ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

Development of Norms for Action Naming Test (Ant) in Malayalam

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Publication Date: 2025/05/21

Abstract: This study aimed to develop normative data for the Action Naming Test (ANT) in Malayalam across age and gender in neurotypical adults. A total of 150 native Malayalam-speaking participants aged 20 years and above were tested using a modified ANT adapted from the Kannada version. Stimuli were validated by speech-language pathologists, and responses were scored using a structured cueing hierarchy. Statistical analysis revealed a significant decline in ANT performance with advancing age, while no major gender differences were observed. This study establishes normative data to aid clinicians in differentiating naming deficits due to neurogenic language disorders from age-related changes.

Keywords:- *Action Naming Test, Malayalam, Norms, Verb Retrieval, Aphasia, Language Assessment*.

How to Cite: Sahana Muralikrishna; Jincily Susan Paul (2025 Development of Norms for Action Naming Test (Ant) in Malayalam. *International Journal of Innovative Science and Research Technology*, 10(5), 842-852. https://doi.org/10.38124/IJISRT/25may801

I. INTRODUCTION

Language disorders, such as aphasia, can significantly impact an individual's ability to communicate effectively, affecting various aspects of language use and comprehension. Naming, a key linguistic ability that relies on both lexical and non-lexical processing, is frequently impaired in individuals with aphasia. Lexical processing involves the storage and retrieval of semantic information associated with words, while non-lexical processing encompasses the perception and recognition of the stimuli that trigger word retrieval. The Action Naming Test (ANT) is a valuable tool specifically designed for evaluating verb retrieval, an important component of overall naming ability. This study addresses the need for normative data by developing norms for the ANT in Malayalam, a language for which such standardized assessment tools are currently lacking.

II. REVIEW OF LITERATURE

Naming is one of the complex aspects of language. Naming deficits are prime indicators of an underlying neural pathology that might affect the language to varying extent. There have been many studies that have reported that impairments in object naming have lesions in the temporal lobes and impairment in naming verbs involves the left frontal cortex. The strain to retrieve a word can be temporary or long lasting and hence a language test battery that includes naming has to be assessed.

Neural interconnection of naming takes place in three stages which is known as the three-stage model of visual confrontation naming and the flow of information in these stages is happening through feedforward mechanism. The three stages are visual object recognition stage (identification of objects takes place visually), semantic stage (storage of non-visual information about the object) and phonological output stage (phonologic knowledge is within the phonologic output system). In the lexical semantic stage, many lemmas will be activated out of which the most appropriate lemma will be selected. Then the syllables corresponding to them are generated and instructions are given to the respective articulators. But a direct connection is also found between the visual object representation and phonological labels for some objects because these objects are taught independently without understanding what is being named. These stages are assumed to be opaque and only their outputs are seen by the next stages.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

In another words, the word finding process involves three stages of representation, semantic representation where the concept is specified, phonological representation where articulatory program is specified and an intermediate lexical representation where semantic features are attached to grammatical features. Cognitive operations such as visuoperceptual process, object recognition, semantic process, lexical process and articulatory processes are involved in naming a picture.

The research on naming tasks and its relevance in language assessment has been in limelight since the early 1980's. The naming assessment initially heavily relied on confrontation naming tasks which mainly focused on noun retrieval information. Lately, there is a slight shift in the naming assessment. The action naming tests have been employed to determine the verb retrieval abilities among neurotypical and neurogenic language disordered population. The list of tests available that evaluates the naming abilities have been given in the table 1.

Table 1 ***Naming tests***

Test	Purpose	Population	Special Features
Boston Naming Test (BNT)	Assesses confrontation naming ability	Adults with aphasia, dementia, brain injury	60 graded line drawings; sensitive to word-finding difficulties
Western Aphasia Battery (WAB) - Naming Subtests	Classifies type and severity of aphasia	Adults post-stroke, TBI, other neurological conditions	Includes object naming, sentence completion, and word fluency tasks
Philadelphia Naming Test (PNT)	Studies naming error patterns	Adults with aphasia; research settings	Large item set; detailed error analysis (semantic, phonological errors)
Expressive Vocabulary Test (EVT)	Measures expressive vocabulary and word retrieval	Children, adolescents, and adults (esp. educational contexts)	Focus on synonyms and naming; strong in school assessments
Multilingual Naming Test (MINT)	Fairly assesses naming across languages	Bilingual and multilingual individuals	Reduces cultural bias; appropriate for diverse populations
Action Naming Tests (Verb Naming Tasks)	Assesses ability to name actions (verbs)	Adults with aphasia or neurodegenerative diseases	Focus on verb retrieval; sensitive to specific language deficits
Bilingual Aphasia Test (BAT) - Indian adaptations	Evaluates naming and language in bilinguals	Bilingual speakers across Indian languages	Adapted versions for languages like Hindi, Tamil, Kannada; culturally appropriate
Indian Picture Naming Test (IPNT)	Confrontation naming with culturally relevant items	Adults and children in India	Developed using Indian pictures; addresses cultural and linguistic familiarity
Kannada and Malayalam Naming Tests (Regional adaptations)	Naming ability in native languages	Native speakers with language impairments	Region-specific images and vocabulary for Kannada/Malayalam speakers
Modified Boston Naming Test – Indian version	Indian adaptation of the BNT	Adults with neurological conditions in India	Culturally adapted images; used in Indian clinical practice

The above table gives information about the naming tests that was developed for western population. There have been few research studies done in India that focuses on development or adaptation of the tests to suit Indian context. The list of tests developed or adapted to Indian context has been given in table 2.

