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# DETERMINANT OF STUNTING AMONG UNDER FIVE CHILDREN AT PUSKESMAS (PUBLICHEALTH CENTER) PONTIANAK CITY

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**Abstract**

***Objective :****This study aimsto analyzetherelationshipbetween macro and micro nutrientsintakeandbreastfeedingduration on stuntingas well asnon-stunting toddlers.* ***Method****: Thestudywasconductedusingthequantitativedescriptivemethodwithacase controldesign. Sixty-eight(68)infant were selected after 224 candidates were screened.Stuntingwas measuredonz-score WHZandanalyzedwithWHO Anthro2005 while nutrientintakewasmeasuredbyRecallform1x24 hours,breastfeeding reports were obtained fromquestionnaire. Furthermore, bodyheight(WHZ)wasmeasuredusing microtoise whileBivariateanalysis was carried out usingChisquaretest.* ***Results****: The results showedthat thereisa relationshipbetweenstunting and energywithp=0.000<α=0.05CI9.905(0.630-37.911),proteinP=0.000<α=0.05CI9.905(0.630-37.911, andvitaminA,p=0.000 <α=0.05CI3.125(1,724-5,664). In addition, there wasalso acorrelationwithcalciump=0.000<α=0.05 CI6.008(2.045-17.650),zinc=0.000<α=0.05CI8.727 (2,287-33,303),andexclusivebreastfeedingp=0.000<α=0.05CI9.905 (0.630-37.911).* ***Conclusion:****Based on theresults(pvalue 0.000),there isa significant correlation between energy, protein, vit A, Ca, as well as zincintake and stuntingin under-fivechildren.*

***Keywords:****Stunting,nutrition,macro,micro,PuskesmasPal 3*

## Introduction

Stuntingisalineargrowthdisordercausedbychronic malnutritionofnutrient intake and/orrecurrentinfectiousdiseasesasindicatedbyaz-scorescoreof heightbyage(HAZ)below-

2standarddeviation(SD)according to theWorldHealth Organization (WHO)(Wang *et al.*, 2009). The prevalence ofstuntingin theworld is still high and wasreportedly confirmed by WHOto be 29.8%in2008.OneofthegoalsofSustainableDevelopmentGoals(SDGs)isto diminishallforms of malnutrition byachievingtheinternationaltargettoreducestunting prevalenceby37.2%from40%in2013and22.3%by2025(Sumekar and Haryadi, 2016).

Stuntingis a widespread nutritionalproblem amongIndonesian children(De Onis, Blössner and Borghi, 2012). The prevalence in childrenaged between6 to11monthsoldis11.9% meanwhile, this value increasesharplyto27.6% and 42.3%atage12-17 and 18-24 months respectively (KEMENKES RI, 2018b). Furthermore, Nationaldataonstuntingincidence indicated that 37.2% of under five Indonesian childrenexperiencethis condition hence,signifyinganincrease comparedto2010(35.6%)and2007(36.8%) (Torlesse *et al.*, 2016). A study reported that WestKalimantan wasranked19thoutof33provincesinIndonesiawith an incidenceof 40.2%In 2015 which is approximately 20.9% of toddlers in Pontianak (Badan Penelitian dan Pengembangan Kesehatan, 2013). Stunting usually occur due to lowintakeofnutrientsincluding energy,protein,iron,zinc,andcalcium. Thesenutrientsareobtainedfrombreast milk(ASI)andfoodcompanionmilk(MP-ASI). It was reported thattheduration of exclusive breastfeedingsignificantlyrelatesto children nutritionalstatus especiallyforthe*z-score*HAZ(RISKESDAS, 2013). Meanwhile, improvement via micronutrientinterventionshavebeenless effective.Therefore, nutrient supplementationisto bedonethroughdiversification offoodsas well astheprovisionofMP-ASI.(Fikadu, Assegid and Dube, 2014)

Childrenrequiresmall amount of micronutrients however, when these needs are not fulfilled,it results in fatal effect which ultimately triggersproteindeficiency in the long run.Zinc(Zn)isamicronutrientthatplays anessentialroleinmanybodyfunctions. Meanwhile,deficiencyoccursinvulnerablegroups, children,pregnantandlactatingmothersas well asparents. In addition, growth disorder has been one of the signsofZndeficiency. Alloway (2009),reportedthatsupplementation of Zn (20mg) and Fe(20mg) once a week increase Z-Score of HAZ in *stunted*childrenaged6-24months. Similarly, Zn (5 mg) supplementation promoted growth of children aged 1 to 6 months in Bangladesh (Lazzerini, 2013). Severalepidemiologicalstudiesproved thatstuntingis induceby severalriskfactors,suchasmacro-nutrients intake(energyandprotein), micronutrients (Fe,Zn,VitaminA, Ca) and exclusivebreastfeeding. Tonderayiet al., (2016)reportedthat family low economic status,historyofannual respiratory infection, and lessproteinintakewere among stunting risk factors. Meanwhile,othersriskfactorsassociated withstuntingincludeEnergyIntake,Protein, Zn and Vitamin A(Kemenkes, 2013).

