

# Clustering of Child Stunting Data in Tangerang Regency Using Comparison of K-Means, Hierarchical Clustering and DBSCAN Methods

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KEYWORDS	ABSTRACT
KEYWORDS Stunting, k-means; hierarchical clustering; DBSCAN; silhouette score; nutritional status; preventive actions; curative measures	ABSTRACT This study aims to analyze stunting in children in Tangerang Regency using clustering methods such as k-means, Hierarchical Clustering with Agglomerative Nesting, and Density-Based Spatial Clustering of Applications with Noise (DBSCAN). Stunting is a significant health issue affecting child growth due to chronic malnutrition and recurrent infections. The research revealed that k-means produced the best clustering results with a Silhouette Score of 0.52, indicating its effectiveness in categorizing children based on age, nutritional status, and stunting risk. The k-means method identified three clusters: Cluster 0 (ages 46-55 months, good nutrition, no stunting), Cluster 1 (ages 9-18 months, varied nutritional status, high stunting risk), and Cluster 2 (ages 27-36 months, good nutrition, no stunting). The study suggests preventive actions such as balanced nutrition education, regular health monitoring, complete immunizations, and physical activity, alongside curative measures like nutritional consultations and supplements. The findings provide a framework for targeted preventive and curative interventions, enabling Tangerang Regency's health department to effectively address and reduce stunting rates.
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#### Introduction

*Indonesia Emas* is the hope of the current government in the future. There are several aspects needed to consider between human resources, economy, and culture to achieve. In human resources, the government has two main aspects that need to be considered and are related with each other, namely education and public health (Fahrudin, 2018). Education and public health are a unity that must be achieved. One of the steps that the government can take is to pay attention to the health of future generations, namely Indonesian children (Agapito et al., 2022). One of the problems related to the health of Indonesian children is stunting. Stunting according to WHO (2015) is a disorder of

children's growth and development due to chronic malnutrition and recurrent infections which is marked by their length or height being below the standard which will ultimately have a long-term impact on the country's generation both in the form of health impacts and economic impacts (H Witten et al., 2017). In article 141 of Law no. 36 of 2009 concerning health, all forms of efforts to improve community nutrition have been regulated by using reference standards used for determining nutritional status by anthropometry the Decree of Minister based on the of Health No.1995/Menkes/SK/XII/2010 with a standard reference of the World Health Organization-National Center for Health Statistics (WHO-NCHS) (Yudoprakoso, 2019). The government has also been serious about handling and solving this problem with the existence of Presidential Regulation No. 42 of 2013 concerning the National Movement to Accelerate Nutrition Improvement. The government under its leadership has set strategic measures to improve community nutrition, including stunting prevention and handling (Kusumawati, 2008).

Stunting is a condition of growth failure in children (body and brain growth) due to malnutrition for a long time. So that the child is shorter than a normal child of his age and has a delay in thinking. Malnutrition for a long time occurs from the fetus in the womb to the beginning of the child's life (the first 100 days) (Prendergast & Humphrey, 2014). Statistically, stunting has decreased from 29% in 2015 to 27.6% last year. However, this figure is still above the limit set by the World Health Organization (WHO) which is 20% (Ministry of Health, 2018). The problem of stunting is a nutritional problem faced by the world, especially poor and developing countries. Several factors cause the high incidence of stunting in toddlers and many people are not aware of stunting as a problem compared to other malnutrition problems (Mitra, 2015).

In Indonesia, in general, there are 2 types of interventions that are common in stunting prevention efforts, namely preventive and curative (Black et al., 2013). Preventive efforts such as health education, mentoring and counselling for pregnant women directly or through applications while the second curative effort is the provision of additional nutrients, vitamins, protein intake, reduction of MDA levels and increase of hemoglobin to increase the weight and body weight of stunted children (Nadirawati et al., 2023). Stunting is a significant health problem in Indonesia, this problem occurs in almost every region, including in Tangerang Regency. In Tangerang Regency itself, the number of stunted children under five can be said to be quite large with a total of 5,391 (https://opendata.tangerangkab.go.id/stunting, 2024) so this is still a special concern for the Tangerang Regency government which is committed to reducing the stunting rate to 0% which is monitored and evaluated periodically (Shalev-Shwartz & Ben-David, 2014). Efforts to reduce stunting carried out by the government such as monitoring the nutritional status of the community, empowering postnatal health care and the DASHAT (Healthy Kitchen for Stunting) program are in the form of providing nutritious food to children at high risk of stunting (Syukron et al., 2022). Programs or interventions carried out for stunting prevention must pay close attention to aspects of each input and process in order to get optimal output (Huljannah & Rochmah, 2022). Therefore, for each stunting program and control, it is necessary to monitor and evaluate to ensure the effectiveness of this program because the stunting problem is flexible and static that continues to move which is influenced by various factors, especially for Tangerang Regency itself has 29 sub-districts with a total population of approximately 3.5 million people (Hammond et al., 2015).

Therefore, looking at the background that has been described earlier. It is hoped

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that this research will be able to provide analysis and provide input or suggestions that can be used as action and evaluation materials for the Tangerang Regency government in an effort to reduce stunting rates in areas that are the target of the health office's work program. Therefore, the title of this study is "Clustering of Child Stunting Data in Tangerang Regency Using a Comparison of K-Means, Hierarchical Clustering and DBSCAN Methods".

# **Research Methods**

The methodology used in this study is data mining to find patterns and relationships with previous data collection and use. Data mining includes a blend of techniques from various fields such as statistics, databases and data warehouses, machine learning, information retrieval, signal processing and analyzed spatial or temporal data. Another term for this process is commonly known as Knowledge Data Discovery (KDD) which in general prediction and description is a technique in data mining. In this method, clustering is carried out. There are many pentodes for clustering such as K-means which have the advantage of being effective for data with a relatively uniform distribution and a known or estimable number of clusters.

