weaned their babies from breast to bottle most expressed feelings of disappointment, guilt, failure, and that they were a 'bad mother.'

Psychological Health

The psychological wellbeing of breast and formula feeding mothers has not been reported consistently in the literature; some studies state that breastfeeding mothers report being calmer, less anxious, and less stressed than their formula feeding counterparts (Wisenfield, Malatesta, Whitman, Granrose & Uili, 1985; Mezzacappa, Guethlein, Nelson-Vaz & Bagiella, 2000). Other research has reported higher levels of depression in breastfeeding mothers than those who have weaned their baby (e.g. Alder & Cox, 1983, Cooper et al., 1993). This finding has been reputed by others who have found that weaning is associated with increases in symptoms and occurrences of panic, anxiety, depression, psychosis, mania and obsessionality in mothers (Susman & Katz, 1988; Cowley & Roy-Byrne, 1989; Klein, Skrobala & Garfinkel, 1995). The inconclusive findings are owing to methodological limitations of the studies undertaken; many studies have failed to differentiate between current and past breast-feeders', and those who formula fed from birth (Mezzacappa et al., 2000). The psychological health of mothers has been measured at very different time periods after birth, ranging from five to 208 weeks (Mezzacappa et al., 2000). Some studies have used unsuitable measures for postnatal mothers. For instance the Beck Depression Inventory (Beck, 1996), is a widely used instrument for measuring the severity of depression;

however, normal postnatal changes such as sleep disturbance may be misinterpreted as depression and consequently misinterpret the actual amount of psychological distress in samples. A study undertaken by Wilkinson and Scherl (2006) attempted to correct for methodological flaws of previous studies by differentiating between current and past breast-feeders and using a smaller time period to measure psychological health (four to six months) of postnatal mothers. In their study they reported that there were no differences on measures of psychological health and distress between breast- and formula feeding mothers. In Wilkinson et al's (2006) study, breastfeeding mothers included those who breastfed exclusively or partially (i.e. formula milk supplementation), therefore, as there was an overlap in the groups, perhaps this contributed to no differences being found in relation to their psychological wellbeing. A summarised description of the previous literature can be found in appendix 3; this demonstrates that research undertaken has predominately been cross-sectional in design, with total sample sizes ranging from 55 – 99 women. It also highlights inconsistencies in feeding classification and the range of different time periods in which mothers psychological health was measured.

Aims and Hypothesis

A review of the literature exploring the psychological health of breast and formula feeding mothers produced inconsistent findings. Appendix 3 illustrates that from some research breastfeeding is associated with increased risk of psychological distress, whilst at other times fewer negative psychological symptoms have been reported. The different methods and measures used, under-powered studies, and inconsistent feeding classifications preclude any definite conclusions being made. It is therefore the aim of the current study to develop a better understanding of psychological health and maternal feeding practices, of

mothers who have i) breastfed exclusively from birth , ii) formula-fed exclusively from birth, and iii) formula fed after weaning from breast. These three groups have been selected to reduce the amount of overlap between groups i and ii, as it is argued that the breastfeeding group (composed of breastfeeding exclusively and combination feeding) in Wilkinson's (2006) study may have contributed to no differences being found in psychological health of mothers who breastfed and formula –fed their infants. Additionally, mothers will be assessed at a common time period after the baby's birth (from eight weeks until solid food has been introduced), using a more appropriate definition and measurement of psychological health for this population. It is hypothesised that any differences found will be in the group of mothers who weaned onto the bottle after initially trying to breastfeed, with this group showing higher levels of psychological distress.

Plan of Investigation

Participants

A total of 63 participants will be recruited for the study, with 21 participants for each group.

Inclusion Criteria

Only female participants with a biological child between the ages of eight weeks to approximately six months will be recruited for the study. Only full term infants (born between 37-42 weeks) will be eligible for the study, as feeding difficulties are common amongst premature babies. Mothers will be recruited if they are 18 years of age or older (the minimum age limit has been set to make issues around consent straight forward). No limit will be set on the number of children that mothers have; mothers who have a partner (including husband, different sex partner, same sex partner) and single mothers will be

included in the study. All socio-economic groups will be eligible to participate in the research.