Aninitialsurveyon10under-five childreninthework areaofPuskesmasPal3 - Pontianak City showedthat80%were stunteddue to insufficient intake of; protein(80%),vitamin A and Zn (60% and 70% respectively) as well ascalcium(60%). In addition, preliminarysurveys revealed that 60%ofstuntedtoddlerswere not exclusivelybreastfed.Therefore, considering these risk factors, this study aims to analyzetherelationshipbetween macro and micro nutrientsintakeandbreastfeedingduration on the stuntingandnon-stunting toddlers.

**Methods**

This study was conducted using the case control design with 220 mothers and toddlers aged between 7 to 60 months. Data were collectedfor3monthsbeginning fromDecember2016toMarch2017. After screening, 68 under-five children obtained from work area of the Pal 3 Public Health Center in Pontianak City were selected as sample. Furthermore,datacollectionwas carried out throughFoodRecallform by an enumeratorattheDepartmentofNutrition Vocational Studies,PoltekesKemenkes Pontianak, Indonesia.The data were analyzed using univariateanalysis technique to obtain thecharacteristics of the proposed variables.Thereafter, thebivariateanalysis was then performedto obtain the independent anddependent variablesincluding,macronutrientenergy intake,protein, micro (vitamin A, Zn, Ca) andexclusive breastfeeding in relationtostuntingusing*chai-square*test.

**Results**

Among the 68 participants, 61.8% had low energy and protein intake, 47.1% lacked vitaminA while 63.3 % and 64.7% had less calcium andZn respectively. Also, noneof the samples were sufficiently breast-fed until after 6 months (table 1). Moreover, table 2 showed that there were correlations between energy intake (odd ratio: 9.905, p = 0.000), protein (odd ratio: 9.905, p = 0.000), vitamin A (odd ratio: 3.125, p = 0.000), calcium (odd ratio: 6.008, p = 0.000) as well as breastfeeding with stunted toddlers (odd ratio: 9.950, p = 0.000).

**Table 1. Univariate Analysisof macro and micronutrient Consumption**

| Variable | Frequency | |
|---|---|---|
| | N | % |
| **Energy Intake** | | |
| Less | 42 | 61.8 |
| Enough | 26 | 38.2 |
| **Protein Intake** | | |
| Less | 42 | 61.8 |
| Enough | 26 | 38.2 |
| **Vit A intake** | | |
| Less | 32 | 47.1 |
| Enough | 36 | 52.9 |
| **Ca Intake** | | |
| Less | 43 | 63.3 |
| Enough | 25 | 36.8 |
| **Zn intake** | | |
| Less | 44 | 64.7 |
| Enough | 24 | 35.3 |
| **Exclusive Breastfeeding** | | |
| 0 month | 6 | 8.8 |
| 1 month | 2 | 2.9 |
| 2 month | 8 | 11.8 |

| | | |
|---|---|---|
| 3 month | 10 | 14.7 |
| 4 month | 17 | 25.0 |
| 5 month | 25 | 36.8 |
| 6 month | 0 | 0 |

Table 2. Differences in stunting Risk Factors in Pontianak, West Kalimantan n (68)

| Variable | Stunting (%) | Not Stunting (%) | *p-value* | OR |
|---|---|---|---|---|
| **Energy intake** | | | | |
| Less | 76.2 | 23.8 | 0.000 | 9.905 (0.630-37.911) |
| Enough | 7.7 | 92.3 | | |
| **Protein intake** | | | | |
| Less | 76.2 | 23.8 | 0.000 | 9.905 (0.630-37.911) |
| Enough | 7.7 | 92.3 | | |
| **Vit A intake** | | | | |
| Less | 78.1 | 21.09 | 0.000 | 3.125 (1.724-6.664) |
| Enough | 25.0 | 75.0 | | |
| **Ca Intake** | | | | |
| Less | 72.1 | 27.9 | 0.000 | 6.008 (2.287-17.650) |
| Enough | 12.0 | 88.0 | | |
| **Zn intake** | | | | |
| Less | 72.1 | 27.9 | 0.000 | 8.727 (2.287-33.303) |
| Enough | 91.7 | 8.3 | | |
| **Exclusive Breastfeeding** | | | | |
| Month>6 | | | 0.000 | 9.950 (2.588-37.911) |
| Month <6 | 7.7 | 92.3 | | |
| | 76.2 | 23.9 | | |