# **Results and Discussions**

Based on each clustering method, namely k-means, *Hierarchical Clustering* with *Agglomerative Nesting* and *Density-Based Spatial Clustering of Applications with Noise* (DBSCAN), clusters have been formed that according to the calculations of each method and provide a good overview and understanding related to the *stunting* problem in Tangerang Regency. However, it is necessary to conduct testing using the best method that is suitable to be applied to the Tangerang Regency Health Office. in this study to get the best method using the *Silhouette Score calculation* (Fadliana, 2015). The results obtained are as follows:



Silhouette Score: 0.3022879679963386 Figure 2 Code Silhouette Score Hierarchical Clustering with Agglomerative Nesting

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60	<pre>from sklearn.metrics import silhouette_score</pre>														
61	# Calculate silhouette score														
62	<pre>if len(set(dbscan_labels)) &gt; 1:</pre>														
63	silhouette avg = silhouette score(scaled features, dbscan labels)														
64	<pre>print(f'Silhouette Score: {silhouette avg}')</pre>														
65	else:														
66	print('Silhouette Score cannot be calculated with less than 2 clusters.')														
67															
PROBLE	MS OUTPUT TERMINAL PORTS DEBUG CONSOLE														
	/Decuments/Information Tech/outher/dhecant outhe														

Silhouette Score: 0.39469401474678745

Clustering of Applications with

*Noise* (DBSCAN)

Figure 3 Code Silhouette Score DBSCAN Methods Table 1 Comparison of Cluster Formation Methods													
Method	Number of Clusters	Silhouette Score											
Clustering K-Means	3	0.5202											
Hierarchical Clustering with Agglomerative Nesting	3	0.3022											
Density-Based Spatial	3	0.394											

Based on table 1, it can be seen that the best method to be applied related to *stunting* problems in Tangerang Regency is *Clustering K-Means*. The results of the method produced can be considered in the decision-making of the Tangerang Regency Health Office related to *the problem of stunting* (Balbaa & Abdurashidova, n.d.). In this method, 3 *clusters* are formed. The Preventive and Curative recommendations related to child nutrition in Tangerang Regency can be given as follows:

······													
Cluster 0	Cluster 1	Cluster 2											
Preventive Measures:	Preventive Measures:	Preventive Measures:											
<ol> <li>Nutrition Education:         <ul> <li>Educate parents about the importance of balanced nutrition for pre-school children, including adequate intake of protein, vitamins, and minerals.</li> </ul> </li> </ol>	<ol> <li>Breastfeeding:</li> <li>Promote exclusive breastfeeding for up to 6 months and continue until age 2 years or more, with nutritious complementary foods.</li> </ol>	<ol> <li>Growth and Development Monitoring:</li> <li>Monitor growth and development regularly to ensure that children grow optimally.</li> </ol>											

#### Table 2 Preventive and Curative Recommendations for Hierarchical Clustering with Agglomerative Nesting

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2	Physical Activity: • Promote age-appropriate physical activities to support the growth and development of children.	2	<ul> <li>Food Education:</li> <li>Educate mothers about providing complementary foods for breast milk that are rich in iron, protein, and vitamins.</li> </ul>	2	Nutrition Education: • Educate parents about the importance of providing nutritious and balanced food according to the needs of children aged 2-5 years.				
3	<ul> <li>Periodic Inspections:</li> <li>Conduct periodic health check-ups to monitor the growth and development of children.</li> </ul>	3	<ul> <li>Healthy Environment:</li> <li>Make sure the home environment is clean and free from infections that can interfere with children's growth.</li> </ul>	3	<ul> <li>Environmental Health:</li> <li>Make sure your child gets a clean and healthy environment, free from infectious diseases that can affect growth.</li> </ul>				
C	urative Action:	Curat	ive Action:		Curative Action:				
1	<ul> <li>Nutrition Consultation:</li> <li>If the child's weight or height is still below the standard, it is necessary to consult a nutritionist for a more appropriate diet.</li> </ul>	1	<ul> <li>Nutrition Interventions:</li> <li>Provide additional foods rich in energy and protein as well as nutritional supplements if needed to improve the child's nutritional status.</li> </ul>	1	<ul> <li>Nutritionist</li> <li>Consultation:</li> <li>If your child's growth is still not optimal, consult a nutritionist to develop a better meal plan.</li> </ul>				
2	Nutrition Interventions: • Give nutritional supplements if needed, especially if certain deficiencies are found based on medical examination.	2	<ul> <li>Medical References:</li> <li>Refer to a healthcare center for further examination and medical treatment if any serious health conditions are found.</li> </ul>	2	<ul> <li>Medical Interventions:</li> <li>Provide medical intervention if any disease or condition is found that affects the child's growth.</li> </ul>				
3	<ul> <li>Monitoring:</li> <li>Monitor your child's development more intensively, especially if there are nutritional or health issues that require special attention.</li> </ul>	3	<ul> <li>Rehabilitation Programs:</li> <li>Involve your child in a nutritional rehabilitation program available at the health center or hospital for growth recovery.</li> </ul>	3	Psychosocial Support: • Make sure your child gets good psychosocial support, such as proper play stimulation and positive social interactions.				

