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Characteristics of the Mother-child Relationship Formation Process for Infants with Down Syndrome and Their Mothers: A Mixed Method Study

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Abstract

Aim: This study sought to clarify characteristics of the process of mother-child relationship formation during the infancy of children with Down syndrome and to examine the necessity for support for this process.

Methods: This study was a short-term longitudinal study examining two groups. Group A was comprised of infants with no health problems and their mothers; Group B was comprised of infants with Down syndrome and their mothers. A mixed research method utilizing quantitative data measurements of mothers' psychological states, infant growth and development, and mother-infant interactions was integrated with qualitative data from interviews to clearly show the process of mother-infant relationship formation. In consideration of the number of subjects, qualitative data were analyzed using qualitative induction, and quantitative data were statistically analyzed for changes over time with nonparametric tests conducted for group comparisons.

Results: Although there was no significant difference in the negative emotion scores of Group B and Group A mothers, mothers in Phase II increasingly commented on negative feelings. Positive emotion scores of Group B mothers toward their own children were significantly lower than Group A, with mothers commenting that they began seeking ways to interact with their own children in Phase II. The developmental status of infants in Group B was delayed 2-3 months in Phase I and 3-4 months in Phase II. Group B mother-infant interaction status scores were significantly lower than Group A scores.

Conclusion: Considering that the developmental delays of children with Down syndrome grow larger as the child ages, the importance of childcare support that decreases mothers' negative feelings and increases their positive feelings toward their own children was indicated.

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Introduction

Down syndrome is a common birth defect. The birthrate of children with Down syndrome in Japan has remained at the same level since 2010, with an estimated 2,200 infants born with Down syndrome per year [1]. Down syndrome is likely to be detected early because of its facial and physical characteristics [2], and diagnosis is often made soon after birth when the parent(s) are not emotionally prepared [3]. This leads to situations where childcare must begin before disability acceptance has been achieved [4]. Furthermore, mothers experience a range of emotions after receiving the diagnosis, including the expression of unbearable shock and denial, and it is believed that it takes time for mothers to accept their children's disabilities [5]. Infants with Down syndrome often also have other medical complications that vary by type and degree [6-7], making it difficult to establish a support system tailored to individual situations [8].

The importance of early support for children with Down syndrome is especially pronounced because of the slow development of the child's physiological, autonomic, motor, and cognitive functions [9]. A "Baby Exercise Program" that promotes the development of motor functions exists in Japan, but the number of facilities that offer this program is limited and only a few allow participation from as early as 3 months of age [10]. Children with Down syndrome often have problems interacting with others and regulating their behavior due to weak responses to others' efforts and poor nonverbal communication, which can be a cause of communication issues with their mothers [11-12] These factors can make it difficult for mothers to establish a relationship with their Down syndrome children, leading mothers to experience a great deal of difficulty, parenting anxiety, and emotional stress in childcare [6]. It is necessary to spend time in mother-child interaction for the mother to accept their child's disability, develop an attachment, and build a mother-child relationship [13].

Although studies in Japan on the process of disability acceptance by mothers of children with Down syndrome have described the significance of early support to establish the mother-child relationship [3-4], there are only a few studies that identify the course of the post-birth mother-child relationship and which detail experiences of support for establishing the mother-child relationship [7,14]. Internationally, there are only a limited number of studies with a similar focus on infants with Down syndrome. Papers presenting research on support information provided on Down syndrome [15-16], breastfeeding support [17-18], and the effects on the mother-child relationship from promoting language development after infancy [19-20] exist, but no empirical studies focusing on the formation of the mother-child relationship during infancy are present in the literature. Furthermore, the papers cited above focused on subjective physical and psychological evaluations provided by the mothers themselves, who also rated their own

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child's growth and development. No studies were found that compared changes over time in mother-child interactions based on behavioral indicators of both mothers and children, or that were based on differences between mothers with healthy children.

Considering the background detailed above, we perceived the need for an initial focus on the mother-child relationship during infancy, thus clarifying mothers' feelings, their psychological states including positive feelings for their own children, and their childcare conditions, all of which may exert influence on the formation of the mother-child relationship. The relationship between mother and child changes over time as the infant grows and develops, forming through the progression of smooth mother-child interactions. Since the infant also bears a certain amount of responsibility for promoting mother-child interaction [21], we additionally believed it necessary to understand infant behavior, growth, and development. The delayed growth and development of children with Down syndrome makes it necessary to understand their differences from healthy children, as well as related changes in mother-infant interactions over time.

The use of a mixed method research method was necessary for this study to clarify the process of mother-child relationship formation in infants with Down syndrome and their mothers. Quantitative research cannot adequately examine specific situations, while qualitative research has issues of objectivity and validity; mixed research methods use both methods simultaneously to compensate for weaknesses in each research method [22]. Integrating quantitative data utilizing scales objectively assessing mothers' complex psychological states, infant growth and development, and the state of mother-infant interaction with qualitative data from interviews about mothers' thoughts on and involvement with their own children and how mothers perceive childcare and infant growth and development will, we believe, more concretely and clearly reveal the process of mother-child relationship formation.