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Table 2 Indian Adaptations of Naming Tests

Sl. No	Test Name	Authors	Year	Language	Content areas	Standardization detail
1.	Bedside Evaluation Screening Test, 2nd ed (BEST-2)	Ramya and Goswami	2011	Kannada	Conversational expression, object naming, object description, sentence repetition, pointing to objects, pointing to parts of a picture and reading	30 neurotypical adults and 7 persons with aphasia
		Kanthima and Goswami	2011	Malayalam		30 neurotypical adults and 10 persons with aphasia
		Bijoya and Goswami	2010	Oriya		30 neurotypical adults and 7 persons with aphasia
2.	Boston Diagnostic Aphasia Eamination	Sona and Shyamala	2004	Malayalam	Conversational and expository speech, auditory comprehension, oral expression, reading, writing and praxis	20 neurotypical adults and 5 persons with aphasia
3.	Western Aphasia Battery (WAB)	Karanth, Ahuja, Nagaraja, Pandit, Shivashankar	1996	Hindi	Content, fluency, auditory comprehension, repetition, naming, reading, writing and calculations, praxis	Data are not provided
		Shyamala and Vijayashree	2008	Kannada		30 neurotypical adults and 150 persons with aphasia
		Jenny and Shyamala	1992	Malayalam		100 neurotypical adults and 8 persons with aphasia
		Sripallavi and Shyamala	2010	Telugu		100 neurotypical adults and 20 persons with aphasia
4.	Action Naming Test (ANT)	Gireesh and Shyamala	2015	Kannada	Action naming	80 neurotypical adults and 8 aphasics
5.	Boston Naming Test (BNT)	Sunil, Vijetha and Shyamala	2010	Kannada	Object Naming	

There have been many research studies done to assess noun and verb retrieval abilities in neurotypical adults and disordered population. Many researchers have used the tests mentioned in the table 1 and table 2 to evaluate the naming functions in neurotypical adults and individuals with neurogenic language disorders. Few of the research studies have been discussed below.

Nicholas, Obler, Albert and Goodglass (1985) investigated the lexical retrieval in healthy aging adults. They examined the lexical retrieval for common nouns and verbs using 2 picture naming tests in 162 healthy female and male subjects aged 30 to 79 years. They scored the responses based on correctness, responsivity to cueing, and the response type. The findings of their study showed that the ability to name both word types declined with age, especially after age 70 in healthy subjects. More errors were made on object names than action names, especially for older subjects. Subjects of all ages were equally able to utilize phonemic cues. With increasing age, subjects produced more circumlocutions and fewer semantic errors. The researchers stated that the response type difference need not reflect qualitative differences in lexical retrieval; rather, they reflect quantitatively greater difficulty of the task for healthy older people as compared to younger adults.

Williams and Canter (1987) examined the influence of two situational contexts on the action-naming performances of 44 aphasic patients: single-word confrontation naming and naming within the context of connected speech. The researchers evenly distributed the participants of their study among the syndromes of Broca's, Wernicke's, anomic, and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

conduction aphasia. The two naming tasks that they employed comprised of the same 18 target verbs. The findings of their study showed that the naming performance was not systematically influenced by the particular naming task in any of the aphasia groups studied. They also highlighted that some individuals, particularly in the group of anomic aphasia, there were substantial performance discrepancies between scores obtained on the two different tasks. Correlations between scores on the confrontation-naming and picture-description tasks were highest for the Wernicke's aphasics, followed by the conduction, Broca's, and anomic aphasics.

Bastiaanse and Jonkers (1998) investigated the verb retrieval in action naming and spontaneous speech in agrammatic and anomic aphasia individuals. They assessed verbs in ANT and in spontaneous speech in 16 aphasic patients (8 agrammatic and 8 anomics). The investigators compared the action naming and object naming performances. The results of their study showed that for both aphasic subgroups object naming was better than action naming and there was no difference between agrammatics and anomics, neither in object naming, nor in action naming. They also accounted that for spontaneous speech, both agrammatics and anomics differed from normal controls on 'verb diversity' furthermore the agrammatics were significantly worse than normal speakers (and the anomics) in verb inflection and the proportion of verbs produced without internal argument was higher than in normal speakers (and in anomics). It was revealed that there was no significant correlation between the scores on the action naming tests and the diversity of verbs produced in spontaneous speech. They postulated that for the anomics, this is due to the fact that for some patients it is more difficult to retrieve verbs in spontaneous speech than in isolation. For the agrammatics, the interference between verb retrieval and verb inflection seems responsible for the lack of a significant correlation.

