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Original Article,

Description of Saliva Viscosity in Underweight Toddlers among 3-5 Years at Silo II Health Center Working Area Jember Regency

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Abstract:

Background; Underweight is a health issue as one of the causes of infant mortality. UNICEF states that underweight contributes to more than one-third of the 9,2 million children under 5 years old, which succumb to death. Underweight toddlers have the potential to increase the risk of dental caries and disrupt the growth of salivary glands, leading to a decreased saliva flow rate. In underweight children, the lack of nutrition during the growth period can have a permanent impact on salivary glands and result in high saliva viscosity.

Objective: This research was conducted in the working area of Silo II Community Health Center in Jember Regency, with the aim of examining the characteristics of saliva in underweight toddlers aged 3-5 years, especially about salivary viscosity.

Material and Methods: A total of 161 toddlers were the subjects of the study, and saliva was collected using the unstimulated spitting method, followed by the measurement of saliva viscosity using an Ostwald viscometer.

Results: The research findings indicate that underweight toddlers have high saliva viscosity with an average of 15,72 cP. Analysis based on age variables shows that 3-4-year-old toddlers have the highest average saliva viscosity (15,77 cP), while based on the severity of underweight, toddlers categorized as severely underweight have the highest average saliva viscosity (17,15 cP).

Conclusions: In conclusion, the condition of saliva viscosity in underweight toddlers in the operational area of Puskesmas Silo II indicates high values, attributed to the insufficient intake of nutrients during the growth period..

Introduction:-

Underweight is a prevalent health issue, especially in developing countries, and is identified as one of the causes of infant mortality. Data from the United Nations Children's Fund (UNICEF) in 2017 revealed that 92 million, or 13.5% of toddlers worldwide, experience underweight issues[1].

Inadequate nutrition in toddlers may lead to atrophy of the salivary glands. As a result of salivary gland atrophy, there is a decrease in saliva flow rate[2]. Children with insufficient nutritional intake experience reduced chewing activity, disrupting the development of salivary glands, leading to atrophy and a decline in saliva flow rate[3]. A low saliva flow rate or hyposalivation can result in dry mouth, mucosal inflammation,taste disturbances, tooth demineralization, and increased bacterial retention[4]. Underweight children tend to exhibit a decreased saliva flow rate, disrupting saliva protection in the oral cavity. A reduced saliva flow rate indicates an increase in saliva viscosity.

The viscosity of saliva becomes a crucial factor in maintaining oral health[5]. Saliva viscosity can be used to detect the occurrence of caries in children, as higher saliva viscosity is associated with the development of caries[6]. The higher the viscosity of saliva, the less effective its cleaning action, leading to an increased rate of tooth decay[7].

In toddlers aged 3-5 years, also known as preschool, it is possible to identify a child's needs and provide an opportunity to prevent the severity of diseases, leading to significantly better outcomes compared to discovering and treating them at a later stage[8].

Preschool-age children undergo development encompassing motor skills, social development,

and language9. Toddlers in the preschool age begin the process of socialization and interaction with others[10]. Therefore, toddlers at this age can be considered to have a good level of cooperation[11]. The Silo Subdistrict is known for its potential in the agricultural and plantation sectors, especially in coffee cultivation,with the majority of its population working as farm laborers[12]. The prevalence of occupations as farm laborers in the community indicates that the area tends to have a lower to middle economic status. Families with limited income may face challenges in meeting their nutritional needs, leading to nutritional issues, especially underweight[13]. This condition is a primary factor contributing to the occurrence of underweight in the Silo Subdistrict. Therefore, the author aims to investigate the profile of saliva viscosity in toddlers aged 3-5 years experiencing underweight in the working area of Silo II Community Health Center in Jember Regency. The objective of this research is to identify the saliva viscosity in underweight toddlers aged 3-5 years in the working area of Silo II Community Health Center in Jember Regency.

Material And Method:-

Quantitative descriptive research is used in this study. The method used is a cross-sectional study conducted from August 2023 to November 2023, with the aim of measuring and describing the phenomenon of saliva viscosity in underweight toddlers aged 3-5 years in the working area of Silo II Community Health Center, Silo Subdistrict, Jember Regency. The sampling technique used in this study is purposive sampling. The Slovin formula will be utilized to determine the sample size for the subjects. Based on this formula, the researcher obtained the required sample size for this study, which is 161 subjects. Data collection in this study use observational techniques by directly observing the research subjects. The interview
technique is used to complement the observation results.
The data processing is conducted through tabulation, which involves creating tables based on the research data obtained in accordance with the research objectives. The data analysis used is descriptive analysis. In this study, the results will be presented in the form of frequency distribution tables, followed by categorization.