Methods

Research design

This study employed a short-term longitudinal mixed-method study

Operative definitions of terminology

mother-child relationship formation: Amidst fluctuating emotions about their children, mothers come to perceive themselves and their children positively through other's support, the growth and development of their children, and childcare. Mother-child relationship formation here indicates a state of long-term stability of a deep and loving bond between mother and child that enhances the capacity of both mother and child to interact smoothly, promoting mother-child interaction.

Conceptual framework

The conceptual framework of this study (Figure 1) is based on the result of conceptual analysis with "a mother's acceptance of their child with Down syndrome" at the core [23]. The "characteristics of disorders in children with Down syndrome" cause negative feelings in mothers such as "uncertainty about raising my child," "distress and denial that my child has Down syndrome," and "feelings of difficulty maintaining harmonious family relationships." Support from family members, mothers of other Down syndrome children, and professionals allows for "mothers' sense of security and trust" to be established, generating feelings such as "prospects for childcare and my child's future" which lead to a mother's positive acceptance of their own child. There is fluctuation between a mother's negative feelings and positive feelings that lead to acceptance. Through this process, mothers become aware of the "growth and development of a child with Down syndrome," which allows mothers to accept in a positive way

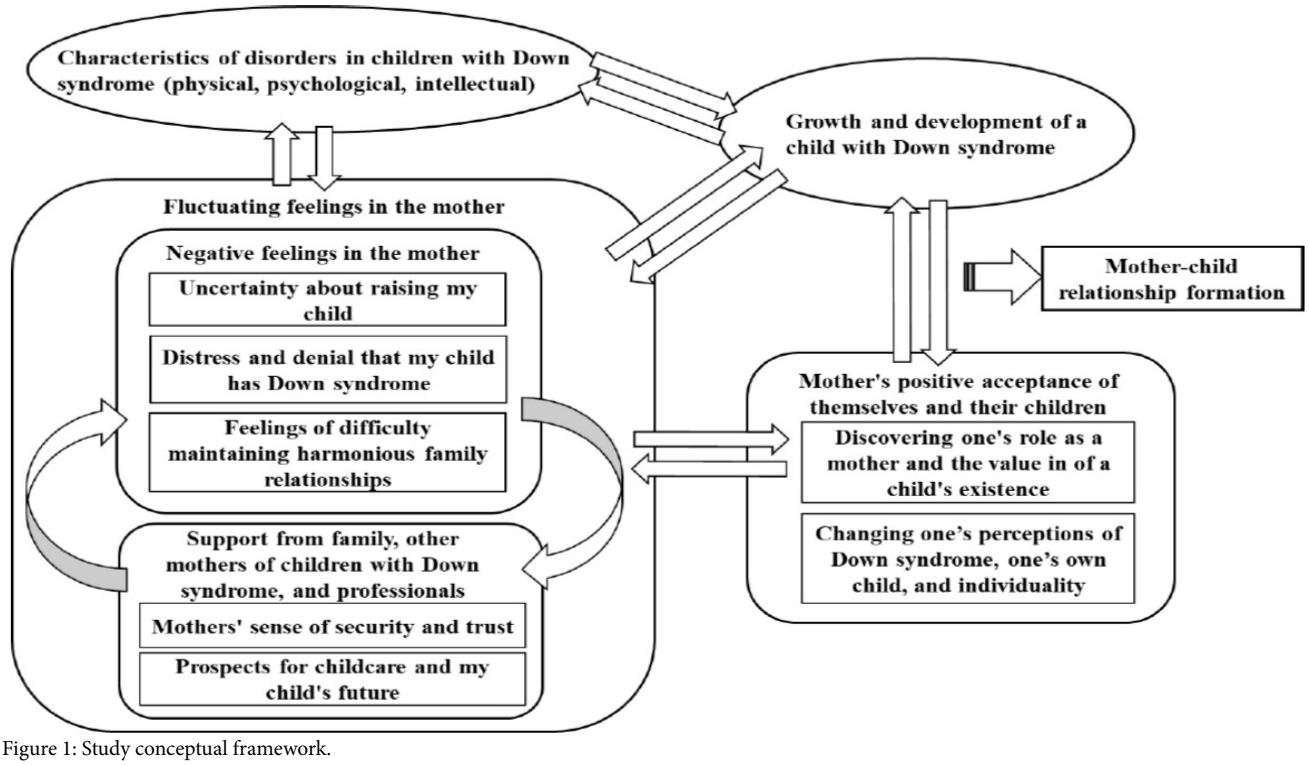


Figure 1: Study conceptual framework.

themselves as mothers and their children with Down syndrome by "discovering one's role as mother and the value of a child's existence" and "changing one's perceptions of Down syndrome, one's own child, and individuality." We posit that the positive acceptance of one's own child would generate a cycle promoting the "growth and development of a child with Down syndrome," in turn advancing smooth mother-child interaction and leading to mother-child relationship formation.

