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Original Article

Differences and Similarities between Father-Infant Interaction and Mother-Infant Interaction

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The aim of this study was to compare father-infant interaction with mother-infant interaction, and explore differences and similarities between parents. Related factors for quality of father-infant interaction were also examined. Sixteen pairs of parents with infants aged 0 to 36 months were observed for play interaction between parents and their children. Results suggested no significant differences between parents, but children's interactions were significantly more contingent with fathers than mothers (p=.045). Significant correlations between parents were found in social-emotional growth fostering encouragement for children during interaction (ρ=.73, p=.001). Paternal depressive symptoms were significantly correlated to paternal sensitivity to child's cues (ρ=-.59, p=.017).

Key words: father, father infant interaction, paternal behavior, marital relationship, NCATS

Introduction

Recently, the public, media, and government have paid more social attention to paternal involvement in childcare. Since child psychologist Lamb[1] reinforced the concept that fathers were the "forgotten contributors to child development," increased work by researchers and government has been undertaken to explore how fathers uniquely contribute to the healthy development of children. Lamb et al[2] has put forth that children who were raised with an actively involved father, as well as mother, have higher cognitive skills[3], better language and emotional development[4,5], and fewer behavioral problems[6].

The Japanese public has been increasingly aware of the importance of fathering while an increase in maternal employment put the spotlight on men's role in housework and child care[7]. Japanese research on fathering has been increasing since 1980s when social problems such as chronic cases of skipping school became issues and the public was made aware that fathers spent insufficient time with their children[8]. A survey by the Ministry of Health, Labor, and Welfare[9] longitudinally followed children from one and half years old to five and half years old, and results suggested that the more children spent time with their fathers, the more likely they were to be patient, attentive, able to focus to their attention, able to listen to others well, adapt to groups well, and be responsible. Most research conducted in Japan has been based on surveys rather than observational study[7]. Moreover, most research[10-12] and government reports[9,13] have mainly focused on the amount or frequency of father involvement in childcare rather than the actual quality of paternal childcare, owing to the insufficiency of a reliable and valid measurement.

As Lamb[14] pointed out, the amount of time fathers and children spend together is probably much less important than what they do with that time, thus the focus should be more on the quality of father-child relationships using more objective measures.

One method of objective analysis is to observe daily

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interaction. Parent-child interaction measurement provides vast amounts of data as to the nature of and key dimensions of the relationship, and the quality of interaction has a strong relationship with child's development and attachment[15]. Due to the lack of reliable and valid measurements to assess the quality of relationship between fathers and children in Japan, one measure, the Japanese Version of Nursing Child Assessment Scale (JNCATS)[16-18], has potential to measure quality of interaction. JNCATS is the Japanese version of the NCATS, developed by Barnard (1979)[19] who described adaptive parent-child interactions as a "dance." Barnard's working theory assumes caregivers and infants have certain responsibilities to keep interactions continuing[16]. Each pair responds and reacts to the other, adapting their behavior to accommodate or modify the behavior in the other's interaction[16]. In this model, both parent and child are assumed to play important roles or responsibilities.

Studies on the quality of father-child interaction using NCATS have been undertaken, exploring Barnard's hypothesis by comparing father-child interactions and mother-child interactions[20, 21]. However, selection bias may have limited the extent of the findings as that they did not compare random couples, but only fathers who were recruited for the studies with mothers registered in the NCATS database (provided by the NCATS program)[19]. Those studies[20, 21] did not match the triad, so the results might have underestimated the impact of child's characteristics on interaction quality. Therefore, a more precise examination of potential differences in interaction between father-infant dyad and mother-infant dyad by sampling couples and their children is warranted. In addition, given that many similarities exist in the behaviors of fathers and mothers in child interactions[14], studying the similarities between father-child and mother-child interaction will contribute to our understanding of family dynamics and offer intervention plans for families with young children.

Many factors could influence father-child interaction such as paternal personality, working status, child's characteristics, and marital relationship, although scant research explored factors related to the quality of father-child interactions. Most research simply described interaction behaviors and fathers' or children's demographic data[19-21]. However, Pleck[22] suggested that no single predictor exerts a predominant influence on paternal involvement, and recently Belsky's[23] process model of parenting has been a central component of many research efforts aimed at identifying factors influencing fathers' parenting.

