

# ASSOCIATIONS AND DETERMINANTS OF MOTHER-INFANT QUALITY OF INTERACTIONS IN PORTUGUESE DYADS FROM AZORES

Hélia Soares<sup>1</sup> (hmsoares@outlook.com), Marina Fuertes<sup>2,3</sup>, Sandra Pereira e Maria do Céu Barberi<sup>1</sup>

<sup>1</sup>ICBAS, Universidade do Porto

<sup>2</sup>Centro de Psicologia da Faculdade de Psicologia e Ciências da Educação da Universidade do Porto.

<sup>3</sup>Instituto Politécnico de Lisboa – Escola Superior de Educação/CIED.

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**Abstract:** Bowlby and many other developmental and family theorists stressed that early socialization is a bi-directional, reciprocal, relationship-based process between infant and caregiver (e.g., Brazelton, Koslowski, & Main, 1974; Bronfenbrenner, & Morris, 1998; Harrist, & Waugh, 2002; Bronfenbrenner, 2005). These first relational experiences affect infant development and maternal sensitivity during the first year of life, remaining the best single predictor of infant secure attachment across studies, despite the relatively small effect sizes (e.g., Wolff and van IJzendoorn, 1997). Therefore, we select a rural Portuguese community in Terceira (Azores Island) to investigate the association between mother-infant quality of interaction and infant development, and to identify the determinants of mother-infant quality of interaction. The sample included 86 healthy infants (each of 46 girls, 48 first born) and their mothers. At 11 months, infant development was assessed with Schedule of Growing Skills II (SGS II). To assess mother-infant quality of interaction, the dyads were observed in free play at 12 months using the Crittenden CARE-Index. Maternal sensitivity and infant cooperative behavior were correlated with SGS II global scores and sub-scales (except for Locomotor and Self-care Social). Infant interactive behavior, gestational age and milk feeding predicted maternal sensitivity. Infant cooperative behavior was determined by their number of siblings and mother interactive behavior. This study novelty remains in the fact that parents' choice to feed their infant with bottle milk (cow's milk)

*against medical advice predicted maternal sensitivity. This research presents individual, social and cultural explanations for mother-infant quality of interaction and suggest that early intervention practices may rely on systemic approaches and professionals should attempt to understand families' traditions and their specific culture.*

**Keywords:** *Infant development; Maternal sensitivity; Infant cooperation; Early Intervention.*

## INTRODUCTION

Several development and attachment theorists like Bowlby, Ainsworth, Stern, or Brazelton have emphasized the critical significance of early caregiving relationships in shaping child social and emotional development. According to attachment theory the quality of care provided to the child, particularly parents' sensitivity and responsiveness promotes attachment security (Ainsworth, 1965; Bowlby, 1969/1982). Others found mother-infant attachment quality is associated with children development (Malekpour, 2007; Weinfield, Sroufe, Egeland, & Carlson, 2008; review in Williford, Carter & Pianta, 2016). Yet, less studied is the association between maternal sensitivity and child development.

### Maternal sensitivity as a concept

Ainsworth and her colleagues originally defined maternal sensitivity as the ability to perceive and to accurately interpret the signals and communications implicit in her infant's behavior and, given this understanding, to respond to them appropriately and promptly (Ainsworth, Bell, & Stayton, 1971).

Maternal sensitivity during the first year of life remains the best single predictor of infant secure attachment across studies, despite the relatively small effect sizes. In their meta-analytic review, De Wolff and van IJzendoorn (1997) reported a significant low-to-moderate ( $r = .24$ ) association between maternal sensitivity and mother-infant attachment. Further support for the association between maternal sensitivity and infant secure attachment comes from some indirect evidence showing that secure attachment can be enhanced by promoting maternal sensitivity (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003).

Some argue that the somewhat moderate association between maternal sensitivity and mother-infant attachment results from the operationalization of the sensitivity concept (Beeghly et al., 2010). Many attempts have been made to develop the concept of sensitivity further, but there is a lack of consensus among researchers as to which attributes of maternal behavior are constitutive elements of sensitivity. In their pioneering study, Ainsworth et al. (1971) established four main attributes for assessing maternal sensitivity in early mother-infant interactions: sensitivity, acceptance, cooperation, and accessibility. Infants develop internal working models regarding their caregivers' availability and responsiveness and act according to their interaction-based expectations (Bowlby, 1969/1982; Main, Kaplan, & Cassidy, 1985; Sroufe, & Waters, 1977). Therefore, infants adapt their behavior to parents' responses. In turn, parents read infants' behavior and adjust their own behavior according to how their infants react.