Subjects

Group A was comprised of infants (age: 6 or 7 months) with no health issues and their mothers. The selection criteria were that infants were the first-born child and that both mother and child had no health issues which required hospital visits. Group B was comprised of infants (age: 6 or 7 months) with Down syndrome and their mothers. No other selection conditions were set for Group B infants, and Group B mothers were selected on the basis that they had no health problems that would require hospital visits.

Study period

The study commenced in March 2022 after receiving Ethics Committee approval and concluded in June 2023.

Research flow

A visual overview of this study is provided in an accompanying figure (Figure 2). Mothers and children who met the respective selection criteria for Groups A and B were visited two times at home by the researcher, who performed the following quantitative and qualitative investigations at the same time: video recordings of play sessions, observations, administering of questionnaires, infant developmental examinations, and interviews. The second visit was conducted three months after the first with the same subjects, using the same investigative instruments as the first survey for each group, which were surveyed and analyzed at the same time.

Quantitative instruments used to clarify the process of mother-child relationship formation were the following: the Japanese Nursing Child Assessment Teaching Scale (JNCATS) [24] to quantify mother-child interaction, the Japanese version of the Profile of Mood States 2nd Edition (POMS2) [25] to quantify mothers' emotions, the Maternal Attachment Inventory Japanese version (MAI-J) [26-27] to quantify mothers' positive feelings toward their own children, and the Enjoji Scale of Infant Analytical Development (DQ) [28] to quantify infant growth and development. In addition, we conducted quantitative and qualitative research by interviewing mothers about their thoughts and involvement with their own children, childcare, and how they perceive their children's growth and development. Group A and Group B investigations and analysis were conducted contemporaneously. All quantitative and qualitative data from each group was then analyzed and integrated to be examined with a joint display. Ultimately, both groups were comparatively analyzed, with joint displays drawn and interpreted to gain new insights.