Based on the literature review above, the primary purpose of this study was to compare father-child interaction with mother-child interaction in a marital context using JNCATS. Previous studies using NCATS showed consistent results suggesting fathers were less sensitive and responsive to their children than mothers[20, 21]. Thus, our working hypothesis matched previous findings, but differences between parents could be different because we employed different sampling from previous studies. The secondary purpose was to explore the relationship between father-child and mother-child interactions. In family context, it was assumed that the quality of interaction might influence positively or negatively each other between parents. The third purpose was to explore which factors might influence the quality of father-child interactions. In this study, we focused on the following three components as possible factors of Belsky's[23] process model of parenting: (1) characteristics of fathers (age, education, and mental health), (2) characteristics of the children (age and gender), (3) contextual sources of stress and support (work and marital relationships). We also examined the correlation between time that fathers spent for childcare and the quality of father-child interaction. Paternal mental health was measured in parenting stress and depressive symptoms.

Methods

Participants

The fathers recruited satisfied all of the following criteria: (a) Japanese nationality, (b) child's biological father, (c) employed full-time, (d) living with their child and involving with childcare. All of the children were (e) 0 to 36 months old, (f) a first-born baby, (g) absence of major congenital anomalies, (h) and no diagnosis of neurological diseases. Only nuclear families were recruited to ensure that the influence of extended family interaction could be controlled for. A convenience sample of 16 parents with a child who satisfied all of the above criteria was recruited by snowball sampling.

Measures

Demographic Data

Fathers completed a questionnaire about their (a) age, (b) educational background, (c) daily working time on weekdays, (d) time for childcare on weekdays, (e) household income, (f) infant's age, (g) infant' gender, (h) duration of marriage. Mothers answered questions about their age, educational background, and

employment status.

Father-Infant and Mother-Infant interaction

The JNCATS[16-18] was designed to measure the quality of parent-child interaction for children from birth to 36 months of age. Certified observer scored the presence or absence of 73 behaviors on a dyadic scale while the parent is teaching a standardized task. Standardized item tasks were the same as the Barnard model[16, 19].

There are four factors which are theorized to contribute to parent's roles/responsibility: (1) Sensitivity to Cues (11 items, e.g., caregiver positions child so that child can reach and handle teaching materials), (2) Response to Distress (11 items, e.g., caregiver makes positive, sympathetic, or soothing verbalization when potent disengagement cues are observed), (3) Social-Emotional Growth Fostering (11 items, e.g., caregiver gently pats, caresses, strokes, hugs, or kisses child during interaction), and (4) Cognitive Growth Fostering (17 items, e.g., caregiver describes perceptual qualities of the task materials to the child). The two factors for child's roles/responsibilities were: (1) Clarity of Cues (10 items, e.g., child changes intensity or amount of motor activity when a task material is given), and (2) Responsiveness to Caregiver (13 items, e.g., child attempts to engage caregiver in eye-to-eye contact).

Thus, the JNCATS is designed with four parent subscales and two child subscales. In addition to these six subscales, there are items to assess the contingency observed in the parent-child interaction. The higher JNCATS scores indicate the more smooth and optimal parent-child teaching interaction.

Parenting stress

Parenting stress was measured with the Japanese Parenting Stress Index (JPSI)[24]. The JPSI is a self-report questionnaire, which includes 78 items rated on a 5-point Likert scale from 5 (strongly agree) to 1 (strongly disagree). The JPSI yields a Total Score and 2 Domain scores: (1) Child domain (concern about the child) and (2) Parent domain (concern about their own parenting ability). Higher scores indicate higher levels of parenting stress.

Depressive symptoms

The Japanese version of the Center for Epidemiologic Studies Depression Scale (CES-D)[25, 26] was used to measure parental depressive symptoms. The CES-D is a self-report scale for depression screening; the scale consists of 20 items. Scores on the CES-D range from 0 to 60; a higher score indicates more evidence of depression. The Cutoff score is 16; it is assumed that a person who scores 16 points or more is considered depressed.

