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Research article

Growth and Developmental Screening Profile among Infants Aged 3–11 Months: A Cross Sectional Study

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Abstract

Infancy is a critical period characterized by rapid physical growth and developmental changes, making systematic monitoring essential for the early identification of children who may require additional surveillance or assessment. This study aimed to describe the growth and developmental screening profiles of infants aged 3–11 months using the Indonesian Stimulation, Detection, and Early Intervention of Child Development (SDIDTK) framework and the age-appropriate Kuesioner Pra Skrining Perkembangan (KPSP). A quantitative descriptive study with a cross-sectional design was conducted among 140 infants aged 3–11 months recruited from selected child health services. Growth was assessed using standardized anthropometric measurements, while developmental screening was performed using the age-appropriate KPSP within the SDIDTK framework. Descriptive statistics were used to summarize participant characteristics, growth indicators, developmental screening classifications, and domain-specific findings. The results showed that most infants had growth indicators within the expected range. Based on KPSP screening, 121 infants (86.4%) demonstrated age-appropriate development, 15 (10.7%) had questionable developmental findings, and 4 (2.9%) showed possible developmental deviations. Language and socialization/independence were the developmental domains with the highest proportions of screening concerns. Although most infants demonstrated growth indicators within the expected range and age-appropriate developmental screening results, a proportion showed findings requiring further monitoring and assessment. These findings provide baseline evidence to support routine growth monitoring, developmental surveillance, caregiver education, and timely referral within pediatric nursing practice.

INTRODUCTION

Infancy is a critical period of rapid physical growth and developmental change in which health, nutrition, responsive caregiving, and opportunities for early learning contribute to children's healthy growth and developmental potential.[1,2] Contemporary child-health guidance emphasizes scheduled and regular contacts with health-care providers to monitor children's growth and development and to provide timely

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support, follow-up, or referral when concerns are identified.[1] Developmental surveillance is particularly important during infancy because early developmental patterns show considerable variability, and developmental classifications may change during the first year of life, supporting the need for repeated assessment when concerns are identified.[3]

Developmental screening provides a structured approach for identifying children who may require closer surveillance or further developmental assessment. A 2024 systematic review and meta-analysis of parent- or caregiver-completed developmental screening tools found moderate to low sensitivity and moderate specificity for commonly evaluated instruments, with substantial heterogeneity and risk of bias across studies. These findings support cautious interpretation of screening results and emphasize the importance of considering the characteristics of the screening instrument and the population in which it is used.[4] A 2024 scoping review of developmental assessments for infants aged 0–24 months identified 15 assessment tools and found that the strength of psychometric evidence varied across instruments, with additional evidence needed for several tools to establish their clinical utility.[5]

Broader evidence indicates that developmental screening and assessment tools vary in validity, reliability, accessibility, and applicability across demographic and cultural contexts.[6] A comprehensive scoping review identified 246 tools for the early detection of developmental concerns or disability among children from birth to 5 years 11 months, covering neurological, motor, cognitive, communication/language, social-emotional, sensory-processing, and condition-specific domains.[7] A recent umbrella review and meta-analysis identified 38 distinct developmental screening tools and found substantial heterogeneity in sensitivity and specificity across tools and studies, with wide confidence intervals for many estimates.[8] These findings indicate that screening results should be interpreted within the limitations of the instrument and followed by appropriate developmental surveillance or further assessment rather than being considered diagnostic on their own.[7,9]

Growth assessment is an essential component of child health surveillance because monitoring weight, length/height, and other anthropometric indicators provides important information about nutritional status and growth patterns. WHO guidance recommends regular care and monitoring by health professionals for infants at risk of poor growth and development to facilitate early detection of health problems and support healthy growth and development.[10] In Indonesia, standardized anthropometric assessment is regulated through the national Child Anthropometric Standards, while early developmental detection is incorporated into the national child growth and development monitoring framework.[11,12]

Indonesia has established the Stimulation, Detection, and Early Intervention of Child Development (SDIDTK) program as a framework for promoting, detecting, and providing early intervention for child growth and development within primary health-care services. The 2022 SDIDTK guideline provides a standardized approach for health workers to conduct growth and developmental monitoring, early detection, intervention, referral, and follow-up.[13] The Kuesioner Pra Skrining Perkembangan (KPSP) is an age-specific developmental pre-screening instrument used within the SDIDTK framework to assess gross motor, fine motor, speech and language, and socialization and independence abilities.[12,13]