The research procedures are as follows:

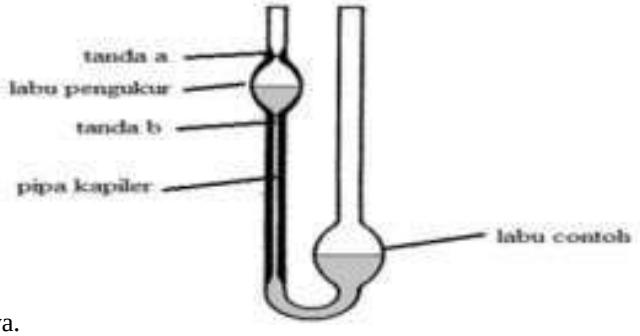
A. Saliva Collection

1. Saliva is collected between 09:00-11:00 AM to prevent bias due to diurnal variations in saliva composition[14].
2. Saliva collection is using the unstimulated spitting method, and the subjects are in a resting condition.
3. Subjects are instructed to spit every minute for a total duration of 5 minutes or until 2 ml of saliva is collected, and it is collected in a saliva container[15].
4. The saliva container is labeled with the subject's name and age.

B. Saliva Viscosity Measurement

1. Measuring saliva viscosity using an Ostwald viscometer.
2. Taking the saliva sample using a disposable syringe, approximately 2 ml, and injecting it into the first orifice.
3. Saliva is aspirated using a rubber bulb through the capillary tube until it passes the mark at point 2, then the rubber bulb is released.
4. Observing until the saliva descends to the boundary of the mark at point a. The capillary hole is closed using finger.
5. Releasing finger and allowing saliva to flow until it reaches the mark at point b, then using a stopwatch to measure the time taken for saliva to flow from point a to b, and recording it. The time obtained from this measurement represents the saliva flow rate time.
6. Calculating saliva viscosity using a formula and then recording the results on the assessment sheet.

$$N = \frac{\pi . h . g . a^4 . t . \rho}{8 . L . V}$$



Viskometer Ostwald (Bird, 1993

N = saliva viscosity π = 3,14
h = the distance from the small pipe to the large pipe (11 cm)
a = the radius of the capillary tube (0,1 cm)
L = distance from point B to the base of capillary tube (9,5 cm)
t = salivary flow from point A to point B ρ = the density of saliva.
g = gravitational acceleration (1000cm/s²)
V = saliva volume (cm³)

$$\rho = \frac{(B + S) - B}{V}$$

(B+S) = the weight of measuring glass + saliva(gr)
B = the weight of measuring glass (gr)
V = saliva volume (cm³) = 2 ml

Tables:-

Table 1. Frequency distribution of underweight toddlers aged 3-5 years based on age

Age (months)	Amount (n)	Percentage (%)
36 – 47	85	53
48 – 59	76	47
Total	161	100

Table 2. Frequency distribution of underweight toddlers aged 3-5 years based on underweight category

Underweight Category	Amount (n)	Percentage (%)
Less	146	91
Severe	15	9
Total	161	100

Table 3. The average measurement of saliva viscosity in underweight toddlers aged 3-5 years

Viscosity Category	Amount (n)	Viscosity Average (cP)	Std. Deviation
Low	0	0	0
Normal	89	12,13	1,27
High	72	20,15	0,92
Total	161	15,72	4,16

Table 4. Distribution of saliva viscosity measurement results in underweight toddlers aged 3-5 years based on age

Age [Month]	Viscosity						
	Low		Normal		High		
	n	$\bar{x}$	n (%)	$\bar{x}$	n (%)	$\bar{x}$	$\bar{x}$
36 – 47	0	0	45 (53%)	11,88	40 (47%)	20,15	15,77
48 – 59	0	0	44 (58%)	12,38	32 (42%)	20,16	15,65

Table 5. Distribution of saliva viscosity measurement results in underweight toddlers aged 3-5 years based on underweight categories

Underweight category	Viscosity						Viscosity
	Low		Normal		High		
	n	$\bar{x}$	n (%)	$\bar{x}$	n (%)	$\bar{x}$	$\bar{x}$
Less	0	0	82 (56%)	12,11	64 (44%)	19,99	15,57
Severe	0	0	7 (47%)	12,32	8 (53%)	21,38	17,15

Table 1.
It can be seen that out of 161 underweight toddlers who were the subjects of the study, there are 85 subjects (53%) aged 36 – 47 months and 76 subjects (47%) aged 48 – 59 months. From this data, it is evident that the most prevalent age group among underweight toddlers is 36 – 47 months.