Exclusion Criteria

Mothers who have a non-biological child will not be able to participate in the study; nor will mothers who both breastfeed and supplement with formula feeding. Premature infants, or infants with congenital deficits (such as lip, mouth, or oesophageal abnormalities) which may impact upon feeding will be excluded, as this group will be more prone to feeding difficulties. Any mothers who have a formal diagnosis of depression or postnatal depression will be excluded from the study, as this study wishes to examine the impact of feeding methods and psychological health within the general population. A further study would be required to examine feeding status and psychological health in this subgroup of women with a clinical diagnosis.

It is acknowledged that factors such as being a single parent, coming from a low socio-economic background, having a chronic illness or disability will impact on psychological wellbeing rather than just feeding practices. It has been decided that these groups of mothers will still be eligible to participate to maximise recruitment to the study, however, these factors will be included as covariates in the analysis.

Recruitment Procedures

With the approval from Children's Service Managers the researcher will attend the waiting area of health visitor clinics, i.e. six to eight week reviews, immunisation clinics, weight

check clinics and the baby clinic, to approach potential mothers and inform them about the research. Potential participants will be provided with written information about the study; if they are agreeable to participating they will first have to complete a consent form. The signed consent form will seek to confirm that participants 1) have read the participant information sheet and had the opportunity to ask questions, 2) know their participation is voluntary and can be withdrawn at any time without giving a reason, 3) agree to take part in the study and 4) agree to provide their GP's contact details before taking part, with the purpose of informing their GP that they have taken part in the study and note concerns if mental health issues are raised. Following signing the consent form participants will be given a research pack. The research pack will contain the questionnaires, a booklet on common psychological difficulties experienced postnatally, and sign posting to relevant services if there are any concerns. Individuals who participate will be asked to inform other new mothers of the study, with the aim of getting them to opt into the study if interested (snowball sampling method).

Participants will also be recruited via posters advertising the study which will be placed in GP surgeries, ante-natal clinics, parent-craft classes, breastfeeding support groups, and mother and baby groups (i.e. baby massage, bounce and rhyme/rhyme time), with permission from the appropriate people (e.g. GP practice manager). The study will also be advertised on parenting websites (e.g. baby centre) with permission from the moderators. Whilst in hospital, all new mothers receive a bounty pack; therefore permission will be sought to place and information on the research in this pack. Before these participants can take part they will be required to initially contact the research team for further information and to provide informed consent (informed consent for these participants is the same as

above). When questionnaire packs are posted to potential participants, a numeric identifier will be noted on each questionnaire to ensure that the participant can be identified by the research team and information can be passed onto the GP if completed questionnaires raise any concerns. A covering letter will be provided with the questionnaire pack to highlight telephone support to complete the questionnaires if needed. It is not possible for the researcher to offer home visits as this would not be approved by the University.

Measures

Data will be collected via a questionnaire booklet (appendix 4) which will consist of several self-report questionnaires measuring psychological health and distress. Psychological health and wellbeing will be operationalised through measures of general life satisfactions, happiness, and positive affect, while psychological distress will be operationalised via measures of anxiety, depression and negative affect.

Psychological Health and Wellbeing

Life satisfaction will be measured with the Satisfaction with Life Scale (SWLS) (Diener, Emmons, Larson & Griffin 1985). This is a five-item measure that asks for a subjective judgement of 'global life satisfaction (e.g. In most ways my life is close to my ideal') on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). A total life satisfaction score is created by summing responses on items and can range from 5 to 35. Diener et al. (1985) report good internal consistency (co-efficient $\alpha = 0.87$) and test-retest reliability ($r=0.82$) for the scale.

Happiness will be assessed through a version of the Happiness Thermometer (Fordyce, 1988). This single-item measure asks for a subjective judgement of happiness over the past week on a 10-point thermometer ranging from 1 (extremely unhappy: utterly depressed, completely down) though to 10 (extremely happy: feeling ecstatic, joyous, fantastic). Previous research has shown good stability over time (test-retest r=0.81 for a one month period) for this measure and a high degree of construct validity.

Positive and negative affect will be measured with the Positive and Negative Affect Schedule (PANAS) (Watson, Clark & Tellegen 1988). This scale consists of 20 adjectives describing the way people feel. Ten items represent positive affect (PA) (e.g. interested, excited, strong) and 10 items represent negative affect (NA) (e.g. distressed, upset, guilty). Respondents rate the extent to which they have felt each feeling or emotion within the past week on a 5-point scale from 1 (very slightly or not at all) through to 5 (extremely). Totals are created by summing scores on defined items and range from 10 to 50. Watson et al. (1988) have reported sound internal reliability for both scales (PA: coefficient $\alpha = 0.86$; NA coefficient $\alpha = 0.84$.