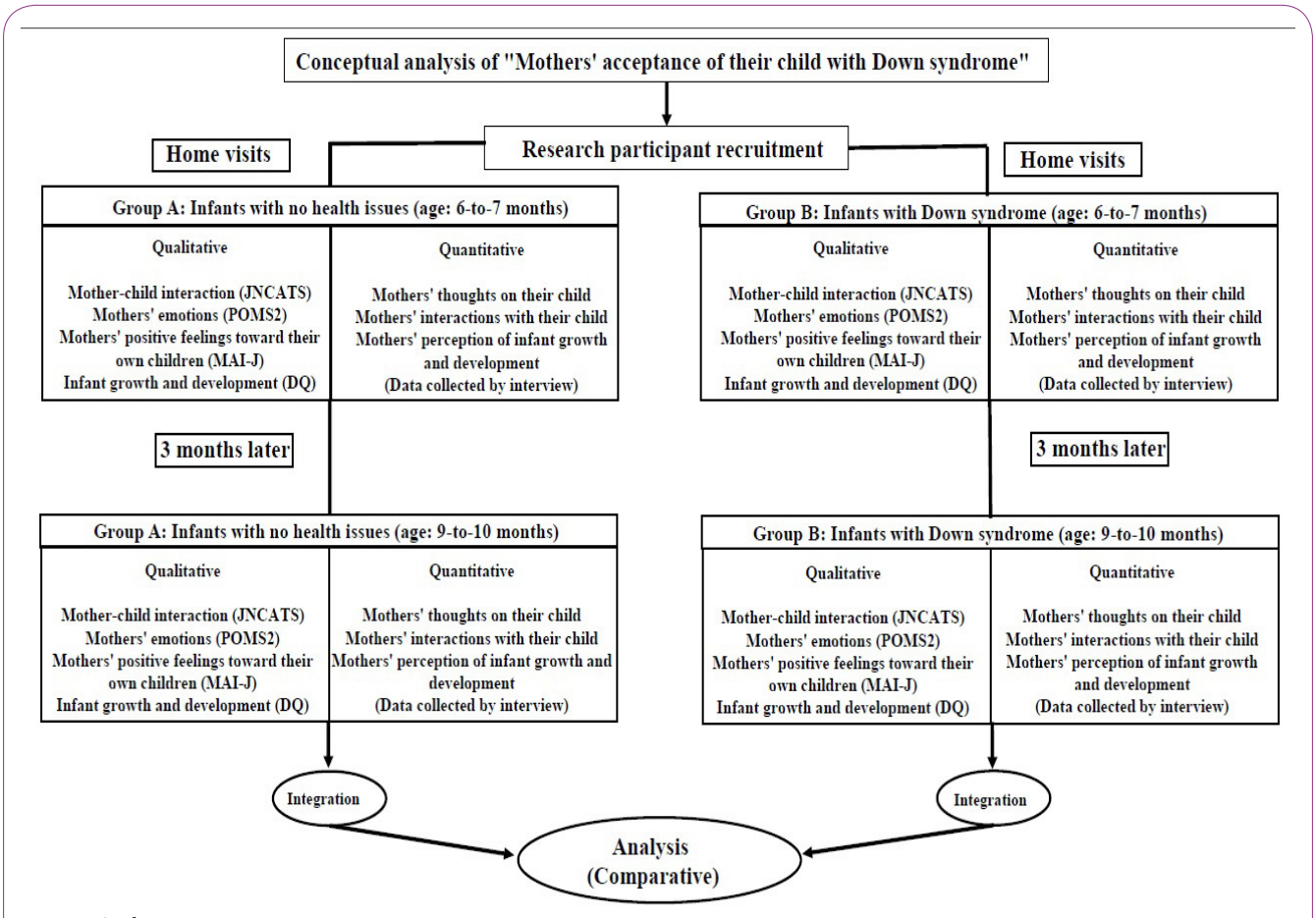


Figure 2: Study overview.

Analytical methods

Quantitative data analysis of scale-based data was performed using IBM SPSS Statistics Ver. 29 for statistical analysis. During analysis, the number of pairs in subject groups A and B was taken into account and a nonparametric test method was used, which does not assume a normal distribution. Qualitative data on the content of the interviews were analyzed qualitatively and inductively.

Ethical considerations

This study was conducted in accordance with the "Ethical Guidelines for Medical Research Involving Human Subjects" published by the Japanese Government following review and approval by the Ethics Committee of the Graduate School of Medical and Nursing Sciences with which the researcher is affiliated.

Due to the large number of survey elements, we explained the purpose of this study using an explanatory letter which provided detailed information on measures to guarantee safety, the risks associated with research cooperation and measures to respond to these risks, guarantees of voluntariness, guarantees of the right to withdrawal during the study, and protections of privacy, anonymity, and personal information. Written and verbal consent was obtained. When conducting the study, we made every effort to be attentive to the feelings of the subjects and to reduce any burden imposed by study participation.

Results

Overview of subjects

The number of subjects who met the selection criteria for the study and cooperated in the study was 14 pairs for both groups, and all participants were included in the analysis with no one withdrawing during the study. The mean (SD) age of mothers was 29.64 (4.14) years for Group A and 37.69 (3.17) years for Group B, with the ages of mothers in Group B significantly higher than Group A ($p < .05$).

The mean (SD) age in months of infants in the study was 6.36 (0.48) months for Group A and 6.31 (0.48) months for Group B. The mean (SD) number of weeks of gestation at birth was 39.82 (0.94) weeks for Group A and 37.23 (0.38) weeks for Group B, indicating that Group B was significantly shorter than Group A ($p < .05$). The mean (SD) birth weight of the infants was 3050.45 (76.24) grams for Group A and 2657.31 (25.19) grams for Group B; there was no significant difference in birth weight. In Group B, 8 infants (57%) had no siblings and 6 infants (43%) had siblings; additionally, 9 infants (64%) had complications and 5 infants (36%) were without complications.

Comparison of Group A and Group B mother-child relationship formation process (Integrated Group A and B data)