Table 2.
It can be seen that out of 161 underweight toddlers who were the subjects of the study, there are 146 subjects (91%) classified as less underweight and 15 subjects (9%) classified as severely underweight based on the weight-for-age calculation. This data indicates that the most prevalent type of underweight among the subjects is in the less underweight category.

Table 3.
The average value of saliva viscosity measurements from the 161 subjects was found to be 15.72±4.16 cP. The categorization is as follows: considered low if the viscosity is less than 2.75 cP, normal if it is between 2.75-15.51 cP, and high if it more than
15.51 cP. There are 89 subjects have normal viscosity with an average of 12.13±1.27 cP. Additionally, 72 subjects have high saliva viscosity with an average of 20.15±0.92 cP, and no subjects have low saliva viscosity.

Table 4.
It was found that among subjects aged 36–47 months, 45 subjects (53%) had normal saliva viscosity with an average of 11.88 cP, and 40 subjects (47%) had high saliva viscosity with an average of 20.15 cP. The average saliva viscosity value for the 85 subjects aged 36–47 months was
15.77 cP. For subjects aged 48–59 months, 44 subjects (58%) had normal saliva viscosity with an average of 12.38 cP, while 32 subjects (42%) had high saliva viscosity with an average of 20.16 cP. The average saliva viscosity value for the 76 subjects aged 48–59 months was 15.65 cP.

Table 5.
Subjects categorized as underweight (less), 146 subjects with an average saliva viscosity value of
15.57 cP. Among them, 82 subjects (56%) had normal saliva viscosity with an average of 12.11 cP, and 64 subjects (44%) had high saliva viscosity with an average of 19.99 cP. Subjects categorized as underweight (severe), there are 15 subjects with an average saliva viscosity value of 17.15 cP. Among them, 7 subjects (47%) had normal saliva viscosity with an average of 12.32 cP, and 8 subjects (53%) had high saliva viscosity with an average of 21.38 cP.

Results:-

The total number of children ages from 3 – 5 years old involved in this study were (161). Underweight toddlers ages from 3 – 5 years old have high saliva viscosity with an average of 15,72 cP. Analysis based on age variables shows that 3 – 4-year-old toddlers have the highest average saliva viscosity (15,77 cP), while based on the severity of underweight, toddlers categorized as severely underweight have the highest average saliva viscosity (17,15 cP).

Discussion:-

The number of underweight cases in children aged 4-5 years appears to be lower compared to the age group of 3-4 years, as seen in the data presented in Table 1. This difference may be due to an increase in the birth rate until early 2020, leading to an increase in the number of 3-year-old children. This finding is supported by the Health Profile Data for Jember Regency, which recorded a relatively high number of baby births in the Silo II Health Center area, totaling 1,030 infants[16]. Another factor that may influence this is the smaller stomach capacity in children aged 3-4 years, resulting in a smaller food consumption portion per meal compared to older children[17].

This is also supported by [18], stating that as age increases, the body's need for nutrition and energy also increases. Otherwise, at a younger age, there tends to be a more limited intake of food, which can affect a higher frequency of underweight in that age. Table 2 shows the results that children in the underweight category are more numerous than those in the severely underweight category due to their rapid growth and development. The toddler period is a crucial period in the human growth and development process because growth and development occur rapidly[19]. Growth spurts do not only occur during infancy but will continue until adolescence. However, in infants, these events occur at the ages of 10-14 days, 3 weeks, 6 weeks, 3 months, and 6 months. During this period, infants tend to be more fussy due to hunger[20]. Additionally, body weight is one of the parameters that describe an individual's body mass and is a highly variable anthropometric parameter. In optimal health conditions and a balance between consumption and nutritional needs, weight development follows age progression[21]. Therefore, the number of underweight children in the weight deficiency category is more significant than those in the severely underweight category.