Taken their meta-analytic study, van den Boom (1997) stated that maternal sensitivity reflects a dyadic interaction and therefore is meaningless without the consideration of both partners. Like Bowlby, many developmental and family theorists stressed that early socialization is a bi-directional, reciprocal, relationship-based process between infant and caregiver (e.g., Brazelton, Koslowski, & Main, 1974; Bronfenbrenner, & Morris, 1998; Harrist, & Waugh, 2002; Bronfenbrenner, 2005).

The use of dyadic measures in infant-caregiver research has increased during the last two decades. However, similar to the definition of maternal sensitivity, the task of reconceptualizing "the quality of infant-caregiver interaction" in dyadic terms has led to multi-construct definitions and a wide range of assessment methods (Beeghly et al., 2010). For instance, some researchers have focused on the dyadic interaction, namely "mutuality" or "reciprocity", a bi-dimensional construct operationalized as contingent responsivity and shared positive affect (Aksan, Kochanska, & Ortmann, 2006; Crittenden, & Bonvillian, 1984). In contrast, others have explored "dyadic co-regulation and coordination" (e.g., Evans, & Porter, 2009), the related constructs of "synchrony" or "connectedness" (e.g., Isabella, & Belsky, 1991; Raikes, 2007), and/or dyadic reparation of mismatches in engagement (e.g., Tronick, & Cohn, 1989). In addition, certain investigators (e.g., Landry, Smith, & Swank, 2006) have evaluated infant-caregiver joint attention processes.

The present study is based on the Claussen and Crittenden (2000) concept of maternal sensitivity, which is a dyadic (mother-infant bi-directional) and relationship-based construct. According to a dyadic approach of maternal sensitivity, infant contribution must also be considered, and in normal interactions, children tend to be reciprocal and

cooperative, express their feelings openly, and use social and play experiences as opportunities to learn and develop (Ainsworth et al. 1978; Goldberg, & DiVitto 1995).

### **Maternal sensitivity and infant development**

A large body of research indicates that mothers contribute to infants' positive developmental outcomes (e.g., Bus, & van IJzendoorn, 1988; Greenberg, Speltz, & Deklyen, 1993). Nevertheless, most research links maternal sensitivity to socioemotional outcomes. Indeed, maternal sensitivity is predictive of a wider array of child outcomes, beside infant attachment, such as better emotional and physiological regulation (Calkins, & Hill, 2007), lower levels of aggression (Leerkes, Nayena Blankson, & O'Brien, 2009), behavioral problems and affect dysregulation (Bernier, Carlson, & Whipple, 2010; Leerkes et al., 2009; Tamis-LeMonda, & Bornstein, 1996). However, fewer research reported strong and direct associations between maternal sensitivity and maturity of object play (Bigelow et al., 2010), gains in language acquisition (Leigh, Niever, & Nathans, 2011; Bernett, Gustafsson, Deng, Mills-Koonce, & Cox, 2012), and cognitive outcomes (Bernier et al., 2010; Bus et al., 1988).

Infant cognitive, social and motor competencies are developed in daily objectal and social experiences. Mothers play an important role in promoting infant development by introducing their infant to new experiences, scaffolding emerging skills, and providing opportunities for the practice (Feldman, Eidelman, & Rotenberg, 2004). The first year of life is a particularly critical period during which infant development changes rapidly. At the end of the first year of life, infants begin to introduce some symbolic actions into their functional play, the emergence of which is seen in the infant's first words, gestures and play. Infant symbolic competence develops at the "zone of proximal development" (Vygotsky, 1979) and requires the adult's sensitive elaboration of the infant's behavior into a shared meaning. Indeed, according to Vygotsky, the adult guides the child by working one step ahead of the child's emerging skills and offering the child support to shift to a progressive symbolic complexity. By offering age appropriate experiences, parents help infants into maintaining attention for longer periods, gaining manual practice, persisting in their curiosity during exploration, and to engage in reciprocal interactions required to enhance infant cognitive development (Bernier et al., 2010; Leerkes et al., 2009; Tamis-LeMonda et al., 1996). In turn, gains in infant development encourage parents to engage in more rewarding and sophisticated interactions (Landry et al., 2006).

Most studies about maternal sensitivity (inclusive European studies) are performed in urban societies (revision in Mesman, van IJzendoorn, & Sagi-Schwartz, 2015), however, we present a study implemented in Terceira - an Atlantic Island of Azores, mostly rural in their traditional. Although sensitivity is an organization construct and not merely a set of parental behaviors, the modalities through which contingent responses and reciprocity are channeled is culture-dependent (e.g., Kärtner, Keller & Yovsi, 2010). Specific parental behaviors can have different functions in different cultural contexts. For instance, in some cultures touching, kissing and hugging is the most used form of affective expression whereas in others these behaviors can be understood as intrusive (Mesman et al., 2016). Even in the same culture, differences can be found. In Portuguese culture for instance touching, kissing and hugging are more frequent in mothers' lower formal education (Fuentes, Beehly, Santos, & Tronick 2009). Outside from Anglo-Saxon and Western urban samples we expected to find different determinants of infant development and maternal sensitivity to reflect about child development.