Psychological Distress

Anxiety will be assessed with the state anxiety scale of the State-Trait Anxiety Inventory Form (STAI) (Spielberger, 1983). This 20-item scale asks respondents to indicate how they feel 'right now' (e.g. calm, tense) on a 4-point scale ranging from 1 (not at all) to 4 (very much so). Summing responses creates a total score that can range from 20 to 80. The STAI has been reported as being internally consistent in previous research (coefficient $\alpha = 0.87$) (Spielberger, 1983).

Depression will be assessed using the Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden & Sagovsky, 1987). This scale was selected to minimise the likelihood of normal postnatal physiological changes being misinterpreted as signs of depression in postpartum women. This 10-item measure asks women to indicate the response that most closely represents how they have felt in the past week. Responses to statements (e.g. 'I have been able to laugh and see the funny side of things') are scored on a 4-point scale from 0-3. A total depression score is created by summing responses on items (seven of which are reverse scored) and can range from 0-30. Cox et al. (1987) report good internal consistency (coefficient $\alpha = 0.87$) for the scale.

A search of the literature has revealed that the EPDS (Cox et al., 1987) and the PANAS (Watson et al. 1988) have been used previously in research investigating psychological health in breastfeeding mothers (Cooper et al. 1993; Mezzacapa et al. 2002).

Design

This study will take a cross-sectional design investigating psychological health between 3 groups of mothers using different feeding methods (i.e. breastfeeding exclusively, formula feeding exclusively, and formula feeding following weaning from breast).

- Independent variable: Feeding method.
- Dependent variable: Scores on the psychological health measures.

Research Procedures

Women who meet the inclusion criteria and who consent to take part in the study will be provided with a questionnaire booklet to complete, which can then be returned via post to the researcher. It will take approximately 30 minutes to complete all of the questionnaires.

Data Analysis

SPSS for Windows (Version 18) will be used for the analyses:

- Analysis 1: This analysis will assess whether there are any differences in breastfeeding, formula feeding, and weaned to formula feeding mothers in terms of demographics (see appendix 6, questions 1-10 inclusive, for information to be collected).

- Analysis 2: The second analysis will look at pregnancy, birth and feeding related characteristics of the participants in the sample (see appendix 6, questions 10-15 inclusive, for information to be collected.

- Analysis 3: This analysis will look at group differences; linear regression will be used to analyse the data, which will take into account all the explanatory variables in the study. This will be undertaken to determine if there are any differences on the measures of psychological wellbeing and distress depending on feeding method.

Justification of Sample Size

A preliminary study examining psychological health in mothers recruited 36 breastfeeding participants and 24 formula feeding participants (Wilkinson et al. 2006) and found no significant difference between the two groups. The study also aimed to recruit mothers

who formula fed from birth but were unable to do so. It is noted that this research was undertaken in Australia, who have a high breastfeeding initiation rate of 81.8% (Donath & Amir, 2000), which is likely to have contributed to their difficulty in recruiting a formula feeding group. The effect size calculated for state anxiety was 0.09, with power calculated as 0.81. Wilkinson and colleague (2006), concluded that the effects of psychological health may be more subtle and smaller than the literature previously suggested, therefore to detect smaller effect sizes it was recommended that future studies recruit larger sample sizes.

The sample size for the current study is based on 3 groups: mothers who breastfeed exclusively, mothers who formula-feed exclusively and mothers who formula-feed after weaning from breast. Assuming equal numbers of participants per group and a two-sided 5% Type I error rate and 80% power a sample of 21 participants per group is needed to detect a difference in the Edinburgh Postnatal Depression Scale between the groups with a standard deviation of 4 points, using a one-way ANOVA test.

In 2010, there were 14,106 births recorded within the Greater Glasgow and Clyde Health Board. Between 1991 and 2010 there has been an average of 14,267 births per year, meaning that <1% of this population will be recruited for the study.

Settings and Equipment

Participants can fill in the questionnaires in their own homes; therefore the equipment needed is the questionnaires, envelopes and freepost.