Ramsay, Nicholas, Au, Obler and Albert (1999) carried out a longitudinal study to assess the verb naming in normal aging individuals. They administered the ANT to observe the performance of sixty-six healthy men and women in the age range of 30 to 79 years. All the participants were tested with the ANT 3 times over a 7-year span. The findings of their study revealed that there was a decline in the ability to retrieve verbs with aging for individuals above 50 years. A more stringent criterion suggests that verb naming difficulties begin by the fourth decade but is noted only by the sixth decade. The researchers also noted that the education does not play a major role in action naming ability for most participants.

Many of the researchers opine that action naming is an interesting area in research involving studies of aphasic and dementia patients. Studies have also been reported that the naming abilities in normal individuals decrease as age progresses. Mackay-Brandt, Connor and Albert (2002) assessed the noun and verb retrieval in healthy aging individuals. They administered BNT and ANT on 171 individuals from 50-88 years and found that there was a decline in the performance with aging. The investigators also noted that the oldest group performed better with phonemic cues than with any other cues.

Albert, Spiro, Sayers, Cohen, Brady, Goral and Obler (2009) evaluated the effects of health status on word-finding difficulty in aging individuals. They carried out a cross-sectional study in a community setting. Two hundred and eighty-four participants in the age range of 55-85 years were selected for their study. They carried out medical, neurological and laboratory evaluations to determine health status. The presence and absence of hypertension and also diabetes mellitus was also considered as variables for their study. The lexical retrieval abilities of the participants were assessed using BNT & ANT. The findings of their study showed that hypertension was found to be an additional factor contributing to word-finding difficulty in normal aging, beyond the effects of age per se, education, sex, and ethnicity. Diabetes mellitus, in contrast, did not influence lexical retrieval in this study.

Papagno, Casarotti, Zariono and Crepaldi (2019) evaluated the performance of 290 normal healthy Italian participants spanning from 19 over 80 years on picture naming test of 50 actions. The researchers carried out multiple regression analyses to decipher the data. The findings of their study revealed that age and education significantly correlated with the subject's score. They reported that increasing age negatively affected the performance while the performance increased with a higher education.

Higby, Cahana-Amitay, Voegl-Enny, Spiro, Albert and Obler (2019) examined the lexical retrieval performance of 264 adults in the age range of 55-84 years by administering the action naming and object naming tasks. They carried out the multiple regression test to determine whether executive function performance predicts naming abilities in older adults. The results of their study showed that the different executive function performance predicted naming speed and accuracy. They also highlighted that decline in lexical retrieval abilities among older adults is related to decreases in certain cognitive abilities.

Most of the studies mentioned above have focused on performance of neurotypical adults and individuals with neurogenic language disorders for various naming tasks. There have been few studies done in our Indian context that examines the ability of individuals on various naming tasks like confrontation naming and action naming.

Girish and Shyamala (2015) established norms for action naming in bilingual individuals (Kannada and English) from 20 to above 50 years. They reported that there was no significant difference across age groups in Kannada but significant difference was found in English. Pooja C (2019) developed a normative for confrontation naming in Kannada for the neurotypical individuals in the age range of 18-88

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

years and found that naming performance started to decline from 50 years and above and cognitive load was also high in naming tasks.

Abhishek & Prema (2014) examined the verb retrieval in persons with aphasia using Action naming test. The results of their study showed that the action naming abilities were greatly affected in individuals with aphasia. There are very few studies that have focused on action naming abilities in Indian population. In order to differentiate individuals with language disorders from normal individuals it is important to know the ability of normal individuals in naming actions in ANT. In order to check the values of action naming test with normative, no established normative is available in Indian context and very few studies have been carried out to establish normative in terms of age and gender.

As shown in the table 2, there is dearth of studies which assesses the naming function for verb retrieval skills in Malayalam language. According to the Indian census of 2011 records, there are 32,299,239 speakers of Malayalam language making up of 2.9 % of Malayalam speakers in India. Therefore, the need for a action naming test in Malayalam is essential to know a clear-cut difference between normal and deviant performances.

➢ *Objectives of the Study:*

- To develop normative data for the Action Naming Test (ANT) in the Malayalam language across different adult age groups
- To examine the effect of age on action naming performance among neurologically healthy native Malayalam speakers.
- To investigate gender differences, if any, in the performance on the Action Naming Test.
- To analyze the types of responses across different age and gender groups.

III. METHODOLOGY

The aim of the present study was to develop norms for ANT in Malayalam on neurologically healthy individuals across various age groups. Informed consent was obtained from all the participants selected for the study. A total of 150 participants were selected through simple random sampling technique, The Mini Mental Status Examination (MMSE) was administered on all 150 participants to rule out cognitive, communicative, and sensory deficits. All the participants who were considered for the current study were native Malayalam speakers. The participants were divided into five age groups consisting of fifteen males and females ranging from 20 to above 60 years with basic educational qualification. The division of the participants in terms of age and gender have been noted in table 3.