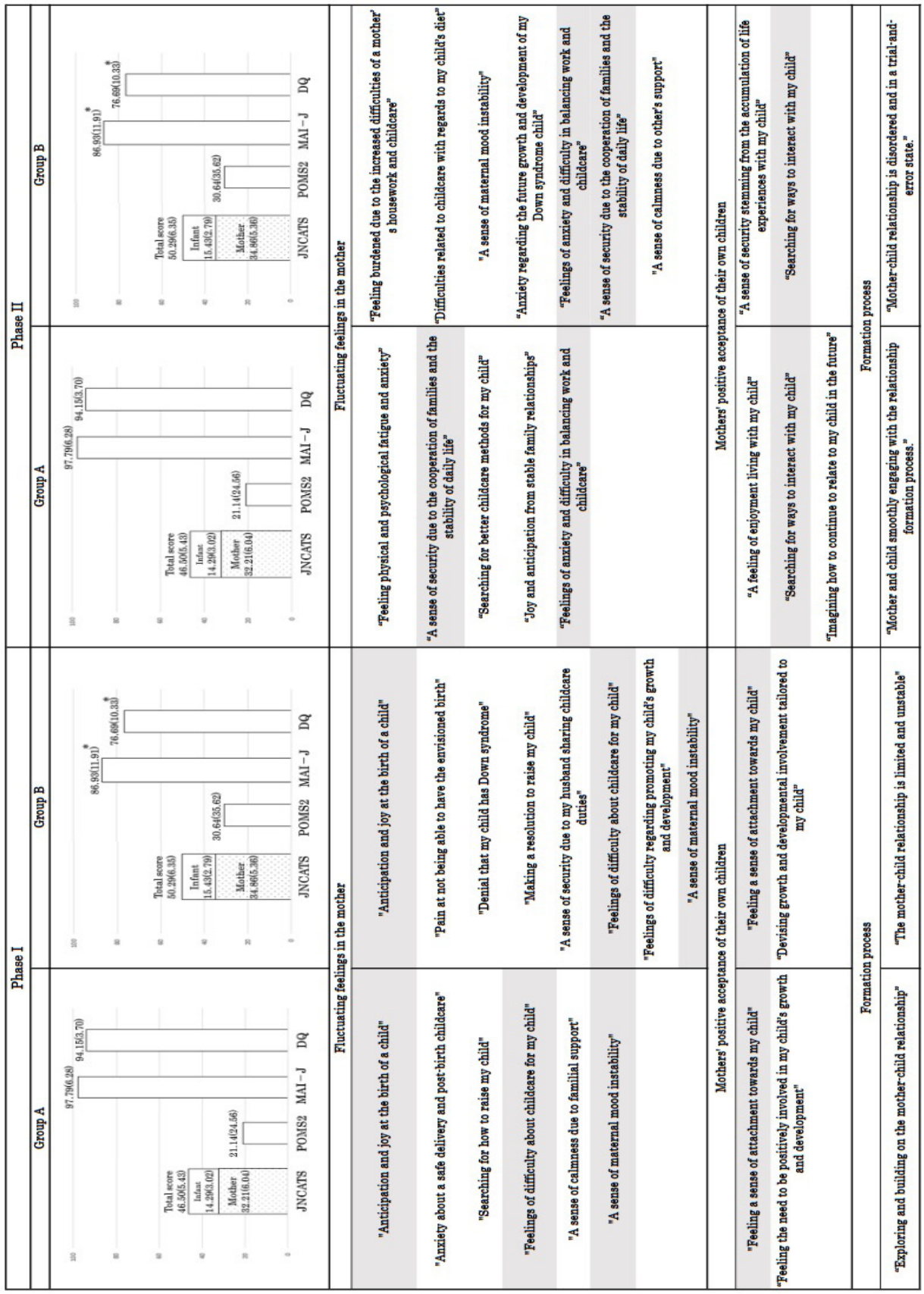
The results were compared and interpreted by drawing joint displays for JNCATS (total score, infant score, and maternal score), POMS2 (Total Mood Disturbance (TMD) score), MAI-J (total score), and DQ values for quantitative data as well as qualitative data for Groups A and B (Figure 3). After conducting the Wilcoxon signed-rank test to observe changes over time (changes from Phase I to Phase II) of each group and to confirm the existence of such changes, quantitative data were subjected to a Mann-Whitney U-test to comparatively analyze the presence or absence of differences between groups. Significance level was set at 5-percent and Figure 3 indicates significant differences were "fluctuating feelings in the mother" and "mothers' positive acceptance of their own children," with shading used to indicate items similar to both groups in each category.

POMS2 TMD scores (SD) for Group B were 30.64 (35.62) in Phase I and 33.00 (31.38) in Phase II. Group B MAI-J total scores were 86.93 (11.91) in Phase I and 86.79 (13.86) in Phase II. DQ values for Phase I and Phase II were the following, respectively: totals were 76.69 (10.33) and 68.21 (7.65); subitem "mobility" was 80.26 (13.46) and 74.74 (10.71); "hand movement" was 86.45 (11.99) and 72.29 (8.34); the "basic habits" aspect of social skills was 76.23 (10.23) and 65.43 (10.93); "interpersonal relations" was 73.92 (11.87) and 63.96 (11.90); "speech" as language was 76.37 (15.64) and 68.90 (8.93); and "language understanding" was 66.92 (13.41) and 63.93 (8.07). DQ scores for both Phase I and Phase II were lower than the DQ developmental test standard of 100.

Significant MAI-J total score ($z = 3.075$, $p = 0.002$) and DQ ($z = 4.487$, $p \leq .001$) differences were observed in the comparison of Group A and Group B in Phase I. In Phase II, JNCATS total score ($z = 4.062$, $p \leq .001$), infant score ($z = 2.639$, $p = 0.008$), mother score ($z = 4.062$, $p \leq .001$); MAI-J total score ($z = 2.411$, $p = 0.017$); and DQ ($z = 4.510$, $p \leq .001$) showed significant score differences.

Regarding mothers' fluctuating emotions during Phase I, mothers in both Groups A and B showed "anticipation and joy at the birth of a child," but Group B expressed "pain at not being able to have the envisioned birth," which was talked about as influencing mothers' post-birth negative feelings. Group A mothers talked about being able to face childcare immediately, despite "anxiety about a safe delivery and post-birth childcare." Group B mothers expressed feeling "denial that my child has Down syndrome" starting from when they learned their child could have Down syndrome and continuing post-diagnosis, and they talked about "making a resolution to raise my child" as a part of childcare. Both Group A and B mothers felt difficulties in raising their children, with Group A mothers stating they were "searching for how to raise my child." In contrast, Group B mothers had "feelings of difficulty regarding promoting my child's growth and development," which prevented them from reaching a stage where they could search for a childcare method. Group B mothers felt "a sense of security due to my husband sharing childcare duties" and the considerable support provided by husbands lead Group B mothers to express "a sense of calmness due to familial support."