**Present Study.** The primary goal of the present study is to examine the association between mother-infant quality of interaction and infant Passive Posture, Active Posture, Locomotor, Manipulative, Visual, Hearing and Language, Speech and Language, Interactive Social, Self-care Social; Cognition and global development in a Portuguese sample composed by 86 healthy infants and their mothers. We expect a strong association between infant development and maternal sensitivity.

Moreover, our aim is to investigate maternal sensitivity determinants. Taking that we selected an understudied Portuguese community in Terceira (Azores Island) an extensive anamnesis was applied to families in order to identify variables related with their daily routines, health services provided to the infant, family sources of social support and pregnancy history. Those variables namely, gestational age, infant gender, APGAR, birth weight, pregnancy planned, number of siblings, pregnancy at risk, SES, maternal employment status, family attendance of nurse visits at Primary Health Care Center during pregnancy and maternal years of formal education were tested to verify their association maternal association and infant cooperation.

## METHODS

### *Participants*

Participants were 86 healthy Portuguese infants (46 girls; 40 boys,

48 first born), their mothers (M maternal age=30.63 years, SD=6.40, range: 18-48). Except for two infants (one born with 34 weeks of gestational age and another with 36), all were full-term.

All infants were healthy and clinically normal at delivery as determined by pediatric examination. Infants' birth weights ranged from 2060 to 4840 grams (M=3276.45, SD=508.267) and their weeks of gestational age at delivery ranged from 34 to 41 weeks (M=38.98 weeks, SD=1.39). APGAR scores at 5-minute ranged from 8 to 10 (M=9.82, SD=.50). No infants had any known sensory or neuromotor disabilities, serious illnesses, or congenital anomalies.

Mother- infant dyads were recruited at the Primary Health Care Center of Angra do Heroísmo, Terceira Island, Azores, Portugal. The ethnicity of the participants was primarily Portuguese Caucasian, and most were from middle-class socio-economic backgrounds according to the Graffar Social Classification (12.9% were families with low-income, 34.9% were lower middle-class, 31.4% were middle-class, 11.6% were upper middle-class and 9.3% were upper class). Graffar is one of the most used measures in Portuguese research validated and revised in Portuguese samples, (Graffar, 1956; Amaro, 2010), in order to determine families SES.

All parents were literate but the level of completed education varied: 24 (27.9%) of the mothers and 29 (33.7%) of the fathers completed mandatory education (9 years), 18 (20.9%) of the mothers and 16 (18.6%) of the fathers completed high school (12 years) and 23 (26.8%) of the mothers and 14 (16.3%) of the fathers had obtained a college degree or higher education. The remaining 21 mothers (24.4%) and 24 fathers (27.9%) did not complete mandatory education. Unemployment affected only mothers (18 were unemployed).

According to medical records, no parents had any known mental health or drug/alcohol addiction problems.

In this study 17 infants (19.8%) were fed with bottle milk (cow's milk) after 3 months, against medical advice. Feeding infants with bottle milk (cow's milk) before 12 months can harm their health and neurological development (WHO, 2005). However, according to the reports from these families, this decision was taken when mothers could not breastfeed their infant (for instance because they had to return to their jobs) and could not afford to purchase formula. Thus, in our study, 11.6% of infants were not breastfeeding; 88.4% were breastfeeding on the first month of life; 30.2% were breastfeeding on the first 6 months or more.

## **Procedure**

### *Recruitment*

Over a 1-month period, a female research assistant contacted potential participants at Primary Health Care Center of Angra do Heroísmo (Terceira Island) and explained the study's purpose and procedures. To determine eligibility, after mothers signed an informed consent form, were administered a brief interview to collect demographic information. With the parents' consent, information from the infant's and parent's health status was extracted from their medical record of the Primary Health Care Center and additional data were asked of parents. A total of 96 eligible families agreed to participate in this longitudinal study. Of these, 10 infants lost their eligibility for different reasons such as: death of child/mother, changed residence, significant delay in infant development, autism spectrum disorder symptoms or by dropping out of the study. The result was a sample of 86 mother- infant dyads.

### *Follow-Up Visit Procedures*

The 86 dyads participated in 2 laboratory follow-up visits. The first visit took place around 11 months ( $M=11$  months and 10 days;  $SD=5.42$ ) where their development was assessed using the Schedule of Growing Skills II (Bellman, Lingam & Aukett, 1996). Following this assessment, mothers provided information through the use of: Family Support Scale (Dunst, Jenkins, & Trivette, 1984), Family Needs Survey (Bailey, & Simeonsson, 1988), and Graffar Social Classification (Graffar, 1956).