Health and Safety Issues

Researcher Safety Issues

The researcher may be visiting NHS and council run sites to recruit participants; the researcher will work within the usual remit of placement procedures. The researcher will notify colleagues before any visits and will return to the designated clinical base after all visits.

Participant Safety Issues

As psychological distress is being examined in the study, completion of the questionnaires may highlight the presence of anxiety or depression (psychological distress). If questionnaire scores indicate risk for the mother or the child, her GP will be informed, who can then offer an assessment. An information sheet with common psychological difficulties experienced post-natally will also be included in the research pack. This sheet also contains contact details for appropriate services and help lines, in case participants have concerns of their own that they would like support with.

Ethical Issues

Ethical approval will be sought from NHS GG&C Research Ethics Committee.

Before partaking in the research, informed consent will be sought from the participants by asking them to sign a consent form. All participants will be given information about the study, and will be informed that they can drop out of the study at any time without giving a reason. For individuals who do take part in the study their data will be kept confidential; all data will be anonymised.

Financial Issues

It has been proposed that five questionnaires will be used in this study, with a sample size of 63 women. Of the questionnaires four of them are in the public domain (Satisfaction with Life Scale; Happiness Thermometer; Positive and Negative Affect Schedule; & Edinburgh Postnatal Depression Scale), while the State Trait Anxiety Inventory needs to be purchased (approximately $150, converts to £94). Alternatively, the minimum number of record forms which can be purchased is packs of 50 forms (costing $100, converts to £63); further packs could be purchased depending on uptake to the study.

If the STAI cannot be purchased, measures such as the Hamilton Anxiety Rating Scale (Hamilton, 1959), or the anxiety subscale of the Depression Anxiety Stress Scales (Crawford & Henry, 2003) could be used instead; both within the public domain.

Costs will also be incurred in producing posters for recruitment, printing information sheets, consent forms and questionnaires, posting surveys, freepost envelopes to return forms and travel to the different sites to recruit participants, however, travel expenses will be claimed within the normal remit of placement procedures.

Timetable

The proposed study will be submitted for ethical approval in June of 2013; if approval is obtained recruitment of participants will commence in July and will run until September 2013. October and November of 2013 will be used to analysis the results and to write up the findings from the study.

Practical Applications

If the hypothesis is accepted, that more psychological distress will be experienced by women who wean onto formula feeding following initial attempts of breastfeeding, this may suggest that some input is needed for these mothers to successfully manage this transition without causing abnormal psychological distress. It may be that midwives will monitor this group of mothers more closely, or that support groups could be set up for these mothers to help promote their psychological health. Additionally, these mothers could be signposted to baby massage groups in order to provide another form of close skin-to-skin contact with their child. Previous research (Glover, Onozawa, & Hodgkinson, 2002; Onozawa, Glover, Adams, Modi & Kumar, 2001) observed improved maternal mood, among mothers attending an infant massage class.