Based on table 2, we can see the recommendations for preventive and curative activities that will be applied to each *cluster* that has been formed in the child data table in Tangerang Regency by performing the necessary fillers based on data analysis that has

been carried out using the *K*-Means Clustering method so that data can be generated as shown in the figure below:

A	В	C	D	E	F	G	H	10 E	3	ĸ	1 L .	M	N	0	P	Q	R	s	T	U	V	W	
No	Nama Anak	JK	Tgl Lahir	Nama Orang Tua	Kec	Pukesmas D	Desa/Kel	Posyandu	RT	RW	Alamat	ia Saat Ukga	I Pengul	Berat	Tinggi	sia (bular	score BB	Status Gi	score TB	tatus Ting	Status Stunting	cluster	
	2 ARLANDA XXX	L	2019-03-	LINXX	BALARAJA	BALARAJA S	ENTULJ	Flamboyan I	2	1	KP. JAXX	4 Tahun - 2	024-02-(	16.5	107.6	58	-1.96969	Gizi Baik	-0.31111	Normal	tidak sunting		0
	3 RIFKI XXX	L	2019-05-	RUXX	BALARAJA	BALARAJ/ S	ENTUL J	Flamboyan I	10	3	KP. JAXX	4 Tahun - 2	024-02-0	15.3	101.4	57	-2.74809	I Gizi Kura	r -1.68888	E Normal	tidak sunting		0
0	4 arka xxx	L	2019-07-	( irwxx	BALARAJA	BALARAJ/ S	ENTUL J	Flamboyan I	3	1	KP. JAXX	4 Tahun - 2	024-02-0	16.6	103.2	55	-1.47286	E Gizi Balk	-1.28888	E Normal	tidak sunting		0
1	5 salsa xxx	Ρ	2019-07-	: muharjxxx	BALARAJA	BALARAJ/ S	ENTUL J	Flamboyan I	3	4	KP. JAXX	4 Tahun - 2	024-02-0	16.9	106	54	0.967741	Gizi Baik	1.3	Normal	tidak sunting		0
	5 Nizar xxx	L	2019-07-	i nursidi	BALARAJA	BALARAJ/ S	ENTUL J	Flamboyan I	3	4	KP. JAXX	4 Tahun - 2	024-02-(	17.1	105.8	54	-0.9375	Gizi Baik	0.904761	Normal	tidak sunting		0
	7 aulia xxx	P	2019-10-	l endx	BALARAJ	BALARAJ/ S	ENTUL J	Flamboyan I	3	4	KP. JAXX	4 Tahun - 2	024-02-(	17.8	106.5	52	1.967213	Gizi Baik	1.425	Normal	tidak sunting		0
1	B AKBAR XXX	L	2019-11-	( INDXX	BALARAJA	BALARAJ <sup>4</sup> S	ENTULI	Flamboyan I	2	1	KP. JAXX	4 Tahun - 2	024-02-(	15.8	104.8	51	-1.52	Gizi Baik	0.666666	Normal	tidak sunting		0
1	9 shalu xxx	Р	2020-01-	( akbxx	BALARAJA	BALARAJ S	ENTULJ	Flamboyan I	3	4	KP. JAXX	4 Tahun - 2	024-02-0	15.6	102	49	0.504201	Gizi Baik	0.3	Normal	tidak sunting		0
1	D SITI XXX	P	2020-01-	TAXX	BALARAJA	BALARAJAS	ENTULJ	Flamboyan I	2	1	KP. JAXX	4 Tahun - 2	024-02-0	13.7	96.3	49	-1.09243	E Gizi Baik	-1.125	Normal	tidak sunting		0
1	1 Nuke xxx	P	2020-01-	Suhexxx	BALARAJA	BALARAJA S	ENTUL J	Flamboyan I	1	1	KP. JAXX	4 Tahun - 2	024-02-0	15.9	102.6	48	0.932203	Gizi Baik	0.45	Normal	tidak sunting		0
1	2 ANNISA XXX	P	2020-05-	DIXX	BALARAJA	BALARAJ/ S	ENTULJ	Flamboyan I	1	1	KP. JAXX	3 Tahun - 2	024-02-0	19.6	103.4	45	4.521739	Gizi Lebi	h 0.65	Normal	tidak sunting		0
1	3 arelian xxx	L	2020-05-	Baxx	BALARAJA	BALARAJ/S	ENTUL J	Flamboyan I	1	1	KP. JAXX	3 Tahun - 2	024-02-(	15.7	101.2	45	-0.67226	E Gizi Baik	-0.19047	K Normal	tidak sunting	-	0
14	4 faiz xxx	L	2020-06-	( ikbal	BALARAJA	BALARAJ <sup>4</sup> S	ENTULI	Flamboyan I	2	1	KP. JAXX	3 Tahun - 2	024-02-(	16	99.5	44	-0.25423	Gizi Baik	-0.59523	E Normal	tidak sunting		0
1	5 atikah xxx	P	2020-06-	( Sukrxxx	BALARAJA	BALARAJA S	ENTUL J	Flamboyan I	1	1	KP. JAXX	3 Tahun - 2	024-02-(	15.5	99.4	44	1.140350	Gizi Baik	-0.35	Normal	tidak sunting		0
1	7 SITI XXX	P	2020-07-	(Zuhrx	BALARAJA	BALARAJ# S	ENTULJ	Flamboyan I	2	1	KP. JAXX	3 Tahun - 2	024-02-0	15	99.3	43	0.796460	Gizi Baik	-0.375	Normal	tidak sunting		0
1	B ROYYAN XXX	L	2020-08-	: IIX	BALARAJA	BALARAJ4 S	ENTULI	Flamboyan I	2	1	KP. JAXX	3 Tahun - 2	024-02-(	15.2	99.4	41	-0.43478	Gizi Baik	1.105263	8 Normal	tidak sunting		0