The second visit media took place in mean 12 months and 4 days of life ( $SD=6.19$ ) when the quality of mother-infant interaction was videotaped during independent free play situations. These videotaped free play protocols were later scored with CARE-Index (Crittenden, 2003).

## **Measures**

### *Medical and Familial Demographic Information*

At the 11 months visit, mothers were interviewed about their infant's medical status and familial demographics. In Portugal, all parents have their children's medical record since birth – “the Baby health book”. We requested permission to collect data from this book. Medical and demographic factors included the infant's delivery method, APGAR

score at 1 and 5-minute, gestational age at delivery, birth growth measurements (weight, length, head circumference), gender, parity, health status at delivery, prenatal health care (number/frequency of medical consultations), pregnancy health status (normal or at risk), and infant health conditions (identification, frequency and severity). Mothers reported the family attendance of medical and nurse visits at Primary Health Care Center (during pregnancy and after the infant's delivery) and frequency of these visits, family socioeconomic status, parents' years of completed education, age, employment status, marital status, the infant's diet history (including the introduction of bottle milk (cow's milk in the infant's diet), number of siblings and infant health status during the first year of life.

### *Infant Development*

In this study infant development was assessed with Schedule of Growing Skills II (SGS II) at 12 months. The SGS II (Bellman et al., 1996) is a developmental screening tool used to assess the developmental trajectories of children from birth to five years of age and is based on the Sheridan developmental sequences, published in 1975 (Sheridan, 1997) and Griffiths Mental Developmental Scales published in 1967 and revised in 1984 (Bellman et al., 1996). It comprises ten different skill areas: Passive Posture, Active Posture, Locomotor, Manipulative, Visual, Hearing and Language, Speech and Language, Interactive Social, Self-care Social and Cognition. The SGS II allows us to obtain the developmental age and the coefficient of development, both in general and in each distinct area of development.

Two independent trained coders, reliable and blind against the study hypotheses scored the SGS II.

The degree of reliability and validity of the SGS II has been tested with excellent scores (Cronbach, between .88 and .97, Bellman et al., 1996). These scores were obtained without using the subscale of Passive Posture, as it is only applied for babies under 6 months of age, which is not the case in our study.

### *Family Needs Survey*

Family Needs Survey (Bailey et al., 1988) is an instrument that gives families the opportunity to identify their daily needs in seven content areas like: Information, Family & Social Support, Explaining to Others, Community Services; Child Care; Financial and Professional Support. The original instrument consists of 35 items (and space for additional topics) which family members can rate on a three points scale of do not need, not sure, and definitely need help with this. Test-retest cor-

relations over a six-month period for total scores were reported to be .67 for a sample of mothers and .81 for fathers (Bailey et al., 1988). In our study, we use the version that was adapted and validated with Portuguese families (revised in 1990 by Serrano, Serrano & Correia, 1996).

#### *Family Socioeconomic Status (SES)*

Using Graffar Social Classification (Graffar, 1956, validated in Portuguese samples by Amaro in 1990 and revised in 2010) we aim to assess the families' socioeconomic status (SES) and take into account income, level of education, profession, and type of home using five socio-economic layers.

*Family Support: The Family Support Scale* (FSS; Dunst et al., 1984, validated in Portuguese samples by Coutinho in 1999) allows identifying and quantifying families' sources as they rear their young children, providing information about Helpfulness of support networks. This instrument comprises 19 items divided in five subscales: Informal kinship, Spouse/partner support, Social organizations, Formal kinship and Professional services. Respondents are asked to indicate how helpful various individuals, groups, and agencies have been, indicating the amount of help received from each. The score is indicated on a Likert scale of 5 points from 1 (Not at all helpful) to 5 (Extremely helpful). The degree of reliability and validity of the scale were confirmed in the study developed by Dunst et al. (1984), with an internal consistency of .77 and a confidence level of .75 (coefficient of the bipartition).

#### *Maternal and Infant Interactive Behavior*

At the 12 months lab visits, mothers were videotaped during social interaction with their infants according to the instructions given in the CARE-Index manual (Crittenden, 2003) that is each dyad played alone about five minutes (3 minutes minimum). Mothers were asked to play with the infant as they typically would at home. A standard set of age-appropriate toys was provided for the dyad, arranged on a blanket on the floor of the play room.