Marital Relationship

Marital relationship was measured with Marital Satisfaction Scale developed by Moroi[27] based on Quality Marriage Index[28]. It is self-report questionnaire. The scale consists of 6 items rated on 4-point Likert scale. A higher score suggests better marital satisfaction.

Procedures

Data was collected at home when parents were available and their child was expected to be alert and not hungry. The parents respectively selected a different task unfamiliar to their child in a list provided by JNCATS. Teaching interaction both in father-infant and mother-infant were videotaped. During the fathers' interaction, the mother was asked to leave the room, and vice-versa. Filming order was random. The interaction videotaped was scored by three certified coders whose inter-rater reliabilities were higher than 90%. All observers were female. After videotaping the interactions, the parents were given the above-mentioned questionnaires and asked to fill them out within 2 weeks.

Statistical Analysis

SPSS (Version 20.0J) was used for analysis. Mann-Whitney U tests was conducted to examine the parent's demographic data and other variables. Wilcoxon signed-rank test was performed to examine differences between scores of the father-infant and mother-infant interaction on JNCATS. When un-paired 2 groups' JNCATS scores divided by child's gender and spouse's working status were compared, Mann-Whitney U test were used. McNemer's test was performed to examine differences between father and mother items on JNCATS for each 73 items. Non parametric correlations (Spearman) were calculated to examine the relationships between fathers' age, education, parenting stress, depressive symptom, working time, time for childcare, child' age, child's gender, marital relationship, mother-infant interaction, and father-infant interaction. As an index of effect size, we used r, which was calculated by dividing the z-score (derived from each test statistic) by the square root of N. Usually, an r of .1, .3, and .5 indicate small, medium, and large effect sizes respectively[29]. The statistical significance of these tests was set at $p < .05$.

Ethical Considerations

The study protocol was approved by the ethics committee of Tokyo Medical and Dental University (receipt No: 1160, date of approval: 2012.2.28). Written informed consent was obtained from all enrolled parents when a principal investigator visited their home. Before the parents gave informed consent, they were informed orally and in written form about the information regarding the study, including the study contents, privacy protection, and the freedom to withdraw from the study.

Results

Demographic data and variables

This study is one of first endeavors of exploration into the quality of father-infant interaction using JNCATS and its related factors extracted in context of family. We recruited 16 pair of parents with infant aged 0 to 36 months and compared paternal JNCATS scores with maternal JNCATS scores to examine differences and similarities between father-infant and mother-infant dyads.

There were no significant difference in the ages and education between fathers and mothers. Fathers' mean daily working time was 10.16 hours (*SD*: 1.69). Mean time for childcare on a weekday was 54.38 minutes per day (*SD*: 31.62). No significant correlation between fathers' working and childcare time was found. Mean marriage duration was 3.19 years (*SD*: 1.52). Children consisted of 11 (69%) male and 5 (31%) female. The mean child's age was 14.31 months (*SD*: 7.84). All seven mothers (44%) had a full time job. There were no significant differences in fathers' time for childcare depending on the spouse's working status. The most frequent family income of the participants was 6-8 and 8-10 million yen (25% respectively, 2 invalid answers). Demographic data are summarized in Table 1.

Table 1. Means and Standard Deviations (SD) of Demographic Data

	Fathers		Mothers			Effect size[a]
	Mean	*SD*	Mean	*SD*	*p*	*r*
Age (years)	33.31	3.74	32.37	2.09	.491	.18
Education (years)	15.81	2.74	16.88	3.61	.515	.18

Note. Mann-Whitney U test
[a]Effect size: *r* was calculated by dividing the z-score (derived from each test statistic) by the square root of N. An *r* of .1, .3, and .5 indicate small, medium, and large effect sizes respectively.

Table 2 shows scores of the JPSI, CES-D, and Marital Satisfaction Scale. The Cronbach's alphas for total scores, child total scores, and parent total scores of JPSI were .98, .95, and .96 respectively. In CES-D and Marital Satisfaction Scale, coefficients were .70 and .93 respectively. For parenting stress measured by JPSI, fathers scored significantly lower than did mothers. There were no other significant differences between fathers and mothers.