1	9 Antia xxx	P	2020-08-	Santxxx	BALARAJA	BALARAJ/S	ENTULJ	Flamboyan I	2	1	KP. JAXX	3 Tahun - 2	024-02-0	14.8	98.5	41	0.900900	Gizi Baik	1.25	Normal	tidak sunting		0
21	D Zea XXX	Р	2020-09-	( Ichxxx	BALARAJ	BALARAJA S	ENTULI	Flamboyan I	10	4	KP. JAXX	3 Tahun - 2	024-02-0	14.8	97.8	41	0.900900	Gizi Balk	1.055555	5 Normal	tidak sunting		0
2	1 Arsaka xxx	L	2020-11-	Sarixx	BALARAJA	BALARAJAS	ENTUL J	Flamboyan I	2	1	KP. JAXX	3 Tahun - 2	024-02-(	15.5	98.6	39	0.176991	Gizi Baik	0.894736	Normal	tidak sunting		0
6	5 KEENAN XXX	L	2019-07-	SYAHRXXXX	BALARAJA	BALARAJ/ S	AGA	ASTER 1	4	3	B DESA SAU	K 4 Tahun - 2	024-02-0	16.4	106	55	-1.62790	E Gizi Baik	-0.66666	6 Normal	tidak sunting		0
7	5 Hafizah xxx	Р	2019-02-	Hasxxx	BALARAJA	BALARAJ/ S	AGA	ASTER 2	8	3	8 Кр. Кехоо	4 Tahun - 2	024-02-0	18	108.2	60	1.076923	Gizi Baik	0.045454	Normal	tidak sunting		0
7	6 Ferdiansyah xxx	L	2019-02-	Kixx	BALARAJA	BALARAJAS	AGA	ASTER 2	7	3	В Кр. Кехко	4 Tahun - 2	024-02-0	16.4	109	59	-2.18045	1 Gizi Kura	r 0	Normal	tidak sunting		0
7	7 LAILA XXX	P	2019-03-	NURHASAXXX	BALARAJ	BALARAJ/ S	AGA	ASTER 2	7	1	Kp. Kexxx	4 Tahun - 2	024-02-0	16	107	59	-0.38759	Gizi Baik	-0.22727	Normal	tidak sunting		0
71	8 NUMA XXXX	Ρ	2019-03-	TEXX	BALARAJA	BALARAJ/ S	AGA	ASTER 2	9	13	PESOXX	4 Tahun - 2	024-02-0	16	107	59	-0.38759	Gizi Baik	-0.22727	Normal	tidak sunting		0
7	MECCA XXX	P	2019-03-	SUHAXXX	BALARAJA	BALARAJ S	AGA	ASTER 2	9	1	PESOXX	4 Tahun - 2	024-02-0	17.2	107	59	0.542635	Gizi Baik	·0.22727	Normal	tidak sunting		0
8	D RIZKI XXX	L	2019-03-	ASMXX	BALARAJA	BALARAJ/ S	AGA	ASTER 2	7	1	KEPXX	4 Tahun - 2	024-02-0	17	109	58	-1.59090	Gizi Baik	0	Normal	tidak sunting		0
8	MOSES XXX	L	2019-03-	MARSINTXXX	BALARAJA	BALARAJAS	AGA	ASTER 2	9	1	PESOXX	4 Tahun - 2	024-02-0	17	108.3	58	-1.59090	Gizi Balk	-0.15555	Normal	tidak sunting		0
8	2 Ahyan xxx	L	2019-03-	Suxx	BALARAJ	BALARAJAS	AGA	ASTER 2	9	1	Kp. Kexxx	4 Tahun - 2	024-02-0	16	107.3	58	-2.34848	Gizi Kura	r -0.37777	Normal	tidak sunting		0
8	FAWZAN XXX	L	2019-03-	DEXX	BALARAJ	BALARAJA S	AGA	ASTER 2	8	1	KP KEPKO	4 Tahun - 2	024-02-0	16.3	107.6	58	-2.12121	Gizi Kura	r -0.31111	1 Normal	tidak sunting		0
8	4 Alby xxx	L	2019-04-	(Khanixxx	BALARAJ	BALARAJA S	AGA	ASTER 2	9	1	в Кр. Керх	x 4 Tahun - 2	024-02-0	16	107.5	58	-2.34848	Gizi Kura	r -0.33333	Normal	tidak sunting		0
8	5 Hafizah XXX	L	2019-04-	Jusminiaxxx	BALARAJA	BALARAJA S	AGA	ASTER 2	9	- 3	Kp. Kepx	x 4 Tahun - 2	024-02-0	16.8	107.6	58	-1.74242	Gizi Baik	-0.31111	1 Normal	tidak sunting		0
8	5 PUTRI XXX	P	2019-04-	HENXXX	BALARAJ	BALARAJ/ S	AGA	ASTER 2	7	3	KP KEPX	4 Tahun - 2	024-02-0	16.2	104.8	58	-0.07812	Gizi Baik	-0.72727	Normal	tidak sunting		0
8	7 ZYAN, XXX	Р	2019-05-	SAEPULXXX	BALARAJ	BALARAJA S	AGA	ASTER 2	8	1	KEPXX	4 Tahun - 2	024-02-0	16.5	107	57	0.236220	Gizi Baik	-0.22727	Normal	tidak sunting		0
8	8 Tristan xxx	L	2019-05-	Luxx	BALARAJA	BALARAJE S	AGA	ASTER 2	9	1	в Кр. Керх	x 4 Tahun - 2	024-02-0	15.2	107.6	57	-2.82442	Gizi Kura	r -0.31111	Normal	tidak sunting		0
8	9 Azmya xxx	P	2019-05-	Sxx	BALARAJ	BALARAJI S	AGA	ASTER 2	9	1	B Pesoxx	4 Tahun - 2	024-02-0	18.6	105.8	57	1.889763	Gizi Balk	-0.5	Normal	tidak sunting		0
	Chafa Chafia M	D	2019.05	C Vool Vaga	DALADAL	DALADALAS	AGA	ACTED 3			Va Konii	A Tabun 3	014 02 /	17.4	107	57	0 044001	Gini Raik	0 11717	Mormal	tidak custing		0