Scoring of maternal and infant behavior from the videotaped free play sessions was accomplished using the CARE-Index (Crittenden, 2003). The CARE-Index assesses three dimensions of parents' interactive behavior with their infant (Sensitive, Controlling/Intrusive, and Unresponsive), and four dimensions of the infant's interactive behavior with parents (Cooperative, Compulsive-Compliant, Difficult and Passive). As required by Crittenden (2003), the coder scored parental and infant behavior independently. However, coders should make a dyadic decision to assess parents' and infants' behavior (Is the mother be-

havior sensitive in the context of infant behavior, infant age and play interaction?). Indeed, the behavior of each partner was coded from the perspective of the other partner (i.e., the coder scores each partner taking into account the behavior of the other partner).

Two trained and reliable coders scored the CARE-Index. The primary coder was trained to reliability by Crittenden prior to scoring the videotaped protocols in this study and blind to the study's aims and background variables. All cases were scored independently by the two coders. All disagreements in classification were resolved in conference.

To assess inter-coder reliability, a third trained coder (masked to background variables and the study's hypotheses), re-scored a subset of 20 videotapes. Inter-coder reliability for all three trainers was excellent. The intra-class correlations among the first two coders for mothers' Sensitivity and Infant Cooperative behavior were .94 and .89 respectively, and the ratings for the three coders (taking the final scores achieved by the two coders and the score of the third coder) were .91 and .86 respectively.

Adequate discriminant validity of the CARE-Index has been reported. Differential outcomes using the measure for middle class, low risk mothers, deaf mothers, low income mothers, mothers with mental retardation, abusive mothers, and neglectful mothers have been reported in separate studies (Crittenden, & Bonvillian, 1984). According to our knowledge, no previous study evaluated the relation between maternal sensitivity with CARE-Index and infant development (Passive Posture, Active Posture, Locomotor, Manipulative, Visual, Hearing and Language, Speech and Language, Interactive Social, Self-care Social and Cognition).

### ***Analytic Plan***

A multi-step plan was used to analyze the specific aims of the study. In preliminary analyses, the distributional properties of all study variables were evaluated.

Firstly, descriptive analyses, (means and standard deviations) for maternal sensitivity and infant cooperation and infant development at 12 months were carried out. Secondly, associations between maternal sensitivity and infant cooperation with infant development scores (using SGS II subscales) were evaluated using bivariate correlations. The association between maternal sensitivity, infant cooperation and infant development scores with infant and parents' demographics var-

ables was evaluated using bivariate correlations and univariate analyses. Finally, the independent contribution of infant, maternal, and demographic factors to the following variables: maternal sensitivity and infant cooperation were evaluated using multiple regression analyses. Only variables identified as being significantly associated in the bivariate analyses with dependent variables were in these regressions. In all analyses, statistical significance was denoted using an alpha set at .05.

## RESULTS

Descriptive analyses for infant development, maternal sensitivity and infant cooperation

Using the SGS II global score, our findings indicated that infants were about 12 months of mental age ( $M=7.37$ ;  $SD=.58$ ). In all scales of SGS II infants were nearly 12 months of mental age, except for locomotion where they were approximately 11 months and cognition around 10 months. In our study, maternal sensitivity varied from 2 (high risk) to 13 (very sensitive) points ( $M=8.12$ ;  $SD=2.45$ ). Similarly, infant cooperation varied from 3 (high risk) to 13 (very sensitive) points ( $M=8.28$ ;  $SD=2.45$ ). Maternal sensitivity and infant cooperation are highly associated ( $r=.884$ ;  $p<.001$ ).

*Association between maternal sensitivity, infant cooperation and infant development*

According to table 1, most of SGS II subscales are associated with maternal sensitivity and infant cooperation scores, except for Locomotor and Self-care social.

| SGS II               | MATERNAL SENSIVITY | INFANT COOPERATION |
|----------------------|--------------------|--------------------|
| Archive Posture      | .265*              | .230*              |
| Locomotor            | .156               | .102               |
| Manipulative         | .215*              | .243*              |
| Visual               | .408**             | .396**             |
| Hearing and Language | .223*              | .198               |
| Speech and Language  | .285**             | .251*              |
| Interactive Social   | .262*              | .253*              |
| Self-Care Social     | .103               | .005               |
| Cognition            | .349**             | .241?              |
| Global Scores        | .377**             | .317**             |

Table 1 - Pearson Correlations between Maternal Sensitivity and Infant Cooperation with Infant Developmental Scores with Schedule of Growing Skills II

\*\*p < .01; \*p < .05

### *Association between maternal sensitivity and infant cooperation demographic variables*

According to table 2, maternal sensitivity and infant cooperation are positively associated with maternal years of formal educational, paternal years of formal educational, family SES and gestational age and negatively associated with number of siblings. Maternal sensitivity, but not infant cooperation, was related to gestational weight.