Table 2. Means and Standard Deviation (SD) of Variables

	Fathers		Mothers			Effect size[a]
	Mean	*SD*	Mean	*SD*	*p*	*r*
Parenting stress						
Child domain	65.94	13.39	72.25	14.84	.254	.29
Parent domain	72.81	17.77	91.50	15.35	.006**	.67
Total	138.75	29.83	164.25	27.39	.035*	.53
Depresive symptoms	5.50	4.35	5.06	4.85	.669	.11
Marital saisfaction	20.94	3.26	21.19	2.90	.926	.03

Note. Mann-Whitney U test (*p<.05, **p<.01)
[a]Effect size: *r* was calculated by dividing the z-score (derived from each test statistic) by the square root of N. An *r* of .1, .3, and .5 indicate small, medium, and large effect sizes respectively.

Comparisons of Fathers-Infant and Mothers-Infant interaction

Alpha coefficients for Total Parent and Total Child of JNCATS for fathers was .64 and .54 respectively. For mothers, coefficients were .78 and .70 respectively. Alpha coefficients for both scores for fathers were below the generally accepted level of .70[30]. It has reported that the Cronbach's alphas for fathers in NCATS were lower than mothers, and Total Parent scores were lower than .70[22]. One plausible explanation is that NCATS was originally developed for observation of mother-infant interactions[19]. Thus, results in this study should be interpreted with caution.

Table 3 below shows JNCATS score result of parents using a Wilcoxon signed-rank test. No significant differences were found in Total JNCATS scores, Total Parent, and Total Child scores. No significant differences were found between each subscale for fathers and mothers except for Child contingency score. However, Children demonstrated greater contingency in interaction with fathers than with mothers. The result of a McNemer's test for each JNCATS item suggests that, Item 9 (Care givers asks for no more than three performances when child is

Table 3. Comparison of Japanese Nursing Child Assessment Teaching Scale (JNCATS) Scores for Fathers and Mothers

	Fathers		Mothers			Effect size[a]
JNCATS Subscales	Mean	*SD*	Mean	*SD*	*p*	*r*
Parent						
Sensitivity to Cues	9.50	1.37	9.69	1.08	.903	.03
Response to Distress	10.06	1.00	9.69	1.30	.193	.33
Social-Emotional Growth	10.06	1.06	9.63	1.03	.052	.49
Cognitive Growth	12.37	2.36	13.13	2.87	.391	.21
Total Parent	42.00	3.56	42.13	4.21	.972	.01
Child						
Clarity of Cues	9.25	0.68	9.19	1.05	.794	.07
Response to Caregiver	9.19	1.64	8.00	2.00	.080	.44
Total Child	18.50	2.07	17.19	2.83	.175	.34
Total JNCATS scores	60.50	3.92	59.31	5.71	.442	.19
Contingency scores						
Parent contingency	16.44	2.39	16.31	2.60	.752	.08
Child contingency	8.44	1.46	7.25	1.84	.045*	.32

Note. Wilcoxon signed-rank test (*p<.05)
[a]Effect size: r was calculated by dividing the z-score (derived from each test statistic) by the square root of N. An r of .1, .3, and .5 indicate small, medium, and large effect sizes respectively.

successful at completing the task), fathers scored significantly lower score than mothers (p=.039).

Correlations between Father-Infant and Mother-infant interaction

Correlation coefficients were calculated between fathers' JNCATS scores and mothers' to examine correlation in interaction within the marital context. Although there were no significant correlations between fathers' and mothers' Total JNCATS scores, Total Parent (ρ=.50, p=.049) and Social-Emotional Growth Fostering (ρ=.73, p=.001) had significant positive correlations within dyads.