In Phase II, Group A mothers were "feeling physical and psychological fatigue and anxiety," but they were also "searching for better childcare methods for my child" and expressed the "joy and anticipation from stable family relationships" due to "a sense of security due to the cooperation of families and the stability of daily life." Conversely, Group B mothers had increased difficulties in childcare, with "feeling burdened due to the increased difficulties of a mother's housework and childcare" and "difficulties related to childcare with regards to my child's diet." Although Group B mothers did express positive feelings such as feeling "a sense of calmness due to others' support" and feeling "a sense of security due to the cooperation of families and the stability of daily life," they also expressed many negative feelings such as "a sense of maternal mood instability" which was not evident in Group A mothers. Finally, in Phase II both Group A and Group B mothers had either returned to work or were planning to return to work, leading to "feelings of anxiety and difficulty in balancing work and childcare" with mothers expressing they were at a turning point and facing challenges establishing new daily routines.



* Group A and Group B comparison, Mann-Whitney U Test ($p < .05$) results shown with Group B results
□ Group A and Group B comparison, shading indicates repeated categories in each phas

Figure 3: Comparison of relationship formation between Group A and Group B (integrated Group A and Group B data)

Regarding mothers' positive acceptance of their own children, in Phase I both Group A and Group B mothers expressed "feeling a sense of attachment to my child," such as feeling the cuteness of their own children during everyday life. Group B mothers specifically mentioned feeling joy at being able to live with their children following discharge from the NICU. Group A stated they were "feeling the need to be positively involved in my child's growth and development," and desired to do what was best for their children. In contrast, Group B mothers spoke of the need for "devising growth and developmental involvement tailored to my child" to improve characteristics specific to Down syndrome.

In Phase II, Group A mothers had settled into stable lives with their children and had "a feeling of enjoyment living with my child," expressing an increase in positive feelings such as concretely "imagining how to continue to relate to my child in the future" while "searching for ways to interact with my child" leading to their continued growth and development. Group B mothers expressed "a sense of security stemming from the accumulation of life experiences with my child" and stated their ability to interpret their child's reactions amidst difficulties were allowing them to engage in "searching for ways to interact with my child."

The above indicates that for the mother-child relationship formation process in Phase I, Group A mothers were capable of "exploring and building on the mother-child relationship" from birth, but for Group B mothers "the mother-child relationship is limited and unstable." In Phase II, Group A continued to improve the ability of both mother and child to interact smoothly with the "mother and child smoothly engaging with the relationship formation process." Conversely, Group B had difficulty improving abilities that would allow them to promote mutual mother-child interaction in Phase II, indicating the "mother-child relationship is disordered and in a trial-and-error state."

Discussion

Subject characteristics

In recent years, the average age of first-time mothers in Japan has remained steady at approximately 30.7 years old and the average birth weight of infants similarly has remained approximately 3020g [29]. Group A mothers and infants showed similar figures and this, combined with the number of weeks of gestation at birth falling in the range of normal term births, allows for Group A to be considered an average population. Although the frequency of Down syndrome birth increases as the age of the mother at birth increases, with the common consensus that Down syndrome birth frequency increases dramatically in mothers over the age of 40, advances in prenatal diagnostic technology in Japan have resulted in more mothers under 40 giving birth to Down syndrome children [1]. The average age of mothers in Group B was between 35, where Down syndrome frequency increases, and 40 years of age. Down syndrome infants are often born early, tend to have birth weights slightly lower than normal, and often have associated complications [3,30]. The number of weeks of gestation at birth, birth weights, and percentage of infants with complications of Group B in this study was consistent with prior research.

The process of mother-child relationship formation between infants with Down syndrome and their mothers

Group B mothers had the strongest negative feelings during the period from learning at birth the possibility that their child had Down syndrome until receiving a clear diagnosis, and at the time of diagnosis [31]. After that, they continued to have negative feelings and difficulties with childcare including how to accept their child, but once Group B mothers were living together with their child in Phase I their acceptance progressed, leading to a slight mitigation in strong negative feelings. However, negative feelings held by Group B mothers continued into Phase II and although positive feelings increased due to support from others, including familial support, emotional states continued to fluctuate, suggesting an improvement to negative feelings cannot yet be anticipated.

Phase I is considered to be the period when a Group B mother begins to have positive feelings toward their child, due to being released from the pain of separation while their child was hospitalized in the NICU and feeling joy at being able to spend time together. Phase II is considered to be the period when acceptance of a child with Down syndrome progresses, due to an accumulation of time spent focused on living with a child with Down syndrome [30,32]. However, in Phase II mothers of children with Down syndrome not only have to handle treatments for complications, but also experience growing developmental delays in motor function and lifestyle habits. This results in mothers searching for childcare methods which can improve their child's characteristics and the subsequent visits to hospitals and other facilities also increases mothers' burdens and anxiety [33]. Therefore, it is thought that these mothers are dissatisfied with the lack of childcare support for their children with Down syndrome in the community and, although their acceptance of their child's Down syndrome is increasing, the burden of raising their child is so great that fatigue and anxiety accumulate, affecting their positive feelings toward their child.