#### Figure 4 Child data filter with cluster 0

A	B	C	D	E	F F	G	н	E	1	K	L	M	N	0	6	Q	R	S	T	U	V	W	
No	Nama Anak	JK	Tgl Lahir	Nama Orang Tua	Kec	Pukesma	Desa/Kel	Posyandu	RT	RW	Alamat	ia Saat U	gal Pengul	Berat	Tinggi	sia (bular	score BB/	Status Giz	score TB/	atus Ting	Status Stunting	cluster	2
43	Akhtar Xxx	L	2022-09-0	Dexx	BALARA	JE BALARAJ	SENTUL J	Flamboyan I	2	1	I Кр. Јахх	1 Tahun	2024-02-0	11.8	82.5	17	1.235955	Gizi Baik	-1.352941	Normal	tidak sunting		1
- 44	Labib xxx	L	2022-09-1	Septxxx	BALARA	JA BALARAJ	SENTUL J	Flamboyan I	2	3	L Кр. Јахх	1 Tahun	2024-02-0	10.8	80.5	16	0.340909	Gizi Baik	-1.941176	Normal	tidak sunting		1
45	6 GHAVI XXX	L	2022-10-1	MONXXX	BALARA	J/ BALARAJ	SENTUL J	Flamboyan I	1	1	L Кр. Јахх	1 Tahun	2024-02-0	10.3	79.7	16	-0.227272	Gizi Baik	-2.176470	Pendek	stunting		1
46	5 Luthfi XXX	L	2022-10-;	Azxx	BALARA	# BALARAI	SENTUL J	Flamboyan I	2	1	Кр. Јахх	1 Tahun	2024-02-0	10.5	79.3	15	0.232558	Gizi Baik	-2.294117	Pendek	stunting		1
47	SAFIRA XXX	P	2022-11-(	NURLXXX	BALARA	# BALARAJ	SENTUL JA	Flamboyan I	2	1	Kp. Jaxx	1 Tahun	2024-02-0	9.7	76.6	15	0.365853	Gizi Baik	-2.84375	Pendek	stunting		1
48	ALBI XXX	L	2023-01-:	MUXXX	BALARA	J/ BALARAJ	SENTUL J	Flamboyan I	2	1	Кр. Јахх	1 Tahun	2024-02-0	9.5	75.9	13	-0.481927	Gizi Baik	-3.294117	Sangat Pe	Severely Stunting		1
45	ARUMI XXX	P	2023-02-(	APxx	BALARA	# BALARAJ	SENTUL J	Flamboyan I	2	1	Кр. Јахх	0 Tahun	2024-02-0	9.3	74.5	12	0.632911	Gizi Baik	-3.5	Sangat Pe	Severely Stunting		1
50	SITI XXX	P	2023-02-:	DAXX	BALARA	A BALARAJ	SENTUL J	Flamboyan I	2	1	Кр. Јахх	0 Tahun	2024-02-0	9.5	77.2	12	0.886075	Gizi Baik	-2.65625	Pendek	stunting		1
51	RAFA XXX	L	2023-02-1	SANXX	BALARA	# BALARAJ	SENTUL J	Flamboyan I	1	1	Кр. Јахх	0 Tahun	2024-02-0	9.6	74.5	12	0	Gizi Baik	-3.705882	Sangat Pe	Severely Stunting		1
52	Naufal XXX	L	2023-02-1	Salpul rijal	BALARA	# BALARAJ	SENTUL J	Flamboyan I	2	10	Кр. Јахх	0 Tahun	2024-02-0	9.7	74.8	12	0.121951	Gizi Baik	-3.617647	Sangat Pe	Severely Stunting		1
53	BELVANIA XX	P	2023-03-0	FITXX	BALARA	JA BALARAJ	SENTUL J	Flamboyan I	1	: d	Кр. Јахх	0 Tahun	2024-02-0	8.7	74.3	11	0.129870	Gizi Baik	-3.5625	Sangat Pe	Severely Stunting		1
54	GHIFARI XXX	L	2023-03-1	NEXX	BALARA	# BALARAJ	SENTUL JA	Flamboyan I	2	्य	Кр. Јахх	0 Tahun	2024-02-0	9.4	73.8	11	0	Gizi Baik	-3.911764	Sangat Pe	Severely Stunting		1
55	5 SHABIRAXXX	Р	2023-03-;	DEXX	BALARA	# BALARAJ	SENTUL J	Flamboyan I	2	- 1	Кр. Јахх	0 Tahun	2024-02-0	8.2	71.6	10	-0.263157	Gizi Baik	-4.40625	Sangat Pe	Severely Stunting		1
56	5 ZIKRI XXX	L	2023-04-0	SUXX	BALARA	# BALARAJ	SENTUL J	Flamboyan I	1	1	Кр. Јахх	0 Tahun	2024-02-0	9.1	73.3	10	-0.126582	Gizi Baik	-4.058823	Sangat Pe	Severely Stunting		1
57	FATAN XXX	L	2023-04-2	ATUXXX	BALARA	JE BALARAJ	SENTUL J	Flamboyan I	2	1	Кр. Јахх	0 Tahun	2024-02-0	9.3	72.3	9	0.519480	Gizi Baik	-4.352941	Sangat Pe	Severely Stunting		1
58	B RUBY XXX	P	2023-05-1	SAXXX	BALARA	# BALARAJ	SENTUL J	Flamboyan I	1	1	Кр. Јахх	0 Tahun	2024-02-0	7.8	70.1	8	-0.136980	Gizi Baik	-4.875	Sangat Pe	Severely Stunting		1