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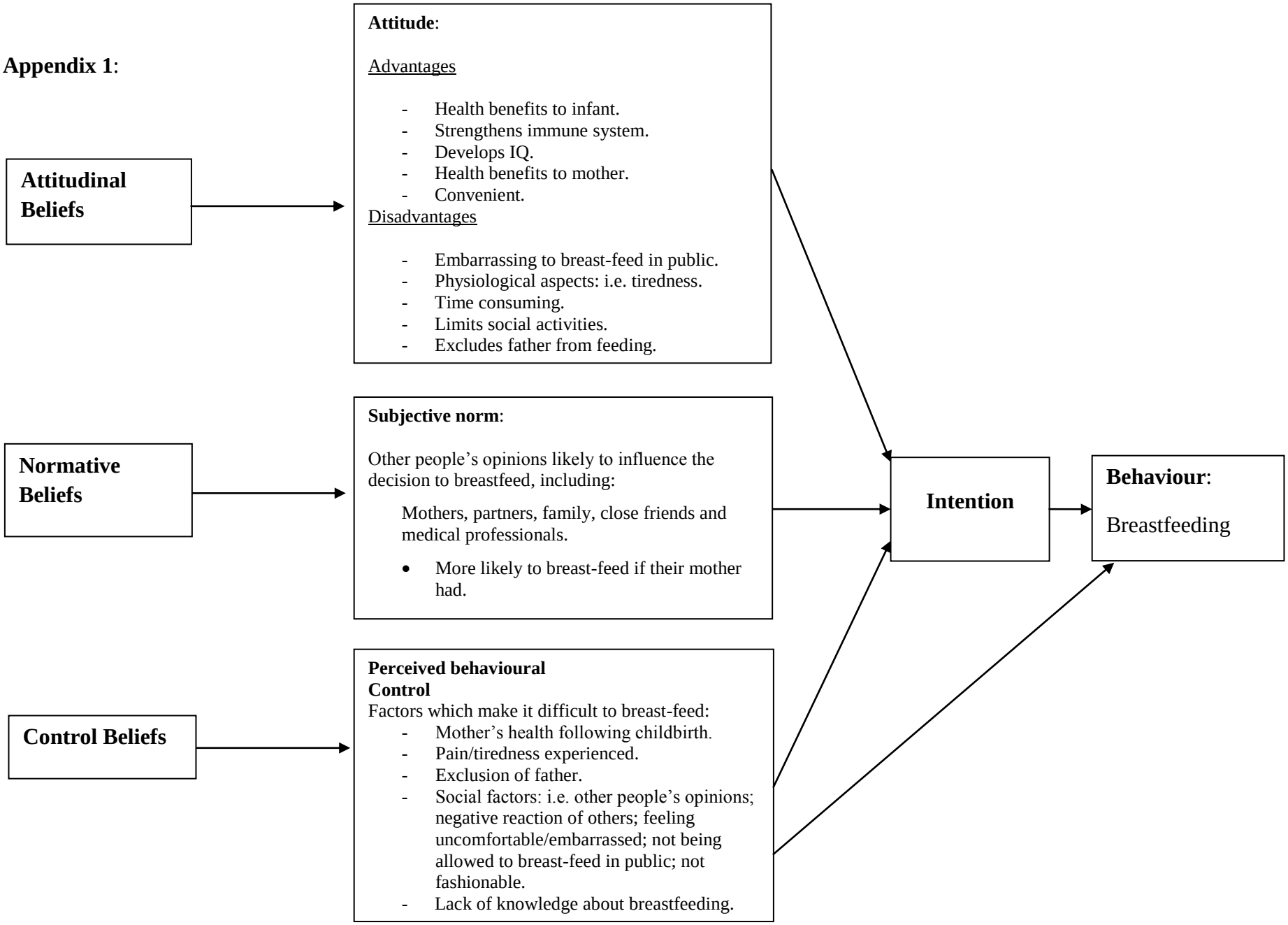
Appendix 1:


Attitudinal Beliefs
Normative Beliefs
Control Beliefs
Attitude:
Advantages
Health benefits to infant.
Strengthens immune system.
Develops IQ.
Health benefits to mother.
Convenient.
Disadvantages
Embarrassing to breast-feed in public.
Physiological aspects: i.e. tiredness.
Time consuming.
Limits social activities.
Excludes father from feeding.
Subjective norm:
Other people's opinions likely to influence the decision to breastfeed, including:
Mothers, partners, family, close friends and medical professionals.
More likely to breast-feed if their mother had.
Perceived behavioural Control
Factors which make it difficult to breast-feed:
Mother's health following childbirth.
Pain/tiredness experienced.
Exclusion of father.
Social factors: i.e. other people's opinions; negative reaction of others; feeling uncomfortable/embarrassed; not being allowed to breast-feed in public; not fashionable.
Lack of knowledge about breastfeeding.
Intention
Behaviour:
Breastfeeding

Appendix 2:

Early Termination of Breast-feeding

Physical	Social	Psychological
Sore nipples	Breastfeeding interfering with mother's lifestyle	Depression
Insufficient milk production	Wanting someone else to feed infant	
Infant's breastfeeding difficulty	Wanting to leave the infant for several hours at one time point	
Infant's dissatisfaction with breast milk alone	Household chores	
	Lower social class	
	Unplanned pregnancy	
	Negative attitudes of partners, family members and health care professionals.	

Table 3: Factors associated with the early termination of breastfeeding.