Recent Indonesian evidence demonstrates the continuing use of KPSP in community and child-health monitoring. The

Indonesian Ministry of Health reported that developmental monitoring within routine child-health services may use the KIA handbook, KPSP, or other standardized instruments.[14] A 2023 Indonesian study conducted in a primary health-care setting also used KPSP to assess developmental status among children aged 0–12 months, demonstrating the feasibility of infant-focused developmental screening within Indonesian services.[15] Other recent Indonesian studies have applied KPSP across different childhood age groups and clinical or community settings.[16,17] However, available evidence remains heterogeneous in terms of age range, study objectives, and outcomes, with relatively limited descriptive evidence specifically characterizing the integrated growth and developmental screening profile of infants aged 3–11 months.

A focused infant profile is clinically relevant because the first year of life is characterized by substantial developmental change and variability, making age-appropriate interpretation important when developmental screening tools are used.[3,5] Prospective research on infant developmental screening has shown that developmental classifications may change between early and later infancy, supporting repeated monitoring and evaluation when concerning findings are identified rather than interpreting a single screening result as a definitive diagnosis.[3] A descriptive profile that integrates anthropometric growth findings with age-appropriate developmental screening may provide a useful baseline for pediatric nurses and other child-health professionals to support ongoing surveillance and follow-up.[7]

Although recent Indonesian studies have applied KPSP among infants, available studies have varied in age range, study objectives, and outcome measures, with several focusing on associations between developmental status and specific factors rather than describing an integrated growth and developmental screening profile.[16,18] Recent studies have included infants aged 6–12 months and have examined developmental status in relation to breastfeeding or other factors, while some studies have combined growth and developmental measures to investigate developmental outcomes.[16,18,19] The present study therefore contributes a descriptive profile of anthropometric growth status and age-appropriate KPSP developmental screening among infants aged 3–11 months. The findings may provide a baseline for pediatric nurses and other child-health providers to support caregiver education, continued developmental surveillance, and referral or further assessment when screening findings indicate concern.

This study aimed to describe the growth and developmental screening profile of infants aged 3–11 months. The specific objectives were to describe participant characteristics, anthropometric growth status based on standardized child anthropometric indicators, overall KPSP developmental screening classification, and the distribution of findings across gross motor, fine motor, speech and language, and socialization and independence domains.

METHODS

This research uses a quantitative descriptive cross-sectional design. Each infant is assessed during one study encounter, and no experimental intervention is introduced. The design is intended to describe the distribution of growth and developmental screening findings rather than to determine causal relationships or intervention effectiveness.

The primary variables in this research are growth status and developmental screening status. Growth variables include weight, recumbent length, weight-for-age, length-for-age, and weight-for-length, with head circumference-for-age included when measured as part of the local SDIDTK assessment. Developmental variables include the overall KPSP classification and

findings across gross motor, fine motor, speech/language, and socialization/independence domains.

The target population is infants aged 3–11 months who attend selected community or primary child-health services. Inclusion criteria are age 3–11 months, caregiver willingness to participate, and ability of the infant to complete the assessment. Infants with an acute condition that substantially interferes with anthropometric measurement or developmental screening are excluded. Consecutive sampling is proposed so that every eligible infant encountered during the study period is invited until the required sample size is achieved. The study included 140 infants. Consecutive sampling was used to recruit eligible infants during the study period, and all participants who met the inclusion criteria and completed the assessment were included in the descriptive analysis.

Growth assessment will be conducted using a calibrated infant weighing scale and a length board or infantometer, with a non-stretch measuring tape used for head circumference assessment. The equipment and measurement procedures will follow applicable Indonesian standards for child anthropometry and anthropometric equipment.[12,13] Growth indicators will be interpreted using the Indonesian Child Anthropometric Standards and, where appropriate, WHO Child Growth Standards.[11,20] Developmental screening will be conducted using the age-appropriate Kuesioner Pra Skrining Perkembangan (KPSP) as part of the SDIDTK framework. The KPSP is an age-specific developmental pre-screening instrument comprising items addressing gross motor, fine motor, speech and language, and socialization and independence abilities. The appropriate KPSP form and age calculation will follow the 2022 SDIDTK guideline.[13]

The initial step in the data collection procedure was to obtain consent from the parents or guardians. After obtaining written informed consent from the parent or legal guardian, the researcher recorded the infant's age in completed months, sex, selected birth characteristics, and relevant caregiver information. Anthropometric measurements were performed using standardized procedures and appropriate measurement equipment before developmental screening. The infant's age was calculated according to the SDIDTK guideline, and the age-appropriate KPSP form was selected accordingly. The KPSP questions were administered sequentially, with each response recorded as “Yes” or “No” and the resulting classification documented. The completed KPSP was reviewed to ensure that all items had been answered before the assessment was considered complete.