55	AHMAD XXX	L	2023-07-0	TIXXX	BALARA	JE BALARAJ	SENTUL J	Flamboyan I	1	1	L Кр. Јахх	0 Tahun	2024-02-0	7.9	67.8	7	-0.540540	Gizi Baik	-5.676470	Sangat Pe	Severely Stunting		1
60	ALESHA XXX	Р	2023-07-:	SUXXX	BALARA	JE BALARAJ	SENTUL J	Flamboyan I	2	1	L Кр. Јахх	0 Tahun	2024-02-0	8.7	69.8	7	1.549295	Gizi Balk	-4.96875	Sangat Pe	Severely Stunting		1
61	REVAN XXX	L	2023-07-;	TURXXXX	BALARA	# BALARAJ	SENTUL J	Flamboyan I	2	1	Kp. Jaxx	0 Tahun	2024-02-0	8.9	71.2	6	1.408450	Gizi Baik	-4.676470	Sangat Pe	Severely Stunting		1
62	DIANDRA XXX	P	2023-08-(	EKX	BALARA	JA BALARAJ	SENTUL J	Flamboyan I	2	1	Кр. Јахх	0 Tahun	2024-02-0	7.9	66.9	6	0.882352	Gizi Baik	-5.875	Sangat Pe	Severely Stunting		1
63	CANTIKA XXX	P	2023-08-;	ANXX	BALARA	# BALARAJ	SENTUL I	Flamboyan I	2	1	Кр. Јахх	0 Tahun	2024-02-0	6.6	64.5	5	-0.454545	Gizi Baik	-6.625	Sangat Pe	Severely Stunting		1
64	RAYYAN XXX	L	2023-08-2	INEXX	BALARA	A BALARAJ	SENTUL J	Flamboyan I	1	1	Kp. Jaxx	0 Tahun	2024-02-0	7.8	68	5	0.434782	Gizi Baik	-5.617647	Sangat Pe	Severely Stunting		1
65	5 SHIDQIA XXX	P	2023-10-0	YAXX	BALARA	J BALARAJ	SENTUL J	Flamboyan I	1	1	Кр. Јахх	0 Tahun	2024-02-0	6.3	62.9	4	-0.158730	Gizi Baik	-7.125	Sangat Pe	Severely Stunting		1
71	DARA	P	2022-07-;	DEXXX	BALARA	# BALARAJ	A SAGA	ASTER 1	3	3	KP. SAXX	1 Tahun	2024-02-(	8.9	77	18	-1.279069	Gizi Baik	-2.71875	Pendek	stunting		1
72	USWATUN	P	2022-09-1	juleXX	BALARA	# BALARAJ	A SAGA	ASTER 1	4	3	KP. SAXX	1 Tahun	2024-02-0	7.3	74	17	-2.941176	Gizi Kura	r -3.65625	Sangat Pe	Severely Stunting		1
73	RAFKHA	L	2022-11-;	DEXX	BALARA	A BALARAJ	A SAGA	ASTER 1	3	3	KP. SAXX	1 Tahun	2024-02-0	8.3	75.8	14	-2.117647	Gizi Kura	r -3.323525	Sangat Pe	Severely Stunting		1
74	INNARA XXXX	P	2023-03-1	JUMXXX	BALARA	A BALARAJ	A SAGA	ASTER 1	4		KP. SAXX	0 Tahun -	2024-02-(	5.9	67	11	-3.506493	Gizi Buru	-5.84375	Sangat Pe	Severely Stunting		1
186	5 BASIMAH XXX	P	2022-05-1	FIRXXX	BALARA	JE BALARAJ	4 SAGA	ASTER 2	9	3	KP KEPKO	1 Tahun	2024-02-0	9	78.4	21	-1.666666	Gizi Baik	-2.28125	Pendek	stunting		1
187	Azizah XXX	P	2022-05-1	Maysaxxx	BALARA	J/ BALARAJ	A SAGA	ASTER 2	8		KP KEPKO	1 Tahun	2024-02-0	11	80	21	0.555555	Gizi Baik	-1.78125	Normal	tidak sunting		1
185	QAIREEN XXX	P	2022-05-;	JUXX	BALARA	# BALARAJ	4 SAGA	ASTER 2	10	-	PRIMAA)	1 Tahun	2024-02-0	10.3	83	20	0	Gizi Baik	-0.84375	Normal	tidak sunting		1
190	Ayup XXX	L	2022-05-:	Kurniaxxx	BALARA	# BALARAJ	A SAGA	ASTER 2	9	3	B Pesxxx	1 Tahun	2024-02-0	10.2	79.5	20	-1.182795	Gizi Baik	-2.235294	Pendek	stunting		1
192	GHAVI XXX	L	2022-06-2	WAHYXXX	BALARA	A BALARAJ	A SAGA	ASTER 2	9	3	B Pesxxx	1 Tahun	2024-02-0	11.8	84.2	19	0.769230	Gizi Baik	-0.852941	Normal	tidak sunting		1
193	HERNA XXX	P	2022-06-2	HENXXX	BALARA	# BALARAJ	SAGA	ASTER 2	7	3	kp kexxx	1 Tahun	2024-02-0	7.8	76.5	19	-2.643678	Gizi Kura	r -2.875	Pendek	stunting		1
194	ALFATIH XXX	L	2022-07-0	DURAHXXX	BALARA	A BALARAJ	A SAGA	ASTER 2	9	3	PESOXX S	1 Tahun	2024-02-0	11.6	83.3	19	0.549450	Gizi Baik	-1.117647	Normal	tidak sunting		1
195	Artis XXX	1	2022-07-	Eav	-	I BALARAL	ISAGA	ASTER 2	7		Ko Kerro	1 Tabura	2024-02-0	11.9	97.2	19	0 769230	Girl Balk	-1 411764	Normal	tidak sunting		4