## DISCUSSION

### Relation between Energy Intake and incidence of stunting

This study showed that there wasasignificantrelationshipbetweenGenesis EnergyIntake and*Stunting*. Theseresults wereconsistentwithexistingtheorieswhich stated that thenutritionalstatus of an individual is largelydeterminedby dailynutritional intakes(energy,protein,carbohydrates,and fats).Hence, whenthereisnobalancebetweennutrientintake and its theoretical needs,nutritionalproblems follows. Furthermore,lowenergyintakeand infectious diseases are also capable of directly inducingmalnutrition and other stunting risk factors. Therefore, the community is advised to obtain quality education, provide balanced nutrient intake, and increase the degree of child health and development of EST (Eco Support Theory) to eliminate stunting in Indonesia (Hadi, Kumalasari and Kusumawati, 2019a). Thisstudyconfirmed previous research that there was a significant relationship betweenenergy intakeand stunting(Rahayu *et al.*, 2020).Sulastri

andDelmi (2012)reportedthat lessenergyintakeis caused by insufficient milk consumption. Stunting risk caused lowenergyintakeis2.52 timeshighercompared to children with goodenergyintakeornormal (Hidayati *et al.*, 2017).

**Relation between Protein and theincidence of*stunting***

There wasasignificant relationship between proteinintakeand*stunting*. Thenutritionalvalue of the available foods determinestheamount to be consumed,hence, tomeet thenormal protein intake,foodswithlownutritionalvalueare to beconsumedat higherquantities. Besides, protein nutritional valueis commonlyinfluencedby2factorsnamely,digestibility andthecompositionofessentialaminoacids.Ingeneral,thenutritionalvalue ofvegetableproteinislowercompared toanimalprotein.Although,theoretically, foods sometimes containa mixtureofvegetableproteinresulting in equal nutritionalvaluewithanimalprotein. Meanwhile,the latterprovidesseveral advantages, suchasfacilitatingtheabsorption ofothernutrientssuchasironandalsomeetthebody'srequirementforvitaminsandminerals. Our study confirmed previous research that indicated adifferenceinproteinintake levelsbetween *stunting*and*non-stunting children*(Kuriyan *et al.*, 2016)**.** Meanwhile, protein adequacyis fulfilled onlywhenenergysufficiencyhasbeenachievedby burning proteins into heatandenergy**.**Deficiency, results inpoorgrowth, decreased immunesystem effectiveness**.** Therefore, mothersarerecommended togiveproteinaceousfoodswhich fulfill ProteinSufficiencyRate≥18gram/day(7-11month)≥26gram/day(1-3 years)and ≥ 35gram / day(4-6year) (Kemenkes, 2013).

**RelationbetweenvitaminAand the incidence*of stunting***

There wasasignificantrelationship betweenvitamin Aintakeand stunting. Meanwhile, VitaminAisan exampleoffatsolublevitamin andfunction inkeepingthegrowth ofepithelialtissue,eyes,hair,andbones(Hadi, Kumalasari and Kusumawati, 2019b).In addition, it facilitatesoxidationprocessesandregulatelightstimulationoftheeyenerve.Deficiency of this nutrienttriggers health disorders including(Nasrul, Maudu and Hafid, 2017);Hemeralopiaornightblindness, (Wang *et al.*, 2009); Friodema (scaly appearance of the hand and feet skin due to disturbance in itsepithelial formation,(Sumekar and Haryadi, 2016);Bleedingonthe intestinallining,kidneys,and lungs(De Onis, Blössner and Borghi, 2012); Damagetothecornea,(KEMENKES RI, 2018a);Cessation ofgrowth and (Torlesse *et al.*, 2016);Delayedgrowth ininfants and Vitamin A diffusion influence protein synthesis, hence, it affects cell growth(Hidayati, Hadi and Kumara, 2010).Therefore,childrenwithvitaminAdeficiencyusuallyexperience growth failure (Rosado *et al.*, 2009). Motheraresuggestedtoprovidefoods thatfulfilVitaminASufficiency Rateof≥400mcg/day(7-11months),≥400mcg/ day(1-3years)and ≥ 450 mcg/ day(4 - 6years)(Bodiga *et al.*, 2012).