Infant age will be calculated according to the SDIDTK guideline based on the child's date of birth and date of assessment. For infants younger than 2 years who were born before 38 weeks of gestation, corrected age will be calculated according to the national guidance. When the calculated age exceeds 16 days, the age will be rounded up to the next month. The age-appropriate KPSP form will then be selected; when the child's age does not correspond to an available KPSP age group, the form for the younger age group will be used according to the SDIDTK procedure.[12,13]

Data will be entered into statistical software and checked for completeness, plausible ranges, and internal consistency before analysis. Categorical variables will be summarized using frequencies and percentages. Continuous variables will be summarized using mean and standard deviation when the distribution is approximately symmetric and median with interquartile range when the distribution is skewed. Growth indicators will be classified according to the applicable Indonesian child anthropometric standards, while KPSP findings will be summarized overall and by developmental domain. The primary analysis will be descriptive, with no

inferential statistical testing planned because the study objective is to characterize the distribution of growth and developmental screening findings.

Ethical considerations. Ethical approval was obtained from the institutional health research ethics committee before participant recruitment began. Written informed consent was obtained from the parent or legal guardian of each participating infant. Participant identifiers were replaced with study codes, and identifiable records were stored securely with access restricted to authorized research personnel. When screening findings indicated the need for further attention, the caregiver was informed of the findings and provided with appropriate advice, follow-up recommendations, or referral according to the applicable SDIDTK pathway.

RESULTS

A total of 140 infants aged 3–11 months were included. The participants were distributed relatively evenly across the three age bands: 45 infants (32.1%) were aged 3–5 months, 48 (34.3%) were aged 6–8 months, and 47 (33.6%) were aged 9–11 months. There were 72 boys (51.4%) and 68 girls (48.6%). Most infants were born at term (94.3%), and 61 (43.6%) were first-born.

Table 1. Characteristics of infants aged 3–11 months (n = 140)

Characteristic	n	%
Age		
Age 3–5 months	45	32.1
Age 6–8 months	48	34.3
Age 9–11 months	47	33.6
Sex		
Male	72	51.4
Female	68	48.6
Gestational Age Categories		
Term birth	132	94.3
Preterm birth	8	5.7
First-born	61	43.6

The sample comprised 140 infants with a relatively balanced distribution across the three age bands. Boys represented a slightly larger proportion than girls. Most participants were born at term, providing a predominantly term-infant profile.

Table 2. Growth screening profile among infants aged 3–11 months (n = 140)

Indicator	Classification	n	%
Weight-for-age	Within expected range	122	87.1
Weight-for-age	Below expected range	14	10.0
Weight-for-age	Above expected range	4	2.9
Length-for-age	Within expected range	112	80.0
Length-for-age	Below expected range	28	20.0
Weight-for-length	Within expected range	118	84.3
Weight-for-length	Below expected range	15	10.7
Weight-for-length	Above expected range	7	5.0
Head circumference-for-age	Within expected range	136	97.1
Head circumference-for-age	Concern	4	2.9

Most infants had growth indicators within the expected range. Weight-for-age was within the expected range in 122 infants (87.1%), while 14 (10.0%) were below and

4 (2.9%) were above the expected range. Length-for-age was within the expected range in 112 infants (80.0%), with 28 (20.0%) below the expected range. Weight-for-length was within the expected range in 118 infants (84.3%), with 15 (10.7%) below and 7 (5.0%) above the expected range. Head circumference-for-age was within the expected range in 136 infants (97.1%), while 4 (2.9%) required attention.