Table 3 Number of Neurotypical Male and Female Participants with Respect to their Age Range

Age Range	Male	Female	Total
20-29	15	15	30
30-39	15	15	30
40-49	15	15	30
50-59	15	15	30
60 years and above	15	15	30
	75	**75**	**150**

IV. MATERIALS

The Action Naming Test was originally given by Albert & Obler in 1979. The original test comprised of 5 practice items and 57 test items. The test items were modified for the Kannada version of Action Naming Test (ANT) given by (Girish & Shyamala, 2015) as some pictures were not appropriate to the Indian setting. The stimulus that we used for the present study was borrowed from the Kannada version of Action Naming Test (ANT) (Girish & Shyamala, 2015) The test items were given to 3 Speech Language Pathologists (3 SLP's who were native Malayalam speakers) of average age between 30-35 years and having above 3 years of teaching and clinical experience. They were asked to rate them on a 3-point familiarity rating scale.

The familiarity rating scale that was used is as follows:

0- Unclear and ambiguous
1- Somewhat clear and non-ambiguous
2- Very clear and non-ambiguous

The pictures rated as 2 and 1 were selected as the test items and the rest were excluded. The line drawings were modified or changed based on the ratings done by the 3 SLPs. After the familiarity test, the final stimulus of the present study had 3 practice items and 50 test items. Few of the stimuli were excluded from the Kannada ANT because some pictures (two or more pictures) depict the same action word in Malayalam and the influence of English language into Malayalam common usage was observed. The new stimulus that was added were cooking, driving, playing, smiling, hugging, crawling, teaching, washing and clapping. The stimulus which was not taken from Kannada ANT were shaking, painting, diving, sawing, watering, digging, lifting, saluting knitting, operating, petting, erupting and proposing. The final stimulus booklet is given in the Appendix B.

➢ *Procedure*

Participants were seated comfortably in a quiet environment and were shown line drawings of action verbs on a 100gsmbook, one at a time and were asked to say what is happening in the picture in their native language only. It was made certain that all the participants were able to see all the pictures clearly. If the participant had difficulty in naming, semantic cue (explaining the characteristics of the picture), phonological cue (cues about first sound or syllable) and

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contextual cue (the clinician may give cues like "what are you doing now?") were given for easing verb retrieval abilities. The order of presentation of cues that is semantic, phonemic and verbal contextual cues was counter balanced across all the participants. Example, for the verb "drawing", if the participant was not able to answer correctly after the presentation of the stimulus, semantic cue (like, "there is a book and colour pencils in the picture"), phonemic cue (like, "the verb starts with the syllable /drɔ:/") and verbal contextual cue (like, "what are you doing now?") were given. If the given response was a correct noun or an incomplete verb then the experimenter prompted the subject to name the action correctly. The test was conducted and the responses were recorded in Malayalam language.

➢ *Scoring*

The maximum score of 100 can be obtained by the participants if all the actions are named correctly. A score of 2 for each stimulus without any cues and a score of 1 (s) was given when the response is elicited with the help of semantic cue, a score of 1 (p) was given when the response is elicited with the help of phonemic cue. A score of 0 if incorrect, incomplete or no response. If the given response was a noun or an incomplete verb, it was marked under incomplete responses.

➢ *Statistical Analysis*

Statistical analysis was carried out using Statistical Package of Social Sciences (SPSS) version 20.0. The descriptive statistics measures such as mean, standard deviation and median were computed. The data was subjected to Shapiro Wilk's test for normality with respect to age and gender. The results revealed that the data was significantly deviating from normal distribution ($p<0.05$). Therefore, the non-parametric test Kruskal Wallis test was carried out to see the significant effect of age groups on total scores. Further if there was a significant difference, Mann Whitney U test was carried out to see the pair wise significant difference between age groups.

V. RESULTS AND DISCUSSION

This section presents the findings of the study conducted to develop normative data for the Action Naming Test (ANT) in Malayalam among neurotypical adults. The results are organized to address performance variations across different age ranges and gender, and to analyze the types of responses elicited. Descriptive statistics including mean, median, standard deviation, and mean ranks are provided for each age group and gender category. Statistical analyses such as the Kruskal-Wallis test and Mann-Whitney U test were employed to examine differences in performance. In addition, the nature and frequency of different response types—Correct Responses Without Cues (CRWC), Correct Responses with Semantic Cues (CRWSC), Correct Responses with Phonemic Cues (CRWPC), and Incorrect Responses (IR)—were analyzed to understand cue dependency and error patterns across age and gender groups. The following subsections detail these findings.

➢ *Effect of age on ANT scores among neurotypical adults.*

The Mean, Median, Standard deviation (SD) and Mean rank across age groups was calculated as shown in the table 4.