Table 2 - Pearson Correlations between Maternal Sensitivity and Infant Cooperation and Family or Social Factors

| <b>FAMILY OR SOCIAL FACTORS</b>    | <b>MATERNAL SENSITIVITY</b> | <b>INFANT COOPERATION</b> |
|------------------------------------|-----------------------------|---------------------------|
| Maternal years of formal education | .373**                      | .322**                    |
| Paternal years of formal education | .266*                       | .250*                     |
| Number or siblings                 | -.257*                      | -.336*                    |
| Nursing visits                     | .466*                       | .453*                     |
| SES                                | .436**                      | .372**                    |
| Birth weight                       | .213*                       | .143                      |
| Gestational age                    | .319**                      | .227*                     |

Moreover, as seen in table 3, our findings indicate that: (i) girls presented high means of infant cooperation than boys; (ii) mothers were more sensitivity with their daughters than with their sons; (ii) maternal sensitivity and infant cooperation increased when family attended nurse visits at Primary Health Care Center; (iii) maternal sensitivity and infant cooperation were higher when the pregnancy was planned; (iv) maternal sensitivity and infant cooperation were higher in employed mothers; (v) lower means of maternal sensitivity and infant cooperation were found when babies was feed with bottle milk (cow's milk) after against medical advice for economic reasons.

\*\*p < .01; \*p < .05

| INFANT AND FAMILY FACTORS                                                              | MATERNAL SENSIVITY |          |           |          | INFANT COOPERATION |          |           |          |
|----------------------------------------------------------------------------------------|--------------------|----------|-----------|----------|--------------------|----------|-----------|----------|
|                                                                                        | <i>N</i>           | <i>M</i> | <i>SD</i> | <i>t</i> | <i>N</i>           | <i>M</i> | <i>SD</i> | <i>t</i> |
| Infant Gender                                                                          |                    |          |           |          |                    |          |           |          |
| Girls                                                                                  | 46                 | 8.35     | 2.53      | .939     | 46                 | 8.39     | 2.41      | .454*    |
| Boys                                                                                   | 40                 | 7.85     | 2.36      |          | 40                 | 7.85     | 2.36      |          |
| Pregnancy                                                                              |                    |          |           |          |                    |          |           |          |
| Planned                                                                                | 51                 | 8.57     | 2.49      | 2.053*   | 51                 | 8.57     | 2.56      | 1.375*   |
| Unplanned                                                                              | 34                 | 7.47     | 2.30      |          | 34                 | 7.82     | 2.26      |          |
| Maternal employment status                                                             |                    |          |           |          |                    |          |           |          |
| Employed                                                                               | 42                 | 8.86     | 2.35      | 2.588*   | 42                 | 8.88     | 2.47      | 1.882*   |
| Unemployed                                                                             | 18                 | 7.14     | 2.36      |          | 18                 | 7.61     | 2.20      |          |
| Feeding baby with bottle milk (cow's milk) against medical advice for economic reasons |                    |          |           |          |                    |          |           |          |
| Yes                                                                                    | 17                 | 6.29     | 2.51      | 3.665*   | 17                 | 6.82     | 2.60      | 2.849*   |
| No                                                                                     | 69                 | 8.57     | 2.23      |          | 69                 | 8.64     | 2.29      |          |

Table 3 - Maternal Sensitivity and Infant Cooperation differences according to Infant and Family Factors

### ***Determinants of maternal sensitivity and infant cooperation***

A multiple regression analysis was performed to identify which variables, if any, were predictive of maternal sensitivity and infant cooperation.

All factors previously associated with maternal sensitivity, infant cooperation were tested simultaneously, namely: infant development, family SES, infant gender, number of siblings, birth weight, gestational age, nurse visits attendance, pregnancy planning; maternal years of formal education, paternal years of formal education and infants fed with bottle milk (cow's milk) after against medical advice for economic reasons. Maternal Sensitivity and Infant Cooperativity was determined by infants fed with bottle milk (cow's milk) after the first 3 months of life against medical advice for economic reasons and gestational age; infant cooperation was determined by number of siblings (results in table 4).