Table 3 shows that toddlers with normal viscosity of saliva have more data compared to the number of toddlers with high saliva viscosity. However, the overall average viscosity of saliva remains in the high category. This is consistent with the research of [22], which mentioned that in the group of underweight children, both stimulated and unstimulated saliva flow rates decrease, leading to increased viscosity compared to normal children. The causes of this phenomenon involve several factors, one of which is nutritional intake. Based on data from Puskesmas Silo II, there is a community service activity in the form of supplementary feeding for toddlers with nutritional deficiencies. Supplementary feeding is a government program for toddlers aimed at providing additional nutrition besides their daily staple food to meet nutritional needs[23]. Supplementary feeding for toddlers can help improve their nutritional intake. This is evidenced by [24] which showed an increase in toddlers' weight after receiving supplementary feeding. The prevalence of underweight can decrease if nutritional needs are sufficient. As a result, the number of underweight toddlers with saliva viscosity in the normal range is higher. However, the supplementary feeding activities carried out in Silo are still not evenly distributed. This uneven supplementary feeding program has led to a high prevalence of underweight toddlers in the Puskesmas Silo II working area.

Toddlers in the age range of 3-4 years have a higher average saliva viscosity compared to those above age range, as presented in Table 4. This is consistent with the research of [24], stating that more toddlers with low body weight are found in the age group of 37-48 months, resulting in higher saliva viscosity due to their tendency towards poor nutritional status. Toddlers in the age range of 3-4 years are considered active consumers, meaning they tend to be selective about their food choices. The growth rate during this period is faster than the pre-school period, requiring a relatively larger food intake. However, the limited stomach capacity means toddlers in this age range can only handle a smaller amount of food per meal compared to older children. Therefore, it is recommended to provide small portions of food but with frequent frequency[19]. The reduced food intake in toddlers leads to a decrease in chewing movements, resulting in a decrease in saliva flow rate[3.] A decreased saliva flow rate increases saliva viscosity, leading to the accumulation of food debris that can subsequently cause tooth decay development[26].

The results of this study indicate that toddlers categorized as underweight with severe malnutrition have higher saliva viscosity compared to toddlers with underweight categorized less, as shown in Table 5. Toddlers classified as severely underweight show a higher average saliva viscosity than toddlers with less underweight criteria. Children experiencing underweight, especially in more severe conditions, tend to have less frequent eating patterns compared to those with normal nutritional status. As a result, the chewing habit within the oral cavity of underweight toddlers becomes less frequent. This is supported by the research of [2], which states that nutritional status is related to saliva flow rate. The worse the nutritional status, the lower the saliva flow rate tends to be, leading to an increase in saliva viscosity. Nutritional deficiencies can affect the development of salivary glands in toddlers, marked by atrophy of acinar cells accompanied by cytoplasmic vacuolization with pleomorphism and periductal fibrosis. Atrophy of acinar cells in salivary glands is

caused by a decrease in cell proliferation or an increase in apoptosis[27]. The occurrence of atrophy in underweight toddlers leads to salivary gland hypofunction, resulting in a decreased saliva flow rate compared to normal toddlers. Another study by [28] also suggests a negative correlation between saliva viscosity and nutritional status, meaning that an increase in saliva viscosity is associated with worsening nutritional status in children.

Saliva viscosity is related to thickness or the ability of saliva to flow and is a parameter for oral health. Saliva viscosity is considered normal when it falls within the range of 2.75 to 15.51 cP (centipoise)[15]. High saliva viscosity has the potential risk associated with oral health problems, one of is dental caries[6]. If this condition is not treated quickly, it will lead to the loss of saliva's protective function. Disrupted salivary glands result in a decrease in self-cleansing ability and buffer capacity, a decrease in antibacterial ability, and make the oral cavity environment more susceptible to bacterial colonization, making it prone to dental caries[29]. It is important for parents to raise awareness of the importance of providing appropriate nutrition for underweight toddlers to reduce the prevalence of underweight and prevent potential negative impacts that may arise due to high saliva viscosity.

Conclusion:-

Based on the results of the conducted research, it can be concluded that the average saliva viscosity of underweight toddlers aged 3 – 5 years in the working area of Silo II Community Health Center, Jember Regency, is 15.72±4.16 cP (centipoise), categorizing it as high. Additionally, the viscosity values of underweight toddlers based on age show a high average for subjects in the 3-4 years age group, which is 15.77 cP. Meanwhile, the saliva viscosity of underweight toddlers based on the underweight category reveals a high average for subjects categorized as severely underweight, which is 17.15 cP.

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