Table 4 Mean Median, Standard Deviation and Mean Rank of Neurotypical Adults Across Age Ranges

Age	N	Mean	SD	Median	Mean Rank	$\chi^2(4)$	p-value
20-29 years	30	98.43	1.52	99.00	103.87	70.79	**0.000****
30-39 years	30	97.43	2.50	98.50	91.38		
40-49 years	30	98.03	1.99	98.50	98.02		
50- 59 years	30	94.50	4.22	95.50	59.35		
60 years and above	30	88.10	6.90	90.00	24.88		

*** Indicates significant at P< 0.05 ** Indicates significant at P<0.01**

A Kruskal-Wallis H test was conducted to compare Action Naming Test (ANT) scores across five different age groups of neurotypical adults: 20–29 years, 30–39 years, 40–49 years, 50–59 years, and 60 years and above. Descriptive statistics including mean, median, standard deviation, and mean rank for each age group are presented in Table 4.

The results revealed a statistically significant difference in ANT scores among the age groups, $\chi^2(4) = 70.79$, $p < 0.001$, indicating that at least one group differed from the others in naming performance.

The mean ANT scores showed a decreasing trend with increasing age. Participants aged 20–29 years recorded the highest mean score (M = 98.43, SD = 1.52), while the lowest mean score was observed in the 60+ age group (M = 88.10, SD = 6.90). The decline became more prominent after the age of 50, with a marked drop in both scores and mean ranks (Table 4).

To determine which age groups differed significantly, post-hoc pairwise comparisons were conducted using Dunn's test with Bonferroni correction. The results (Table 5) showed significant differences between the 50–59 and 60+ age groups when compared with all younger groups (20–49 years), particularly with the 60+ group.

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Table 5 Post-hoc Pairwise Comparisons Using Dunn's Test with Bonferroni Correction

Comparison	Z Value	Adjusted p-value	Significance
20–29 vs 30–39 years	1.77	0.235	ns
20–29 vs 40–49 years	0.60	1.000	ns
20–29 vs 50–59 years	4.88	0.000**	**
20–29 vs 60+ years	7.98	0.000**	**
30–39 vs 40–49 years	-1.17	0.732	ns
30–39 vs 50–59 years	3.14	0.011*	*
30–39 vs 60+ years	6.19	0.000**	**
40–49 vs 50–59 years	2.14	0.044*	*
40–49 vs 60+ years	5.34	0.000**	**
50–59 vs 60+ years	3.20	0.010*	*

Note: $p < 0.05$ = *, $p < 0.01$ = **, ns = not significant.

No significant differences were found between the **20–29**, **30–39**, and **40–49** age groups, suggesting relatively stable performance among younger and middle-aged adults. In contrast, the scores of participants aged 50 and above were significantly lower than those of younger groups.

These results confirm an age-related decline in naming abilities, particularly evident after the age of 50, with older adults also showing increased variability in performance. The findings emphasize the need for age-stratified normative data when using the ANT in clinical or research settings.

The present study revealed significant age-related differences in action naming performance among neurotypical adults. While naming abilities were relatively stable across the younger and middle-aged groups (20–49 years), a noticeable decline was observed in individuals aged 50 years and above. Post-hoc analysis confirmed that the differences were especially significant between the older (50–59 and 60+ years) and younger age groups.

These findings align with prior research indicating that aging negatively affects lexical access, particularly for verbs and action-related words (e.g., Shafto & Tyler, 2014; Burke & Shafto, 2004). Shafto and Tyler (2014) proposed that lexical access declines in older adults due to age-related changes in brain structures, such as reduced gray matter in areas associated with language processing, including the left frontal and temporal lobes. This decline is further compounded by reductions in processing speed and working memory (Burke & Shafto, 2004).

Furthermore, the increased variability in scores among the older participants, particularly in the 60+ group, suggests individual differences in cognitive reserve, education, and general health status may modulate the effects of aging on language. These variations highlight the need for clinicians to apply age-adjusted norms when using the ANT for diagnostic or screening purposes.

In conclusion, the findings underscore the importance of age as a key factor in interpreting naming performance. Future studies could explore longitudinal trends and examine protective factors such as bilingualism, educational attainment, and cognitive stimulation to better understand and mitigate age-related language decline.

- *Comparison of ANT scores across gender in neurotypical adults*

To determine whether gender influences performance on the ANT Malayalam test, scores of 75 males and 75 females were compared. Descriptive statistics and results from the Mann-Whitney U test are presented in Table 6.

Table 6 ***Mean Median, Standard Deviation and Mean Rank across gender***

Age	n	Mean	SD	Median	Mean Rank	|Z|	p-value
Male	75	95.83	5.15	98.00	79.35	1.093	0.275
Female	75	94.77	5.79	97.00	71.65		

*** Indicates significant at P< 0.05 ** Indicates significant at P<0.01**

The mean ANT score for males (M = 95.83, SD = 5.15) was slightly higher than that for females (M = 94.77, SD = 5.79), with a corresponding median of 98.00 for males and 97.00 for females. However, the Mann-Whitney U test did not reveal a statistically significant difference between the genders (|Z| = 1.093, p = 0.275). The mean ranks for males and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

females were 79.35 and 71.65, respectively. These results suggest that there was no significant gender-based difference in ANT performance.