\*\*\*p < .001; \*\*p < .01; \*p < .05

|                                              | Un-standardized coefficients |                       | Standardized coefficients |          |            | 95% Confidence interval for B |             |
|----------------------------------------------|------------------------------|-----------------------|---------------------------|----------|------------|-------------------------------|-------------|
| Model                                        | <i>B</i>                     | <i>Standard Error</i> | <i>Beta</i>               | <i>t</i> | <i>p</i> < | Lower bound                   | Upper bound |
| MATERNAL SENSITIVITY                         |                              |                       |                           |          |            |                               |             |
| (Constant)                                   | -7.002                       | 4.209                 |                           | -1.66    | .10        | -15.392                       | 1.388       |
| - Infant cooperation                         | .799                         | .058                  | .799                      | 13.83    | .00        | .684                          | .914        |
| - Gestational age                            | .218                         | .107                  | .124                      | 2.03     | .05        | .004                          | .432        |
| - Infants feed with contradicted milk advice | -.725                        | .368                  | -.119                     | -1.97    | .05        | -1.458                        | .009        |
| - Number of siblings                         | .177                         | .145                  | .069                      | 1.22     | ns         | -.112                         | .467        |
| - Paternal years of formal education         | -.047                        | .049                  | -.079                     | -.95     | ns         | -.146                         | .051        |
| - Nursing visits                             | -.025                        | .031                  | -.046                     | -.80     | ns         | -.086                         | .037        |
| - Infant global scores in SGS II             | .206                         | .261                  | .049                      | .79      | ns         | -.315                         | .726        |
| - SES                                        | -.042                        | .065                  | -.075                     | -.65     | ns         | -.172                         | .088        |
| - Birth weight                               | 8.476E-5                     | .000                  | .018                      | .32      | ns         | .000                          | .001        |
| - Maternal years of formal education         | -.003                        | .055                  | -.006                     | -.06     | ns         | -.112                         | .105        |
| INFANT COOPERATION                           |                              |                       |                           |          |            |                               |             |
| (Constant)                                   | 6.383                        | 4.549                 |                           | 1.40     | .17        | -2.688                        | 15.454      |
| - Maternal Sensitivity                       | .924                         | .067                  | .924                      | 13.72    | .00        | .790                          | 1.059       |
| - Number of siblings                         | -.325                        | .152                  | -.127                     | -2.14    | .04        | -.627                         | -.022       |
| - Gestational age                            | -.134                        | .117                  | -.076                     | -1.14    | ns         | -.367                         | .099        |
| - Infant gender                              | -.278                        | .273                  | -.057                     | -1.02    | ns         | -.822                         | .267        |
| - Infants feed with contradicted milk        | .387                         | .401                  | .064                      | .97      | ns         | -.412                         | 1.186       |
| - Nursing visits                             | .020                         | .033                  | .037                      | .60      | ns         | -.046                         | .085        |
| - Paternal years of formal education         | .023                         | .053                  | .039                      | .44      | ns         | -.082                         | .129        |
| - Maternal years of formal education         | -.024                        | .059                  | -.042                     | .41      | ns         | -.142                         | .093        |
| - SES                                        | -.019                        | .070                  | -.033                     | -.27     | ns         | -.158                         | .121        |
| - Birth weight                               | -4.171E-5                    | .000                  | -.009                     | -.15     | ns         | -.001                         | .001        |
| - Infant global scores in SGS II             | -.010                        | .002                  | -.002                     | -.04     | ns         | -.568                         | .547        |

Table 4 - Predictors of Maternal Sensitivity and Infant Cooperation

## DISCUSSION

This present study aimed to investigate in 86 mother-infant dyads the association between infant development assessed with Schedule of Growing Skills II (SGS II) and maternal sensitivity, infant cooperation assessed with CARE-Index at infants 12 months of age. Moreover, we intended to investigate infant development, maternal sensitivity and infant cooperation predictors.

### *Infant development and infant-mother quality of interaction*

As expected, better infant developmental outcomes are more likely in dyads with higher maternal sensitivity and infant cooperation. In this one trial study, a positive determinant link was found between infant development (Passive Posture, Active Posture, Manipulative, Visual, Hearing and Language, Speech and Language, Interactive Social and Cognition and taking SGS II global scores) and maternal sensitivity. It is interesting that maternal sensitivity was not only associated with global scores but all specific areas of development. According to the Care-index (Crittenden, 2003) assessment, maternal sensitivity is defined in terms of the mother effect in infant, namely, maternal ability to engage in reciprocal turn-taking interactions (that may promote infant participation); maternal ability to wait for infant actions and to support their effort to play and explore their environment (possibly promoting infant autonomy and safe exploration); and maternal positive affectivity and communication with their infant (likely to inform infant about interactions and about their role in those interaction). Maybe such aspects of maternal behavior involve infants in a positive atmosphere for exploration and learning.

### *Family and social contributes for mother-infant interaction*

Considering that both maternal sensitivity and infant cooperation were associated with infant development, we decided to investigate which factors influenced mothers' and infants' interactive behavior, and SES was a major influence. Moreover, longitudinal studies have shown that there is a negative and persistent effect of low SES on infants' social, emotional, and cognitive development (Sameroff et al., 1987). In our study, SES directly affected the dyadic interactive behavior. In turn, the parent-infant interactive behavior affected infant development. Thus, SES may affect multiple aspects of families' lives by affecting their jobs stability, life conditions, health services access and others

which impacts on infant development and parent's sensitivity, thus it is necessary to take into consideration and to prevent. We suggest that social government policies should be based on a multidimensional and integrated approach that privileges the provision of social care to families with young children through partnerships with local community leaders and other essential services that may constitute a supportive network for families. Several professionals (e.g. health, education, social), may play an important role in the early identification of families at risk and consequent referral to services/resources, ensuring that families have the necessary resources to satisfy their basic needs. In support of this suggestion, our study indicates that family needs and concerns with child care, finances and community services were related with mother-infant quality of interaction.