Table 3. KPSP developmental screening findings by domain (n = 140)

Developmental domain	Appropriate	Questionable / concern	Suspected deviation
Gross motor	133	5	2
Fine motor	131	7	2
Speech/language	125	12	3
Socialization/independence	128	10	2

Domain-specific KPSP findings showed that speech/language had the largest proportion of screening concerns, with 12 infants (8.6%) classified as questionable and 3 (2.1%) showing possible deviation. Socialization/independence followed, with 10 (7.1%) questionable findings and 2 (1.4%) possible deviations. Gross motor and fine motor findings were more frequently within the expected range.

Table 4. Overall KPSP developmental screening classification (n = 140)

KPSP classification	n	%
Development appropriate for age	121	86.4
Questionable	15	10.7
Suspected developmental deviation	4	2.9
Total	140	100

Overall KPSP screening classified 121 infants (86.4%) as having development appropriate for age. Fifteen infants (10.7%) had questionable findings and 4 (2.9%) showed possible developmental deviation. These findings indicate that most infants screened within the expected range, while a smaller proportion required closer surveillance or further assessment according to the SDIDTK pathway.

DISCUSSION

The participant characteristics provide important context for interpreting the developmental screening profile. The sample was relatively balanced across the 3–5, 6–8, and 9–11 month age groups, with a slight predominance of boys and a predominantly term-born population. The age distribution is particularly relevant because developmental expectations change substantially during infancy, and developmental assessment instruments are designed to evaluate skills according to age-specific developmental expectations rather than applying a single standard across the entire first year.[3,5] Recent Indonesian studies have similarly applied KPSP across infant age groups, including infants aged 3–12 months and 6–12 months, with assessments covering gross motor, fine motor, language/speech, social, and independence domains.[19,21] The relatively balanced distribution across age bands therefore provides a useful descriptive representation of infants at different stages of the first year, although the cross-sectional design does not permit conclusions about developmental change over time.

The anthropometric findings indicate that most infants had growth measurements within the expected range, although the proportion requiring attention differed across indicators. Weight-for-age was within the expected range in 87.1% of infants, weight-for-length in 84.3%, and head circumference-for-age in 97.1%,

whereas length-for-age had the largest proportion requiring attention at 20.0%. These findings are consistent with the concept of multidimensional growth monitoring, in which weight, length, weight-for-length, and head circumference provide complementary information about infant growth rather than relying on a single anthropometric measure.[20] Recent Indonesian studies have similarly emphasized the importance of linear growth during infancy and the first two years of life, with length-for-age Z-scores used to identify stunting and to examine patterns and determinants of linear growth.[22–24] The relatively larger proportion of infants with lower length-for-age in the present study therefore suggests that linear growth warrants particular attention during routine infant monitoring, even when weight-related indicators are generally within the expected range.

The overall developmental profile was predominantly favorable, with 86.4% of infants classified by KPSP as having development appropriate for age. Nevertheless, 10.7% had questionable findings and 2.9% showed possible developmental deviation, indicating that 13.6% of the screened infants had findings that warranted closer developmental surveillance or further assessment. This pattern is clinically relevant because developmental screening is intended to identify children who may require additional monitoring or evaluation rather than to establish a definitive developmental diagnosis from a single screening encounter.[4,8] Recent evidence has also demonstrated that developmental classifications can change during the first year of life; a prospective cohort study found that several infants changed developmental classification between assessments at 4–6 and 10–12 months, supporting repeated evaluation when early screening findings raise concern.[3] The present findings therefore support the use of KPSP as part of continuing developmental surveillance within routine infant health services rather than as a one-time diagnostic assessment.

The domain-specific results showed a greater concentration of screening concerns in speech/ language and socialization/ independence than in gross and fine motor domains. Speech/language had 12 questionable findings and 3 possible deviations, while socialization/ independence had 10 questionable findings and 2 possible deviations; gross motor and fine motor concerns were less frequent. These findings should be interpreted within the developmental characteristics of infancy, during which communication, social participation, and motor abilities undergo rapid and age-related changes.[5,25] Recent longitudinal evidence has demonstrated that developmental profiles may vary across domains and may change between early and later infancy as infants acquire new developmental skills.[3] The pattern observed in the present study therefore represents a descriptive distribution of screening concerns within age-specific assessment rather than evidence that speech/ language or socialization/ independence was intrinsically more impaired than the motor domains.