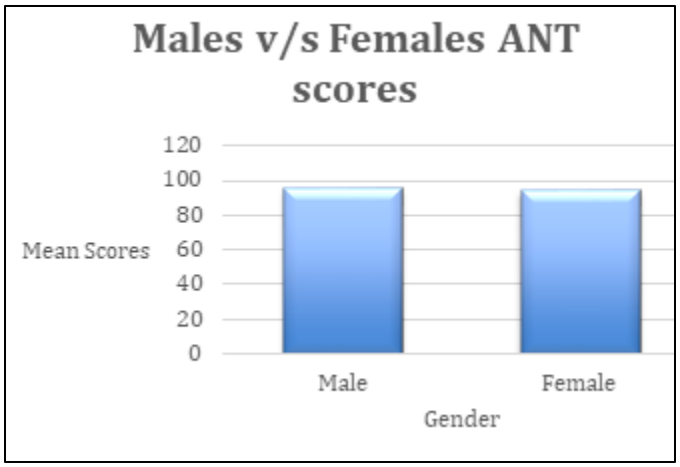


Fig 1 Mean Scores Across Gender

Figure 1 displays the average scores for males and females, demonstrating the minimal and statistically insignificant difference in performance.

To further investigate potential gender-based differences, separate analyses were conducted within each age group using the Mann-Whitney U test. The results are summarized in Table 7. In all five age ranges, no statistically significant differences were found between male and female participants ($p > 0.05$ for all comparisons). Mean ranks and median scores across genders were comparable within each group.

Table 7 Gender-Wise Comparison Across Age Groups

Age Group	Gender	N	Mean	SD	Median	Mean Rank	|Z|	*p*-value
20–29 years	Male	15	98.33	1.72	99.00	15.37	0.086	0.932
	Female	15	98.53	1.36	99.00	15.63		
30–39 years	Male	15	97.13	2.77	98.00	14.90	0.380	0.704
	Female	15	97.73	2.25	99.00	16.10		
40–49 years	Male	15	98.67	1.05	99.00	17.50	1.272	0.203
	Female	15	97.40	2.50	98.00	13.50		
50–59 years	Male	15	95.80	3.19	97.00	18.10	1.627	0.104
	Female	15	93.20	4.80	95.00	12.90		
60+ years	Male	15	89.20	7.35	91.00	17.30	1.123	0.261
	Female	15	87.00	6.47	89.00	13.70		

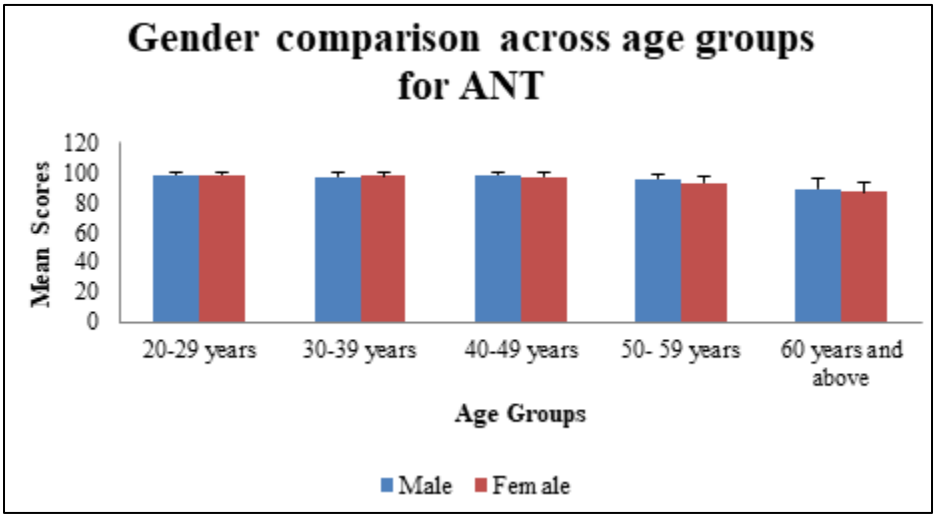


Fig 2 Mean Scores of Genders Across Age Groups

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

Figure 2 illustrates the performance of males and females across different age groups. It clearly shows the parallel trend of mean scores for both genders, confirming the absence of gender influence.

The present study investigated whether gender had any impact on action naming abilities in neurotypical adults, as measured by the ANT Malayalam test. The results indicated **no statistically significant difference in performance between males and females**, both in the overall sample and within individual age groups.

Despite slight variations in mean scores and ranks, the Mann-Whitney U test results were non-significant ($p > 0.05$), suggesting that **gender does not play a critical role in naming performance**. This is in agreement with earlier findings by Girish and Shyamala (2015), who also reported similar results in naming and lexical tasks.

These findings reinforce the notion that **language functions—specifically naming—are equally distributed across genders** in healthy adults. While neurological and anatomical studies have identified structural and functional differences between male and female brains, these do not appear to manifest in basic linguistic tasks such as action naming in neurotypical individuals.

From a clinical and assessment perspective, this implies that **gender-specific norms are not necessary** for the ANT Malayalam test. Practitioners can rely on a **unified normative standard** for both males and females, with greater emphasis placed on age-related variations, which have been shown to be more influential.