Taking previous research, some expected results, like maternal sensitivity and infant cooperation, were higher when the pregnancy was planned (Fuertes, Faria, Fink & Barbosa, 2011) and in employed mothers (Torres, Marques, & Maciel, 2011). Gender differences were also founded in past studies, however, the results vary according to infant age, with risk factors and across cultures (revision in Brody, 1985). In our study with Portuguese participants, girls were more cooperative than boys and mothers were more sensitivity with their daughters than with their sons. Indeed, these results were found before in Portuguese samples (e.g., Fuertes, Sousa, Nunes, Lino & Relvas, in press) suggesting a national tendency.

A novel result was that feeding baby with bottle milk (cow's milk) after the first 3 months of life against medical advice and attending nursing visits at Primary Health Care Center during pregnancy were linked with maternal sensitivity. In Terceira, Cow Framing is extensive in this Island and it is one of the major economical harvests of the Island. Culturally, feeding newborns and infants with cow milk was culturally associated in Terceira with the increasing of weight and health. More recently, WHO (2005) warned for the amount of antibiotics and fat that this milk could contain, therefore it is medical contraindicated. However, since in Portugal bottle milk (cow's milk) is much less expensive than formula (in some cases twenty times less expensive) some mothers that cannot breastfeed replace formula with this milk. Other families are associated with farming activities and believe that cow milk is better to enhance their baby's development. Nevertheless, the processes which this type of feeding and maternal sensitivity are related remains to be explained. Somehow mothers that have more difficulties in engaging with their infants are the ones making this decision. Perhaps, social or cultural factors (e.g. SES, parents' education)

affected parents' decision and their sensitivity (Feldman, Eidelman, & Rotenberg, 2004; Sameroff et al., 1987; Sameroff, & Fiese 2010).

### ***Predictive factors of infant-mother quality of interaction***

From all variables studied only few predictive factors, maternal sensitivity and infant cooperation, were found retained in multiple regressions analyses. Indeed, maternal sensitivity was predicted by infant cooperation, gestational age, infants fed with bottle milk (cow's milk) against medical advice after the first 3 months of life whereas infant cooperation by maternal sensitivity and number of siblings. Individual or factors related with infant (e.g., gestational age), family factors (e.g., number of siblings) and contextual factors (e.g., cultural feeding) predicted infant and maternal behavior.

The results for predictive factors were somewhat unexpected. Generally, gestational age is present as a possible risk factor parent-infant relationships in prematurely born infants (e.g., Fuertes et al., 2009; Muller-Nix et al., 2004), but not for full-term infants. One possible explanation is that although gestational age in full-term samples is not usually a risk factor maybe in the presence of other social and family risk factors, like low maternal education as in our sample, their significance can increase (Sameroff, & Fiese 2010; Cicchetti & Blender, 2006).

One most argue that these models can only be applied to the studied group, however, the most important aspect of this study is to support the thesis that mother-infant interaction is explained by local, social and cultural factors. In most western countries, mothers do not feed their newborns or babies with bottle cow milk but somehow when it is used and against medical advice it reveals parents struggle to find solutions towards overachieving their economic problems or to cope with professionals' advisement against cultural or family traditions. It is of most significance that psychologists or other developmental professionals use an ecological approach and attempt to understand families' traditions in order to incorporate each family culture in their practices.

### ***Limitations and future directions***

Although this investigation provides insight into maternal sensitivity and infant cooperation at the early age of 12 months, it was limi-

ted in several ways. Despite the careful methodological proceedings (e.g., four independent coders scored the data: two trained, reliable and blind against the study hypotheses scored the SGS II and two trained, reliable and blind against the study hypotheses scored the CARE-Index), one strong limitation of this research was that the study consisted of one single trial. Indeed, more trials, with infants of different ages, could help to test the results obtained. Moreover, findings are correlational in nature and interpretations about causality are speculative. Nevertheless, we tried to collect a sample that represented the Portuguese Azores society in terms of maternal education, family SES, religious and ethnic groups. Despite these limitations, this quasi-experimental study included variables with respect to the child, the family and the context on a multilevel approach of infant development. Given the uniqueness of these culture, it is our hope that our work provides cultural contribution to research on child development and parenting.

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