# Figure 5 Child data filter with cluster 1

No	Nama Anak	JK	Tgl Lahir	Nama Orang Tua	Kec	Pukesmas Desa	/Kel	Posyandu	RT	RW	Alamat	ia Saat Ukgal	Pengul	Berat	Tinggi	sia (bulans	core BB/Sta	tus Gia	score TB/tatus Ting	Status Stunting	cluster	ł
1	ERINA XXX	Р	2021-12-2	AXX	BALARAJ	BALARAJ/ SAG	A A	ster 17	5	7	PERMXXX	x 2 Tahun - 20	24-02-:	12.2	85.6	26	0.9375 G	zi Baik	-0.03125 Normal	tidak sunting	2	1
10	AISYAH XXX	P	2020-06-	BADRXXX	BALARAJA	BALARAJA SENT	UL JA F	lamboyan I	2	1	KP. JAXX	3 Tahun - 20	24-02-0	10.8	90.5	44 -	2.98245( G	zi Kura	r -2.575 Pendek	stunting	2	
23	ADRENA	Р	2021-02-	EXX	BALARAJ	BALARAJ/ SENT	ULIF	lamboyan i	1	1	KP. JAXX	2 Tahun - 20	24-02-6	12.6	94.7	36 -	0.37735E G	zi Baik	0.194444 Normal	tidak sunting	2	
2	iqbal	L	2021-03-3	Enxx	BALARAJA	BALARAJ SENT	TUL JI F	lamboyan I	10	4	KP. JAXX	2 Tahun - 20	124-02-6	14	95	35 -	-0.45871! G	zi Baik	-0.052631 Normal	tidak sunting	2	
24	QIANA XXX	P	2021-04-1	NURFATIXXX	BALARAJA	BALARAJ SENT	ULAF	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-0	13.7	93.2	34 0	0.961538 G	zi Baik	-0.222221 Normal	tidak sunting	2	
25	i Davanka XXX	L	2021-05-3	Adi XXX ibA	BALARAJ	BALARAJ/ SENT	TUL JI F	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-6	13.6	93.7	33 -	0.467285 GI	zi Baik	-0.39473ť Normal	tidak sunting	2	
21	RAFISKI XXX	L.	2021-05-	SITI XXX	BALARAJ	BALARAJ SENT	UL JA F	lamboyan I	1	1	KP. JAXX	2 Tahun - 20	124-02-6	12	86.3	33 -	1.96261ť G	zi Baik	-2.34210! Pendek	stunting	2	
2	Albian xxx	L	2021-07-0	Egxx	BALARAJ	BALARAJ SENT	UL JA F	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-6	14.4	91.8	31 0	0.666666 GI	zi Baik	-0.894736 Normal	tidak sunting	2	
21	CHAYRA XXX	P	2021-08-0	IDHXX	BALARAJ	BALARAJ/ SENT	UL JA F	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-6	12.7	90.1	30	0.7 G	zi Baik	1.375 Normal	tidak sunting	2	
25	Aftab XXX	L	2021-08-3	Dixx	BALARAJ	BALARAJ SENT	UL JA F	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-6	13.3	91.3	29 0	0.097087 G	zi Baik	1.235294 Normal	tidak sunting	2	
30	HAIKAL XXX	L	2021-08-	SIRODJUXXX	BALARAJA	BALARAJ SENT	ULAF	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-6	13.2	91.4	29	0 Gi	zi Baik	1.264705 Normal	tidak sunting	2	
3	Al Fatir XXX	L	2021-10-0	Dexxx	BALARAJ	BALARAJ SENT	ULAF	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-0	12.6	89.4	28 -	0.39215£ G	zi Baik	0.676470: Normal	tidak sunting	2	
33	Aidan XXX	L	2021-11-2	Νακκ	BALARAJ	BALARAJA SENT	TUL JA F	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-6	12.4	88.8	26	-0.2 Gi	zi Baik	0.5 Normal	tidak sunting	2	
3	Azizah	P	2021-12-0	Azxx	BALARAJ	BALARAJ SENT	ULIF	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-6	11.9	86.8	26	0.625 G	zi Baik	0.34375 Normal	tidak sunting	2	
34	Erzan XXX	L	2021-12-1	1xxxx	BALARAJ	BALARAJ SENT	ULIF	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-0	12.4	88.3	26	-0.2 G	zi Baik	0.352941 Normal	tidak sunting	2	
35	Fahrezi XXX	L	2021-12-2	Faxxx	BALARAJ	BALARAJ SENT	ULAF	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-0	12.6	88.1	25 0	0.204081 G	zi Baik	0.294117 Normal	tidak sunting	2	
36	6 Kinanti xxx	P	2021-12-1	Uxx	BALARAJ	BALARAJ/ SENT	ULIF	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-0	11.5	86.7	25 0	0.319148 Gi	zi Baik	0.3125 Normal	tidak sunting	2	
3	Gibran xxx	L	2022-01-0	KDKK	BALARAJ	BALARAJ SENT	ULJA	lamboyan I	2	1	KP. JAXX	2 Tahun - 20	24-02-4	12.2	87.3	25 -	0.204081 GI	zi Baik	0.058823 Normal	tidak sunting	2	
31	AFZAL XXX	L	2022-02-	ТАхжк	BALARAJ	BALARAJ SENT	UL JI F	lamboyan I	2	1	KP. JAXX	1 Tahun - 20	24-02-0	9.9	81.6	24 -	2.371134 GI	zi Kura	r -1.617647 Normal	tidak sunting	2	
35	ANDINI XXX	P	2022-03-1	RUXX	BALARAJ	BALARAJ SENT	UL JA F	lamboyan I	2	1	KP. JAXK	1 Tahun - 20	24-02-4	11	84.7	22 0	0.329670 G	zi Baik	-0.3125 Normal	tidak sunting	2	
- 40	ALULA XXX	P	2022-04-2	ILHXX	BALARAJ	BALARAJ SENT	ULAF	lamboyan I	2	1	KP. JAXX	1 Tahun - 20	24-02-0	11	83.9	21 0	0.555555 Gi	zi Baik	-0.5625 Normal	tidak sunting	2	
4	ANINDITA XXX	P	2022-05-0	YUXX	BALARAJ	BALARAJ SENT	ULAF	lamboyan I	2	1	KP. JAXX	1 Tahun - 20	24-02-6	10.5	82.9	21	0 G	zi Baik	-0.875 Normal	tidak sunting	2	
43	ANINDYA XXX	P	2022-05-0	YUXX	BALARAJ	BALARAJ SENT	UL JA F	lamboyan I	2	1	KP. JAXX	1 Tahun - 20	24-02-6	10.6	82.8	21 0	0.111111 G	zi Baik	-0.90625 Normal	tidak sunting	2	
6	Jeje XXX	P	2020-08-	Nurhasaxxx	BALARAJ	BALARAJI SAG	A 4	STER 1	4	3	KP. SAXX	3 Tahun - 20	24-02-6	13.2	91	41 -	-0.54054( Gi	zi Baik	-0.83333: Normal	tidak sunting	2	
61	SEFTI XXX	P	2020-09-3	EMXXXX	BALARAJ	BALARAJ/ SAG	A 4	STER 1	4	3	DEXX SAU	X 3 Tahun - 20	24-02-0	10.8	85	40 -	2.545454 Gi	zi Kura	r -2.5 Pendek	stunting	2	
65	siti xxx	P	2020-12-1	munaxxx	BALARAJA	BALARAJ/ SAG	A A	STER 1	4	3	DEXX SAU	X 3 Tahun - 20	24-02-0	13	93.6	38 -	0.27777; G	zi Baik	-0.111111 Normal	tidak sunting	2	
70	Cahya xxx	P	2021-02-	Junaxxx	BALARAJ	BALARAJ/ SAG	ъ л	STER 1	4	3	Saxx	2 Tahun - 20	24-02-6	11.1	87.5	35 -	1.619047 G	zi Baik	-1.80555! Normal	tidak sunting	2	
140	AISYAH XXX	P	2020-10-2	RAXX	BALARAJ	BALARAJ SAG	A A	STER 2	9	3	KP. KEXOO	X 3 Tahun - 20	24-02-6	12.3	93	39 -	1.100917 G	zi Baik	-0.277777 Normal	tidak sunting	2	
142	rohman xxx	L	2020-11-0	Exx	BALARAJ	BALARAJ/ SAG	A A	STER 2	10	3	Kexxx	3 Tahun - 20	24-02-4	15	98	39 -	0.26548t G	zi Baik	0.736842 Normal	tidak sunting	2	
14	Aromi xxx	Р	2020-11-2	Dixx	BALARAJ	BALARAJ/ SAG	A /	STER 2	9	3	KP. KEXXX	X 3 Tahun - 20	24-02-0	14	96.1	38 0	0.648148 G	zi Baik	0.583333 Normal	tidak sunting	2	
14	Ali xxx	L	2020-11-3	Elxx	BALARAJA	BALARAJ SAG	A A	STER 2	8	3	KP. KEXOO	X 3 Tahun - 20	24-02-0	14.3	99.2	38 -	0.71428! G	zi Baik	1.052631 Normal	tidak sunting	2	
145	Naura xxx	P	2020-12-0	Rohxxx	BALARAJ	BALARAJ SAG	A	STER 2	10	3	Kexox	3 Tahun - 20	24-02-4	15.3	97	38 1	1.851851 G	zi Baik	0.833333 Normal	tidak sunting	2	
14	i Nadira xx	P	2020-12-0	Fauzixxx	BALARAJ	BALARAJ SAG	A A	STER 2	9	3	KP. KEXXX	x 3 Tahun - 20	24-02-0	13.3	91	38	0 G	zi Baik	-0.833333 Normal	tidak sunting	2	
14	azkia xxx	P	2021-02-	азпох	BALARAJA	BALARAJ SAG	A A	STER 2	10	3	Kexxx	2 Tahun - 20	24-02-4	14.7	95.2	36 1	1.603773 G	zi Baik	0.333333 Normal	tidak sunting	2	
14	rasya xxx	L	2021-02-3	khozinatxxxx	BALARAJ	BALARAJ SAG	A	STER 2	8	3	Kexxx	2 Tahun - 20	24-02-6	14.7	95.4	35 0	0.183486 G	zi Baik	0.052631 Normal	tidak sunting	2	