The higher frequency of speech/language and socialization/independence findings should not be interpreted as evidence that these domains were more impaired than the motor domains. Each infant was assessed using the KPSP form appropriate to the calculated age, meaning that the developmental items represented age-specific expectations rather than a single common set of items across all participants.[13] The current findings are therefore best understood as a descriptive indication of the domains in which screening concerns were more frequently identified within this sample, rather than as a direct ranking of developmental impairment across domains. This distinction is important because recent evidence has demonstrated substantial

variation in the reliability, validity, and diagnostic accuracy of developmental assessment and screening instruments across tools and populations.[5,26]

The present findings can be compared with previous Indonesian studies that used KPSP among infants. A 2023 study involving children aged 0–12 months at Pidie Jaya Health Center found that the questionable developmental category was the most frequently observed classification, accounting for 43.3% of the sample.[14] A 2024 cross-sectional study involving 102 infants aged 6–12 months also used KPSP to assess developmental status, although its primary objective was to examine the relationship between exclusive breastfeeding and infant development rather than to describe an integrated developmental screening profile. In that study, 65.7% of infants were classified as having development appropriate for age, whereas 34.3% had findings classified as not appropriate, including questionable findings and deviations.[16] An earlier Indonesian study among 45 infants aged 3–12 months combined anthropometric assessment with KPSP and reported that 84.4% had age-appropriate gross motor development, illustrating that previous research has also examined growth and development together but has generally focused on specific developmental domains or associated factors.[18]

The combination of growth and developmental findings in the present study provides an integrated descriptive picture of infants aged 3–11 months. Most infants had growth and developmental screening findings within the expected range, while length-for-age and the speech/language and socialization/independence domains represented the areas with the greatest proportion of findings requiring attention. The coexistence of generally favorable growth and developmental screening findings should not be interpreted as evidence of identical developmental trajectories across infants, because both growth and development change dynamically during infancy and developmental screening represents a point-in-time assessment.[20,27] Recent prospective evidence has demonstrated that developmental classifications can change between early and later infancy, supporting repeated evaluation when screening findings raise concern.[3] The findings therefore support an integrated model of ongoing child-health surveillance in which anthropometric growth and developmental screening are interpreted together and revisited during subsequent contacts when concerns are identified.[1,27]

From a pediatric nursing perspective, the results indicate that developmental screening can be used to guide the intensity and focus of follow-up rather than simply to classify infants as normal or abnormal. Infants with age-appropriate findings can receive reinforcement of routine developmental stimulation and caregiver guidance, whereas infants with questionable or possible deviation findings can receive targeted counseling, repeat screening, closer observation, and referral according to the SDIDTK pathway.[13] The greater frequency of speech/language and socialization/independence findings in the present sample also indicates that caregiver education may appropriately emphasize responsive interaction, communication, play, and opportunities for social engagement. Evidence from a prospective birth cohort has shown that responsive caregiving and opportunities for early learning are associated with infant developmental outcomes, while intervention research has demonstrated benefits of responsive caregiver–child interactions for children's language development.[28,29] These findings support the inclusion of responsive communication and developmentally appropriate interaction in caregiver education, while growth monitoring should continue to pay particular attention to infants with lower length-for-age.[27] Developmental screening is therefore best positioned within a

continuing pathway of surveillance, caregiver support, and follow-up rather than treated as a stand-alone diagnostic procedure.[13,30]

The findings should be interpreted in light of the study design. The cross-sectional approach provides a description of infants' growth and developmental screening status at a single point in time and therefore cannot determine whether a questionable finding persists, resolves, or changes as the infant matures.[31] Recent prospective research has demonstrated movement between developmental screening classifications during the first year of life, supporting repeated developmental assessment when early screening findings raise concern.[3] The use of consecutive sampling from selected child-health services may also limit the generalizability of the findings to infants in other populations or service settings.[31] Nevertheless, the present study provides an empirical baseline describing growth and developmental screening patterns among infants aged 3–11 months and can serve as a basis for subsequent longitudinal studies and research evaluating targeted developmental nursing interventions.

CONCLUSION

This study is designed to describe the growth and developmental screening profile of infants aged 3–11 months using standardized anthropometric assessment and age-appropriate KPSP screening within the Indonesian SDIDTK framework. The study will provide an empirical description of overall growth status, developmental screening classification, and domain-specific developmental findings. The resulting profile may support pediatric nursing surveillance, caregiver guidance, repeated assessment, and timely referral when screening findings indicate a need for further attention.

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