Factors correlated with Father-infant interaction

Characteristics of fathers: Age, education, mental health, and time for child care

Father's age and educational level were not significantly correlated with any of the JNCATS subscales. For parenting stress, Total and Parent domain scores on the JPSI was not significantly correlated with any of the JNCATS scores. The Child domain score, however, was positively correlated with some Child subscales scores in JNCATS: Total Child (ρ=.54, p=.031), Responsiveness to Caregiver (ρ=.61, p=.012), and Child contingency (ρ=.62, p=.010). For the CES-D, the mean score of fathers was 5.50 (*SD*: 4.35), and none of the fathers scored higher than 16. Fathers' CES-D scores were significantly correlated with Sensitivity to Cues (ρ=-.59, p=.017). There were no significant correlations between paternal time for childcare and JNCATS scores.

Characteristics of Child: age and gender

There were no significant correlations between the child's ages and scores of the JNCATS total or its subscales. To determine differences on the JNCATS scores between fathers of boys and girls, a Mann-Whitney's U test was conducted (Table 4). There were no significant differences except Child contingency score, and scores of boys' fathers were similar to girls' fathers.

Work: Working time and spouse's working status

The results also did not reveal a relationship between paternal daily working time and the JNCATS scores. We further divided fathers into two groups according to the mother's working status and compared JNCATS scores between two groups to explore its effect on father-infant interaction (Table 4). Although insignificant, there was a tendency for fathers whose wives had full-time jobs to report higher scores on overall Total, Total Parent, and Total Child.

Table 4. Comparison of fathers' Japanese Nursing Child Assessment Teaching Scale (JNCATS) Scores by child gender and spouse's working status

	Child's gender						Spouse's working status					
	Boys (n=11)		Girls (n=5)				Two-income[a] (n=7)		One-income[b] (n=9)			
JNCATS Subscales	Mean	*SD*	Mean	*SD*	*p*	*r*[c]	Mean	*SD*	Mean	*SD*	*p*	*r*
Parent												
Sensitivity to Cues	9.55	1.04	9.40	2.07	.743	.09	9.86	0.90	9.22	1.64	.681	.11
Response to Distress	9.82	1.08	10.60	0.55	.661	.13	9.43	0.98	10.56	0.73	.031*	.56
Social-Emotional Growth	10.27	0.91	9.60	1.34	.661	.12	10.57	0.79	9.67	1.12	.142	.42
Cognitive Growth	12.45	2.42	12.20	2.49	.510	.17	13.00	2.31	11.89	2.42	.210	.34
Total Parent	42.09	3.39	41.80	4.32	.583	.15	42.86	3.81	41.33	3.43	.351	.26
Child												
Clarity of Cues	9.45	0.69	8.80	0.45	.145	.42	9.71	0.49	8.89	0.60	.023*	.61
Response to Caregiver	9.00	1.73	9.60	1.52	.115	.40	9.57	1.27	8.89	1.90	.470	.19
Total Child	18.55	2.30	18.40	1.67	.090	.45	19.29	1.60	17.89	2.26	.252	.31
Total JNCATS scores	60.64	4.37	60.20	3.11	.069	.47	62.14	3.76	59.22	3.73	.114	.40
Contingency scores												
Parent contingency	16.27	2.69	16.80	1.79	.221	.33	16.43	2.64	16.44	2.35	.837	.05
Child contingency	8.18	1.47	9.00	1.41	.038*	.53	8.57	1.27	8.33	1.66	.837	.06

Note. In this table, two sets of test are shown. One set is for child's gender. The other is for spouse's working status.

[a]Fathers whose spouses have full time job [b]Fathers whose spouses are full-time housewives

[c]Effect size: *r* was calculated by dividing the z-score (derived from each test statistic) by the square root of N. An *r* of .1, .3, and .5 indicate small, medium, and large effect sizes respectively.

Mann-Whitney U test (*p<.05)

Marital relationship

The mean score on the Marital Satisfaction Scale was 20.94 (*SD*: 3.26). Father's satisfaction with their marital relationship was not significantly correlated with the JNCATS scores. In addition, mean score of Marital Satisfaction Scale had an extremely strong negative correlation with Total score in JPSI (ρ =-.73, p=.001).

Discussion

Comparison of Fathers-Infant and Mothers-Infant interaction

Significant differences between fathers' scores and mothers' scores on the JNCATS were not found except for Child contingency scores. The results, however, should be interpreted cautiously because they were not consistent with previous studies. Previous studies consistently found that fathers scored significantly lower than mothers in NCATS Parent subscales and, on the other hand, had significantly higher score in Child subscales[20, 21].