Appendix 3:

Previous Research on Infant Feeding Methods

Authors	Study Methodology	Aim	Total Sample Size	Groups	Measures Completed	Findings (relating to psychological wellbeing)
Alder and Cox, 1983	Cross-sectional (Retrospective)	To investigate the relationship of hormonal variables and Breastfeeding patterns to the frequency of depression in the puerperium (four week period following child birth).	N = 62	1) Total breast-feeders (breastfed fully for at least 12 weeks) (N=29) 2) Partial breast-feeders (breastfed but introduced solids or regular milk feeds before 12 weeks) (N=33).	1-2 years postpartum.	Taking the 'pill' or fully breastfeeding increased risk of being depressed 3-5 months post-partum.
Alder and Bancroft, 1988	Longitudinal (3 time points)	Impact of feeding method on sexuality and mood	N = 87	1) Breastfeeding (breastfed exclusively >7 weeks) (N=60). 2) Artificial feeding (breastfed < 6 weeks) (N=27).	11-23 weeks pre-natally. 3 months postpartum. 6 months postpartum.	Breast-feeders more at risk of postnatal depression.
Romito, 1988.	Longitudinal (4 time points). Quantitative and qualitative	To examine women's experience of first motherhood, including feeding.	N = 44	1) Breast (n=18). 2) Bottle (n=23). 3) Combination (unclear if this was supplemented	Third trimester 3 times after birth, up to 5 weeks post-	Breastfeeding was a difficult experience for many of the mothers and often placed great constraints on mothers.

	methods			with formula, expressed milk, or both) (n=3).	partum.	
Virden, 1988	Cross-sectional	Impact of feeding method on maternal anxiety and mother-infant mutuality	N = 60	1) Breast feeding (n = 33) 2) Bottle feeding (n = 13) 3) Combination (breast and bottle) (n = 14)	4-6 weeks postpartum.	Breast-feeders less anxious than bottle feeders, combination feeders had an anxiety score in between the other two groups.
Mezzacappa, 1997	Cross-sectional	Impact of breastfeeding on psychological variables (mood & stress), and upper respiratory infections.	N = 99	1) Current breast-feeders (n=14). 2) Past (non-current breast-feeders) (n=49). 3) Never breastfed (n=36).	13.79 months postpartum.	Current breast-feeders had fewer psychological symptoms, better mood and lower stress levels. Past breast-feeders had worse mood, stress and greater numbers of psychological symptoms.
Mezzacappa & Katkin 2002	Cross-sectional	Impact of feeding method on subjective stress.	N = 55	1) Breast-feeders (breastfeeding exclusively, n=14, or with formula supplementation, n=14). 2) Bottle-feeders (breastfed in the past, but now were not breastfeeding at all, n=13), or had never breastfed, n=14).	1-12 months postpartum.	Breast-feeders reported significantly less perceived stress compared to bottle feeders. No significant differences in the groups for trait anxiety, anger, or curiosity.
Wilkinson &	Cross-sectional	Impact of feeding method on psychological	N = 60	1) Breastfeeding fully or	4-6 months	No difference was found between breast- and formula

Scherl,2006)		health, maternal attachment, and attachment style.		partially (n=36). 2) Fully formula feeding following weaning (n=24).	postpartum.	feeding mothers in terms of their psychological health.

Appendix 4:

Questionnaire Booklet

The Satisfaction with Life Scale
E. Diener

DIRECTIONS: Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number in the line preceding that item. Please be open and honest in your responding.

1 = Strongly Disagree
2 = Disagree
3 = Slightly Disagree
4 = Neither Agree or Disagree
5 = Slightly Agree
6 = Agree
7 = Strongly Agree

_____1. In most ways my life is close to my ideal.
_____2. The conditions of my life are excellent.
_____3. I am satisfied with life.
_____4. So far I have gotten the important things I want in life.
_____5. If I could live my life over, I would change almost nothing.

The Happiness Thermometer

M. Fordyce

Part 1 Directions: Use the list below to answer the following question: IN GENERAL, HOW HAPPY OR UNHAPPY DO YOU USUALLY FEEL? Check the one statement below that best describes your average happiness.