Focusing on infant growth and development, Down syndrome infant motor function development has been estimated in Japan to be delayed about 3 months [10]. This study clearly indicated a 2-to-3-month delay in Phase I and a 3-to-4-month delay in Phase II, showing increasing delays in infant development as the child ages. Large developmental delays in basic habits and social aspects such as interpersonal relationships are believed to affect mothers' sense of childcare as a burden, which affects the mother's ability to adapt to her child (communication skills, ability to cope) [34], elicits negative feelings, and negatively affects the positive feelings these mothers feel toward their children.

With regards to mother-infant interaction, Down syndrome infants' gentle smiling facial expression and lack of responsiveness towards their mothers often hinders mothers from grasping the miniscule expressions and responses of their infants [21]. Combined with the influence of slowed infant growth and development, we believe it is difficult to manifest interactions which match the development of infants with Down syndrome. This was especially true during Phase II, where increasing developmental delays made it difficult for children with Down syndrome to exhibit reactiveness and responsiveness easily interpreted by their mothers, which in turn made it difficult for mothers to engage in interactions which actively promote appropriate infant reactiveness and responsiveness, and which also promote infant growth and development.

Characteristics of relationship formation between mothers and infants with Down syndrome

Comparing Groups A and B, no significant differences were evident in mothers' negative feelings (POMS2). In first-time mothers of

healthy children, the accumulation of fatigue has a strong effect on maternal negative reactions [35-36], a trend we believe to also be true for Group A mothers. Since Group B mothers were encountering Down syndrome children for the first time and their average age was also higher than mothers in Group A, we considered Group B mothers to exhibit similar trends to older first-time mothers. Although older first-time mothers in Japan have more social experience and an ability to overcome the challenges of childcare, it has been reported that when these mothers are unable to feel satisfaction in being mothers and lack confidence in themselves in the role of mother it creates a feeling of difficulty with childcare, allowing fatigue to accumulate [37]. The mothers in Group B had difficulty accepting that their child had Down syndrome. They also had difficulty feeling satisfied with being a mother because they had been separated from their child shortly after birth, which caused difficulty in childcare and increased fatigue, further influencing negative feelings. Mothers raising children with Down syndrome who have siblings also consider the impact of childcare on the non-Down syndrome children, and we believe that mothers' consideration of family relationships also contributes to mother's negative feelings. We believe that difficulties and negative feelings in mothers arise during childcare, regardless of the child's level of health, leading to no observed difference in scores.

Positive feelings of mothers toward their children (MAI-J) were significantly lower in Group B than Group A during both Phase I and Phase II. This result is believed to stem from Group B mothers having difficulty understanding their children due to the characteristics of Down syndrome. Moreover, child acceptance and childcare being affected by prejudices toward Down syndrome held by others and mothers themselves is a result consistent with previous studies suggesting such bias exerts large effects on mothers' positive feelings toward their children [31,38].

Infant growth and developmental status also showed clear differences between Group A and Group B. Group A infants met all indicators for growth and development but there were increasing delays in Group B infants as infant age in months increased. These delays were especially pronounced in motor function and social skills development. The slow development of physiological, autonomic, motor, and cognitive functions characteristic of infants with Down syndrome indicated delays in motor function and basic habits. Infants' limited reactiveness and responsiveness delays the development of interpersonal relationships, a finding consistent with previous studies [39-41]. We consider the delayed state of infant growth and development to negatively affect mothers' feelings and their childcare and, furthermore, believe that this emphasizes difficulties in engaging in a relationship that promotes the growth and development of the child.

In mother-child interaction (JNCATS), Group B had significantly lower total scores, infant scores, and mother scores than Group A in Phase II, suggesting that mothers and infants in Group B had difficulty smoothly progressing with mother-child interaction due to lack of infant reactiveness and responsiveness. We propose that mothers in Phase II are more clearly aware of their discomfort than they were in Phase I, which we believe is influenced by infant reactiveness and responsiveness which can lead to a mother's understanding of their child being limited due to developmental delays in motor function and social skills [21], as well as the fluctuating feelings of the mother making it difficult for mothers to actively engage with their children and limit how much they can work on improving their mother-child interactions. If mothers' acceptance of their children remains stagnant or there are increases in delays to growth and development, this will affect fluctuations in mothers' feelings and will prevent both mother and child from improving their ability to engage in the quality interactions necessary for both mother and child to smoothly promote mother-child interactions and to form a mother-infant relationship. The continuation of such a situation is likely to make the mother-child relationship more difficult and complex in the future.