The most plausible reason for this inconsistency may be the small sample size in the study. Owing to the small sample size, the statistical tests used might not have been robust enough to extract the specific association when the association is present in the population (false positive). A secondary reason for the inconsistency may be sampling bias. Because we employed convenience sampling, fathers in the study might have been more interested and more positively involved in child care than a normative population. Although there are clear limitations as mentioned above in the study, it is important to point out that the current study compared with the pairs of parent with infant. Result suggested that there might not be definitive differences between parents if father-infant interaction with mother-infant interaction within a family context were compared. In other words, if we were able to control for parent-child interaction, fathers might have reported similar sensitivity and responsitivity as mothers. Moreover, it is noteworthy that the JNCATS score of fathers for two factors of Parent subscale (Response to Distress and Social-Emotional Growth Fostering), one factor of Child subscale (Response to Caregivers), and Child Total were higher than those of mothers and Effect size for those scores were medium (.33-.49). This might imply that fathers have not only similar, but also greater competence for keeping interaction with

children more smoothly than mothers. Further replication with larger samples and random sampling is needed to test these assumptions.

Next we performed McNemer's test on each JNCATS item to explore the more detailed difference between parents. Result suggested that fathers asked for excessive performances even when their children were successful at completing the task during teaching interaction, whereas mothers did not do so. The item is for measuring whether a caregiver demands excessive performances is regarded as a negative element of caregiver behavior[16]. The difference between fathers and mothers on this item might be related to paternal features that weigh with the achievement of certain tasks in a teaching session. Marcos[31] pointed out that fathers are more task-oriented while mothers shared verbal descriptions with their child in a specifically planned session. Conner et al[32] reported that fathers of 2 years olds are more focused on literary tasks and attempt to keep their children on task than mothers. Moreover, Harrison et al[21] found that the average length of fathers' teaching interaction in NCATS was 6.6 minutes, resulting in Item 50 (caregiver spends no more than 5 minutes and not less than 1 minute in teaching) being scored "No" for approximately half of the fathers and concluded that fathers might have unique goal-directedness in father-child interactions. Those paternal task-oriented features in interaction might hold relevance in the differences between fathers and mothers in this study. Although the way of interaction penalizes fathers in the JNCATS, fathers possibly stimulate child development in a different manner than do mothers.

Correlation between Father-infant interaction and Mother-infant interaction

We found significant correlations that were positive and strong between parents in Total Parent and Social-Emotional Growth Fostering scores. Social-Emotional Growth Fostering includes: The affective domain such as caregiver's tone and pitch of voice, facial expression, types of touch, and types of statements made to and about child during interaction. Cheerleading types of statements, gently patting, smiling, and hugging demonstrated by caregivers help create a warm, supportive atmosphere and facilitate a child's social-emotional growth during a teaching interaction[16].

The findings imply that the quality of interaction led by fathers and mothers, especially social-emotional encouragement, might be comparable to each other or gradually become similar to each through the process of marital life. Prior research has suggested that married couples are similar in cognitive and psychological functioning[33]. Although the scope of this paper does not permit a probe of such relationship, it may be plausible that a partner influences the quality of parent-infant interaction. The results also suggest an intervention program for parenting for fathers or mothers might have a positive affect not only for the participants but also their partners. Furthermore if both parents become involved in a program such as the one that we advocate, positive effects on the family as a whole can be obtained.

Factors correlated with Father-Infant interaction

We explored elements related to father-infant interaction in the context of family because father-infant interaction is created on demographics and multiple elements of the family. First of all, fathers' age and education were not significantly correlated with the quality of the interaction with their child. Although JNCATS database[17] reported that significant correlation between mothers' age and education and JNCATS scores, the correlation were small (r=.13-.18). In addition, results in the study were also consistent with previous findings[20,21].