20. Extremely happy (feeling ecstatic, joyous, fantastic!) □
10. Very happy (feeling really good, elated!) □
9. Pretty happy (spirits high, feeling good.)□□
8. Mildly happy (feeling fairly good and somewhat cheerful.) □
7. Slightly happy (just a bit above neutral.)□
6. Neutral (not particularly happy or unhappy.) □
5. Slightly unhappy (just a bit below neutral.) □
4. Mildly unhappy (just a little low.) □
3. Pretty unhappy (somewhat "blue", spirits down.) □
2. Very unhappy (depressed, spirits very low.) □
1. Extremely unhappy (utterly depressed, completely down.) □

Part II directions: Consider your emotions a moment further. *On the average*, what per cent of the time do you feel happy? What per cent of the time you feel unhappy? What per cent of the time do you feel neutral (neither happy nor unhappy)? Write down your best estimates, as well as you can, in the spaces below. Make sure the 3 figures add-up to 100%.

ON THE AVERAGE:

The per cent of time I feel happy _____%

The per cent of the time I feel unhappy_____ %

The per cent of the time I feel neutral_____%

Total: 100%

The Positive and Negative Affect Schedule

Watson et al., 1988

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure).**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a bit	Extremely

_____1. Interested	_____11. Irritable
_____2. Distressed	_____12. Alert
_____3. Excited	_____13. Ashamed
_____4. Upset	_____14. Inspired
_____5. Strong	_____15. Nervous
_____6. Guilty	_____16. Determined
_____7. Scared	_____17. Attentive
_____8. Hostile	_____18. Jittery
_____9. Enthusiastic	_____19. Active
_____10. Proud	_____20. Afraid

Appendix 6:

Demographic Information

Fit the inclusion criteria?	Yes No
Allocated Participant Number:	

Part 1

Name: _____

Address: _____

Post Code: _____Phone number: _____

Would you like to receive a copy of the lay summary at the end of the research study?

Yes [ ] No [ ]

Part 2

- Age: ____
- Marital Status (please circle): Single Co-habiting Married Divorced Other

  (please specify): _____
- Ethnic origin (please tick)

White	[ ]	Black or Black British	[ ]
Mixed	[ ]	Chinese or other ethnic group	[ ]
Asian or Asian British	[ ]	Prefer not to say	[ ]

Other (please specify): _____

- Working status prior to maternity leave: (please tick)

Unemployed	[ ]
Employed part-time	[ ]
Employed full-time	[ ]

If employed, please state job title: _____

- Combined house-hold income: _____ Prefer not to say [ ]

- Highest educational attainment (please tick):

No formal qualification [ ]

High school qualifications [ ]

Undergraduate degree [ ]

Post-graduate degree [ ]

Prefer not to say [ ]

- Smoking status (please tick): Smoker [ ] Non-smoker [ ]

- Is this your first child (please tick): Yes [ ] No [ ]

- If no, please state how many biological children you have: _____

- How did you feed your other children:

N/A: [ ]

Child # 1: _____

Child # 2: _____

Child # 3: _____

- Was the current pregnancy (please tick): Planned [ ] Unplanned [ ]

- Did you have any complications with the most recent pregnancy: No [ ] Yes [ ]

If yes, please describe (e.g. gestational diabetes, preeclampsia, anaemia, foetal problems, etc.)__

_____

_____

- Did you have any complications with the birth: No [ ] Yes [ ]

If yes, please describe (e.g. *meconium aspiration*, *prolapsed cord, C-section* etc.):

_____

_____

- What was your intended feeding method:

Breastfeeding exclusively [ ]

Formula-feeding exclusively [ ]

Breast & formula feeding [ ]

- What was your feeding method at birth:

Breastfeeding exclusively [ ]

Formula-feeding exclusively [ ]

Breast & formula feeding [ ]

- What is your current feeding method (at the time of completing the questionnaire):

Breastfeeding exclusively [ ]

Formula-feeding exclusively [ ]

Breast & formula feeding [ ]

- If you initiated breastfeeding, but then weaned onto formula feeding, what age was your baby (in weeks) when this happened? _____

- If you initiated breastfeeding, but then weaned onto formula feeding, what were you reasons for doing this:

Infant not gaining enough weight [ ]

Sore/cracked nipples [ ]

Mastitis [ ]

Latching difficulties [ ]

Time constraints [ ]

Little support from partner/family [ ]

Others (please specify): _____

_____

- Baby's date of birth: _____

- Date when you completed the questionnaires: _____

Appendix 7:

Lay Summary

Background

Feeding a young infant is a large role undertaken by a new mother, yet research has reported inconsistent findings on how the chosen feeding method (breast or formula feeding) affects the psychological wellbeing of the mother. Generally studies have produced three different findings: 1) breastfeeding mothers experience more psychological distress (depression/anxiety), 2) formula feeding mothers experience more psychological distress, and 3) no difference has been found. Additionally, studies have also reported that higher levels of depression are seen in breastfeeding mothers compared to those who have weaned their child onto formula milk, and the opposite has also been reported.