➢ *The Types of Responses Obtained for ANT Malayalam among Neurotypical Adults*

The Action Naming Test (ANT) responses were analyzed based on four categories:

- CRWC – Correct Responses Without Cues
- CRWSC – Correct Responses With Semantic Cues
- CRWPC – Correct Responses With Phonemic Cues
- IR – Incorrect Responses

The mean and standard deviation (in percentages) of these response types across different age groups are shown in Table 8.

Table 8 Percentage of Types of Responses According to Age Ranges

Age		CRWC	CRWSC	CRWPC	IR
20-29	Mean	96.83	4.29	2.00	-
	SD	3.086	2.704	.000	-
30-39	Mean	94.93	6.52	2.00	-
	SD	4.948	4.679	.000.	-
40-49	Mean	96.20	4.87	3.00	-
	SD	3.800	3.609	1.414	-
50-59	Mean	89.80	9.10	5.14	2.00
	SD	7.563	6.667	2.268	.000
Above 60	Mean	79.67	14.00	6.47	7.83
	SD	10.765	8.836	5.854	5.006
Total	Mean	91.49	8.22	5.45	6.67
	SD	9.189	6.984	4.808	5.052

CRWC= Correct Responses Without Cues,
CRWSC=Correct Responses with Semantic Cues,
CRWPC= Correct Responses with Phonemic Cues, IR= Incorrect Responses

Younger age groups (20–49 years) demonstrated very high accuracy in spontaneous naming, with CRWC percentages above 94%. Notably, 20–29-year-olds had the highest CRWC (Mean = 96.83%), with minimal reliance on cues and zero incorrect responses (IR). As age increased, there was a gradual decline in CRWC and a corresponding increase in reliance on cues and incorrect responses. 50–59 years: CRWC dropped to 89.80%, with increased usage of semantic (CRWSC = 9.10%) and phonemic cues (CRWPC = 5.14%), and the emergence of IR (2.00%). 60+ years: CRWC further declined to 79.67%, with the highest reliance on semantic cues (14.00%), phonemic cues (6.47%), and highest IR (7.83%).

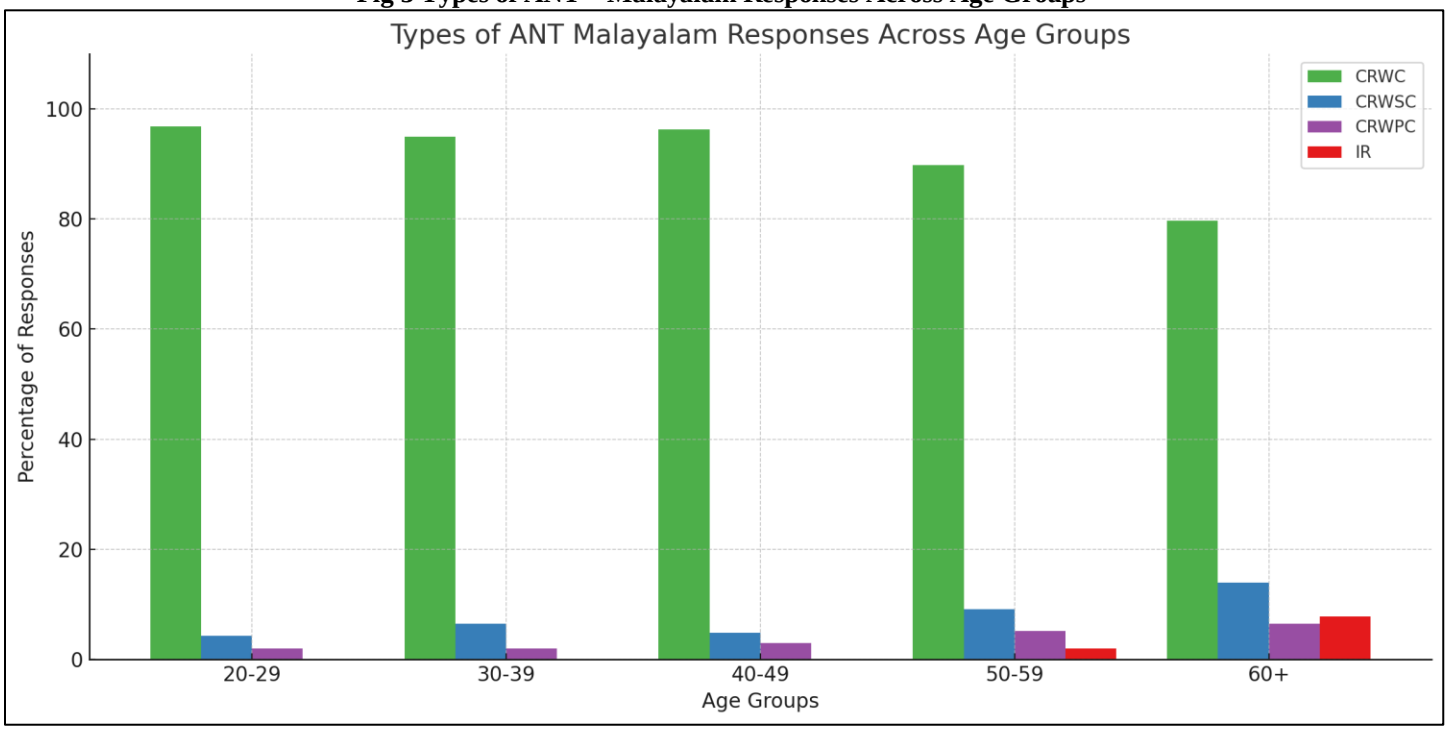
These patterns suggest a clear age-related trend—as individuals age, their ability to retrieve words spontaneously reduces, and they increasingly benefit from external cueing, especially semantic cues. Additionally, older adults are more likely to make errors, possibly due to declining processing speed or reduced lexical access.