Furthermore, Phase II marks the return to work for both Group A and Group B mothers, a turning point in the lives of mothers' families and their infants. This produces "feelings of anxiety and difficulty in balancing work and childcare" and the burden of searching for this balance was indicated. Group A mothers were able to engage in "searching for better childcare methods for my child" and feel "a sense of security due to the cooperation of families and the stability of daily life," which is believed to allow these mothers to plan for the future because they have stable lives with their infants and have become accustomed to balancing childcare and housework. Conversely, despite Group B mothers' feelings about having a child with Down syndrome stabilizing by "a sense of security due to the cooperation of families and the stability of daily life" and feeling "a sense of calmness due to others' support," these Group B mothers also reported "feeling burdened due to the increased difficulties of a mother's housework and childcare" and "difficulties related to childcare with regards to my child's diet." Group B mothers are believed to feel an increasing sense of burden regarding childcare for their children. Group B mothers also started to feel "anxiety regarding the future growth and development of my Down syndrome child" and felt difficulties when planning to return to work regarding childcare, medical care, and doctor's visits for their children. It is believed the accumulation of maternal fatigue will continue to increase.

Supporting relationship formation between mothers and infants with Down syndrome

The results of this study indicate that the growth and development of infants with Down syndrome is increasingly delayed as their age in months increases, which affects mothers' emotions and active involvement with their children. In addition, it is difficult for both mother and child to improve their abilities to facilitate mother-infant interaction, and this may have an impact on the mother-infant relationship. In order for mothers to actively interact with their children it is important to provide support that reduces the mother's negative feelings and increases their positive feelings, which will ultimately have a positive impact on infant development.

Mothers of children with Down syndrome experience more positive feelings when their childcare is supported by family and others, allowing for the inference that such support also increases mothers' acceptance of the fact that their children have Down syndrome. To build better family relationships and achieve a higher quality of life we believe support provided not only by family but also other people in the community is indispensable [34]. We believe support provided not only by family but also other people in the community is indispensable. One characteristic of children with Down syndrome is that multiple factors such as the physical and psychological state of the mother, the child's degree of intellectual disability, social isolation, and economic issues can create a negative cycle that increases childcare difficulties for the mother, which has been linked to an increased risk of child abuse [43]. Despite mothers with Down syndrome children needing support because of these abuse risk factors, we believe the fact that mothers sought childcare methods appropriate to their

children indicates a need to establish a support system which takes into account the characteristics of Down syndrome and risk factors so that others can provide support which reduces childcare burdens and is tailored to an individual mother's conditions. Mothers are looking for support from others in the following areas: support allowing them to feel their child's growth and development; support to obtain desired information on childcare; support to meet other children of the same age; and support to help with housework and childcare, including financial support. Considering the fact that developmental delays increase even over the short period of infancy, it is important to provide support from the early stages of infancy. In addition, since family support for mother and child is important, we believe that the surrounding support should include not only the mother and child but also the family.

Based on the above, it is believed that when mothers' childcare burden is reduced, their childcare will become more positive and their feelings for their child will grow stronger, which leads to a better understanding of the child [43]. Support that reduces a mother's childcare burdens stabilizes their positive feelings and the increase in interactions with the child promotes infant growth and development. As a result, the ability of both mother and child to facilitate mother-infant interaction is enhanced, leading to the formation of a mother-infant relationship [21,30].

When providing childcare support to mothers, it is possible that some mothers may not be able to accept that their child has Down syndrome. This makes it necessary to coordinate with these mothers from the early stages of infancy to devise ways for them to interact with their child and to utilize social resources, including hospitals and medical care appointments, according to their individual needs, so that active support can be extended to these mothers. We believe that it is necessary to have a comprehensive coordinator who can engage with mothers from the early stages of infancy, devising ways for mothers to relate to their children and utilize social resources, including hospitals and medical care appointments [44].

Limitations of This Study and Issues for Future Research

We believe that there are limitations in generalizing our findings for the mothers of children with Down syndrome who chose to participate in this study because of the short-term longitudinal nature of the study, uncontrolled family structures, the study's limited geographic area, and the small number of participants. However, at the time of participant recruitment there were few locations to meet infants with Down syndrome and their families, and such environments could not be entered by outsiders due to the required delicate consideration. Considering the treatment of complications and mothers' acceptance of their children, it is difficult to perform detailed surveys and meet a larger number of participants in the early stages immediately post-birth. Moving forward, in conjunction with a more detailed understanding of the process from birth to infancy, there is a need for continual support leading towards early childhood and a need to construct a support system that facilitates continuing childcare so that a mother can be actively involved with their child with Down syndrome to form a mother-child relationship.

Conclusions

This study used a mixed-methods approach to clearly indicate that in the process of relationship formation between infants with Down syndrome and their mothers there are difficulties enhancing the abilities of both mother and child to facilitate mother-child interaction. In order to support relationship formation between infants with Down syndrome and their mothers, it is important to provide support which both reduces mothers' negative feelings such as their "acceptance of my child with Down syndrome" and promotes mother-child involvement (the accumulation of mother-child interaction) which can increase positive feelings for the child. Study results suggest the need for society as a whole to provide support which can reduce mothers' childcare burdens from early infancy, allowing for mothers to be actively involved in their child's care and be involved in improving such care, which can improve some characteristics of children with Down syndrome and reduce delays in their growth and development.

Conflict of Interest

The author declares no conflict of interest.

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