Aims

Due to inconsistencies in the existing research this study aims to develop a better understanding of how different feeding methods impact upon the psychological health of mothers.

Methods

This research will look at three difference feeding practices: 1) breastfeeding exclusively, 2) formula feeding exclusively, and 3) formula feeding after weaning from breastfeeding. The study will include 135 mothers of infants between 4 weeks and 6 months (or until solid food has been introduced). Forty-five women will be assigned to each group depending on what feeding method. Participants will complete 5 questionnaires which measure psychological

wellbeing (life satisfaction, happiness, and positive emotion) and distress (anxiety, depression, and negative affect) which will be completed on one occasion only. It is expected that women who have weaned their babies onto formula milk will experience more psychological distress.

Practical Applications

It is hoped that this study will make it clearer if any feeding method increases the likelihood of psychological distress. It is important to know this as mental health problems in mothers can have a negative impact on infant's development. This information could then be used to develop strategies to help at risk mothers and infants.

Appendix 8:

RESEARCH EQUIPMENT, CONSUMABLES AND EXPENSES

Trainee: Ursula O'Donnell

Year of Course: **2nd** **Intake Year: 2010**

Please complete the list below to the best of your ability:

Item	Details and Amount Required	Cost or Specify if to Request to Borrow from Department
Stationary	Ream of white paper x 1 Envelopes (A4) x 1 boxes	£2.08 £6.42 Total = £8.50
Postage	Freepost x 185	0.45 x 185 Total = £83.25
Photocopying and Laser Printing (includes cost of white paper)	Questionnaires (740) Consent forms (185) Information sheets (370)	740 x 0.08 185 x 0.08 370 x 0.08 Total = £103.60
Equipment and Software	N/A	
Measures	State-Trait Anxiety Inventory. Will need 185, but can initially purchase 1 pack of 50 forms to see uptake to study. STAI manual.	Costs depending on number of forms: 50 forms = £63 **100 forms = £70** 150 forms = £83 200 forms = £101 Borrow STAI manual from department.
Miscellaneous	N/A	

Trainee Signature…… … Date……

Supervisor's Signature …….. Date ……

Chapter 3: Advanced Clinical Practice I, Reflective Account (Abstract)

Developing Skills to Undertake a Robust Risk Assessment:

***Ursula O'Donnell**

Word Count: 2876

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Submitted in part fulfilment of the requirements for the Degree of Doctorate in Clinical Psychology

Abstract

Background: The following reflective account is based upon my experience of working with individuals who pose a risk to others, focusing on my development of carrying out risk assessments and using this information to make complex judgements. In particular I address how I managed to develop professional relationships with incompatible individuals in order to assess risk robustly.

Guidelines: These issues are discussed using best practice guidelines from the Health and Care Professions Council (HCPC; 2012), the Risk Management Authority (RMA; 2006) and available empirical evidence.

Reflection: The account is structured using Kolb's (1984) model of reflection which provides a description of the learning experience, a reflective observation of the experience with the aim of developing an abstract conceptualisation of the situation in order to actively experiment on how to approach future experiences.

Chapter 4: Advanced Clinical Practice II, Reflective Account (Abstract)

Self-disclosure, patient choice and the implications for the service.

***Ursula O'Donnell**

Word Count: 3259

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Submitted in part fulfilment of the requirements for the Degree of Doctorate in Clinical Psychology

Abstract

Background: The following reflective account is based upon my experience of being pregnant whilst working in a maternity and neonatology service. In particular, I address how I managed the emotional and psychological impact of this, how my pregnancy impacted upon therapeutic alliances and the consequences that this has for the service, as well as decisions about self-disclosure.

Guidelines: These issues are discussed using best practice guidelines from the Health and Care Professions Council (HCPC) and the available literature on this subject area.

Reflection: The account is structured using Kolb's (1984) model of reflection which provides a description of the learning experience, and reflective observation of the experience with the aim of developing an abstract conceptualisation of the situation in order to actively experiment on how to approach future experiences.