**Relation between calciumintake and theincidenceof*stunting***

There wasasignificantrelationshipbetweencalciumintakeand*stunting incidence.* Aside helping in bone and teeth formation, calciumisalsoimportantforgrowth,bloodcoagulation,and asacatalystfor variousbiological reactions. Duringgrowth,thehard*boneshaft*extendsthrough anewcollagenmatrixfollowedbyossification. The*Trabeculae,*locatedattheendsand withinthe*boneshaft*isaporouscrystalstructuredirectlyrelatedtobone

veinsthatsuppliescalciumandblood.Furthermore,theteeth consistoftwolayersnamely,enameland dentine hence,changeinteeth calciumisslower compared tobone. Calciumlevel is acontributing factorto proteinavailability(Torlesse *et al.*, 2016).This study isnotinlinewithS. Sari et.al (2017)which reported thatthereisnosignificantdifference betweencalcium and nutritional status in*stunted* and normal childrenaged7-12years(Sari *et al.*, 2017).Non-stunting toddlers were found *to*consumemoremilk, eggs and shrimp whilestunted toddlersrarelyconsumethese foods. Therefore, mothersaresuggested togivefoodthatfulfillscalcium sufficiency rateof≥250mg /day(7-11months),≥650 mg/ day(1-3years) and≥ 1000 mg/ day(4-6year). (Stevens *et al.*, 2015),(Rosado *et al.*, 2009).

**Relation between Zn intake and theincidenceofstunting**

Based on previous reports, there isasignificant relationship between Znintakeandstunting. Also, there is a correlationbetweenZn,cellgrowthandstabilityofvarioustissue functions hence,it isanessentialmicronutrientinmaintainingoptimalhealth (Hidayati, Hadi and Kumara, 2010). Meanwhile,aboutthreezinc crossroadsarecontainedwithintheskeletalbone. Foodsources(shellfish, oysters,beans,milkandwheat)or supplementsimproves zinc circulationfromthepancreastothegastrointestinaltract,thereby,facilitating theformationof*chylomicrons*ongastrointestinalsurfaces.

Theseconditionsalsoimprovessharpnessoftastethereby,increasing appetite.Zinc absorptionisaffectedbythebody'szincstatus, therefore, whenmorezincisneeded, productionincreases.Similarly,dietaryfiber and phytatesaffectsabsorption byinhibiting theavailability of Znbiologics.Incontrast,histidineproteins facilitatesabsorption, for example, when thevalueof blood albumindecreasesduringlow nutritional state, absorption also decreases(Montoya *et al.*, 2009). This study indicated a significantrelationship between Zinc intake and*stunting* (Rosado *et al.*, 2009). Therefore, mothersarerecommendedto provideZncontainingfoodswhichfulfillZnsufficiency of≥3mg/day (7-11months),≥4mg/day(1-3years)and≥ 5 mg/ day(4-6year)(Kemenkes, 2013). This is not in line with a multivariable binary logistic regression study affected by birth weight (OR = 0.12; 95 % CI 0.07, 0.21, P < 0.001) and maternal height (OR = 0.94; 95 % CI 0.91, 0.98, P = 0.001(Kartono *et al.*, 2012).

**Relation between breastfeeding and theincidenceof*stunting***

There was a significant relationship between exclusivebreastfeeding and stunting. The *AmericanDietetic Association*(ADA)and*TheAmericanAcademyofPediatrics*(APP)recommended that babies are to beexclusivelybreastfedforthefirst6monthsthenfollowedbya complementaryfeedingofatleast12months. Moreover,previous studies reported that infants thatwerenotexclusivelybreastfedhada3.7 timesfixedriskbeing*stunted*atage3-4years.The breastfeedingeffectismediatedbytheanti-infective function of breast milk. Hence, inadequatebreast-feedingandearlyfeedingorformulaincreasetherisk of*stunting* asinfantsfail to growdue toinfectiousdiseasessuchasdiarrhea and respiratory disorders(Sari *et al.*, 2017).ThisstudyisinlinewithAl-Rahmadet al. (2013)withp=0.002which indicated thatthereisa relationship between exclusivebreastfeedingandtheoccurrenceof*stunting*withOR of 4.2 (95%CI:1.8-10.0). Therefore, mothers are recommended to breastfeed for6 monthswithout any food otherthan breast milk (Arlius, Sudargo and Subejo, 2017).

**Conclusion :**

Base on theresults,thereisa significant correlation between energy, protein, vit A, Ca, as well as zincintake and stuntingin under-five children. Therefore, itisrecommendedthathealthinstitutionsprovide adequatesupplementation of Zn,Ca,andVitaminA. Motherare to be also morecreative in providing varieties of foodsforunder-five children.

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