Belsky[23] suggested that parents should be psychologically healthy enough to provide developmentally flexible growth in promoting care for children. In the current study, we focused on parenting stress and depressive symptoms as indicators to measure fathers' psychological integrity. Paternal parenting stress was significantly lower than mothers' except for the Child domain scores. The result was consistent with the report by Mikuni et al[34] who explored the differences between parenting stresses experienced by Japanese fathers and mothers with 1.5 years old infants. There were no significant correlations between Total and Parent domain subscale scores in JPSI and JNCATS scales. However, the significant positive correlation between Child domain scores on the JPSI, Total Child, Responsiveness to Caregivers, and Child contingency scores in JNCATS were found. Thus, the more the fathers reported feeling stress with their children, the more the children were responsive and contingent with fathers during their interactions. On one hand, JNCATS focuses on parent-child relationship. On the other hand, sources of parenting stress are multidimensional, and child's various characteristics such as adaptability, mood, distractibility, and hyperactivity might be factors of perceived parenting

stress by caregivers[24]. There is a limitation to capture child's characteristics and parental perceptions of them within the JNCATS framework. Thus what needs to be kept in perspective is the degree of paternal parenting stress needs to be interpreted carefully even if the scores in JNCATS do not suggest otherwise.

Paternal depressive symptoms were related with their sensitivity to child's cues during interaction. This suggests that fathers' depressive symptoms might hinder their ability to appropriately recognize and respond to the child's cues. Research on maternal postpartum depression examined the impact of maternal depression on the interaction with their child has consistently reported negative correlations[35-37]. Research on fathers as well, reported that paternal depression limited father involvement, which, in turn, ill affected child's cognitive development[38], and depression in fathers during the postnatal period was associated with adverse emotional and behavioral outcomes in children aged 3-5 years[39]. The rate of paternal depression between the first trimester and 12 months postpartum was estimated at 10.4%, and a correlation between paternal and maternal depression was positive and moderate in size (r=.308; 95% CI, 0.228-0.384)[40]. Findings in this study suggest that depressive symptoms might be a crucial factor that health workers and parents alike should take into account when raising an infant.

A child's age and gender were not correlated with the quality of the father-infant interaction. This result was consistent with the previous findings using NCATS[20, 41]. Findings indicated that fathers in JNCATS seemed to interact with boys similar to girls.

Fathers' working time and spouse's working status was not related with any of the JNCATS subscales. In previous research findings, the shorter fathers' working time and the more mothers' increase in working hours influenced the quantity of fathers' engagement with child care[42-44]. However, it's not clear the impact of these condition on the quality of father-child interaction yet owing to the insufficiency of study exploring its relationship. NICHD[45] reported that the paternal sensitivity during play interaction was related to less traditional child-rearing beliefs rather than working hours. Traditional child-rearing belief is referred as strict, conservative, and authoritarian belief about child child-rearing, for instance the belief that children should not question the authority of their parents[46]. Broom[47] postulated that parents tend to provide sensitive parenting regardless of mothers' employment status, and marital quality, and psychological well-being was the important factor in sensitive parenting. The result in current study implied that parent's working status might not directly affect the quality of their interaction, and that we might have more considered the beliefs about child rearing such as traditional or progressive.

Although it was pointed out that marital quality directly or indirectly affects parents' sensitivity and their psychological well-being[23], there was no relationship between fathers' marital satisfaction and their sensitivity during interaction with child in this study. Meanwhile, the degree of marital satisfaction was significantly related with fathers' parenting stress. We did not measure whether marital relationship directly or indirectly impacts the quality of father-infant interaction. Nevertheless, it might be important that we include factors that might have a potential impact of marital relationship on parental mental health in further studies.

Limitations and future directions

The result of this study must be interpreted cautiously due to a small sample and sampling method. Owing to a small sample size, we could not perform multivariate statistics on the data. Thus the relationships presented in current study was not causal relationship but correlational. The fathers who were recruited for this study were from a convenience sample and might have been more highly motivated, more interested in childcare, and had better marital relationships than the Japanese population in general. Despite the limitation of our study, it has generated some insight into the result that fathers positively engage with childcare. Further investigations and replication will be needed for using JNCATS with father-infant interactions in different situations and families with different demographics in the future.

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