Figure 6 Child data filter with cluster 2

Clustering of Child Stunting Data in Tangerang Regency Using Comparison of K-Means, Hierarchical Clustering and DBSCAN Methods

Based on the data that can be filtered in the draw, child nutrition data has been collected in 3 *clusters*. It is hoped that with this data, the Tangerang Regency Health Office can take preventive measures and suppress the growth of *stunting* rates, for example filtering by *name* or by *address* on each child.

#### Conclusion

Research on stunting analysis in children in Tangerang Regency using the k-means clustering method, Hierarchical Clustering with Agglomerative Nesting, and Density-Based Spatial Clustering of Application with Noise (DBSCAN) showed that k-means produced 3 clusters with cluster 0 aged 46-55 months, the majority of which were well nourished and not stunted; cluster 1 is 9-18 months old with most of the nutrition is good, but there are proportions that need more attention related to nutrition and stunting risk; Cluster 2 is 27-36 months old with the majority of them being well nourished and not stunted. Hierarchical Clustering produced cluster 0 aged 37-53 months, good nutrition, no stunting; cluster 1 is 23-24 months old, good nutrition, not stunted; cluster 2 aged 0-40 months with a z-score TB/U -5.58 indicates most severe stunting. DBSCAN produces cluster-1 aged 26-52 months, good nutrition, no stunting; cluster 0 aged 39-54 months, good nutrition, not stunted; cluster 1 aged 12-25 months with a low z-score TB/U indicates a high probability of stunting. The results of clustering with Silhouette Score show k-means (0.52) as the best method for stunting analysis. Based on the results of kmeans, preventive measures such as providing balanced nutrition, health monitoring, immunization, physical activity, and parental education, as well as curative measures such as nutritionist consultation, supplementation, and follow-up examinations can be carried out. The Tangerang Regency Health Office can utilize the results of this analysis for preventive and curative actions that are right on target.

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