Across all age groups, both males and females performed similarly with minor variations. In younger age groups (20–49 years), both genders had comparable CRWC scores (above 94%) and negligible reliance on cues or IR. In older age groups (50+ years), males generally had slightly higher

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

CRWC scores than females. Females tended to show greater reliance on semantic cues and slightly higher incorrect responses, especially in the 60+ group (IR: Females = 9.20%, Males = 6.86%). While gender differences were not statistically significant, the data suggest that males may retain slightly stronger spontaneous naming abilities into older age. However, both genders show similar trends of increased cue-dependence and errors with advancing age.

Fig 3 Types of ANT – Malayalam Responses Across Age Groups



Semantic cues yielded greater benefit than phonemic cues, especially among older adults. This is in contrast to findings by MacKay (2002), who reported phonemic cueing as more beneficial in elderly individuals. The current study suggests that semantic associations may remain more intact in the aging brain compared to phonological access.

The study highlights a progressive decline in spontaneous naming accuracy (CRWC) with age, accompanied by increased dependence on semantic and phonemic cues. This implies that as people age, lexical retrieval becomes more effortful, and cueing strategies become essential support tools, particularly in clinical settings.

The fact that incorrect responses were absent in younger adults but increased in older adults indicates the growing vulnerability of the lexical-semantic network in aging. Semantic cueing appeared to be more helpful than phonemic cueing, possibly because semantic networks are broader and more interconnected, allowing easier access in the face of word-finding difficulties. While gender did not significantly affect the types of responses, older females showed a slightly greater reliance on cues and produced more errors than their male counterparts—though this difference did not reach statistical significance.

VI. SUMMARY AND CONCLUSIONS

This study aimed to establish normative data for the Action Naming Test (ANT) in Malayalam among neurotypical adults, focusing on performance variations across age and gender. The results indicated clear trends in naming abilities, highlighting significant differences in performance between younger, middle-aged, and older adults, with age emerging as a key factor influencing lexical access.

Descriptive statistical analyses revealed that younger adults (20–49 years) performed consistently better than the older age groups (50 years and above), with performance significantly declining in the 60+ group. The Kruskal-Wallis and Mann-Whitney U tests further supported these findings, confirming statistically significant differences in naming performance between the younger and older participants. These results align with previous research suggesting that aging negatively impacts lexical access, particularly for verbs and action-related words, due to changes in brain structures such as reduced gray matter volume and declines in cognitive processing speed (e.g., Shafto & Tyler, 2014; Burke & Shafto, 2004).

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may801

Gender differences were also observed, although these were not as pronounced as age-related effects. However, both males and females showed similar trends in naming accuracy, with older adults demonstrating more variability in response patterns, potentially due to individual factors such as cognitive reserve and health status.

The analysis of response types revealed varying levels of cue dependency across age groups. Older participants, particularly those aged 60+, exhibited higher frequencies of Correct Responses With Semantic Cues (CRWSC) and Correct Responses With Phonemic Cues (CRWPC), suggesting that they relied more on external cues to facilitate lexical retrieval. In contrast, younger adults displayed a higher frequency of Correct Responses Without Cues (CRWC), indicating more efficient lexical access without the need for additional support.

In conclusion, the findings underscore the importance of considering age and, to a lesser extent, gender when interpreting ANT performance. Age-related declines in naming ability, particularly in older adults, highlight the necessity of age-adjusted norms for clinical use of the ANT. Future research should explore longitudinal changes in action naming ability and investigate the role of protective factors such as bilingualism, education, and cognitive stimulation in mitigating the effects of aging on lexical access.

This study provides valuable normative data for the ANT in Malayalam, contributing to a better understanding of language processing in neurotypical adults across the lifespan. The results have important implications for the use of the ANT in clinical settings, particularly in the context of assessing language abilities in aging populations.

FUTURE DIRECTIONS

Future research should focus on longitudinal studies to track naming changes over time, apply the Malayalam ANT to clinical populations for diagnostic validation, and explore cognitive and neurological correlates of naming decline. Investigating protective factors like bilingualism and education, assessing cultural and dialectal influences, and developing digital testing formats can further enhance the test's utility. Additionally, expanding normative data to include diverse demographics such as children, the elderly over 75, and individuals from varied educational and regional backgrounds will broaden its clinical relevance.

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