NUTRITIONAL INTERVENTION IN STUNTING CHILDREN AGED 1-5 YEARS-OLD USING ORAL NUTRITIONAL SUPPLEMENTS (ONS) IN SURABAYA CITY

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ABSTRACT

Growth faltering, also known as failure to thrive, in pediatric populations may arise from a combination of insufficient nutritional intake and the presence of chronic infections. When this condition persists over an extended duration, it can culminate in stunting—a form of chronic malnutrition characterized by impaired linear growth—which continues to exhibit a high prevalence rate across various regions of Indonesia. As part of the national effort to mitigate and prevent stunting, oral nutritional supplements (ONS), which are specifically formulated for both therapeutic and dietary management in pediatric patients with specific health conditions, including growth failure, play a critical role. This study aims to examine the impact of ONS intervention, with a caloric density of approximately 1 kilocalorie per milliliter, on stunted children between the ages of one and five years at a private healthcare facility, namely Husada Utama Hospital in Surabaya. This study is an observational analytical study of a quasi- randomized control trial with a pre- and post-test design. The sample of this study was stunting children aged 1-5 years as many as 20 subjects who were willing to follow the ONS intervention research in achieving optimal growth. After being given intervention for 90 days, the number of normal HAZ/LAZ children became 5 (25% increase). There was a decrease from severely stunting by 7 subjects to stunting and a decrease in stunting to normal by 5 subjects. Ideal Body Weight (IBW) achievement occurred in 9 (45%) subjects, while 11 (55%; 6 male and 5 female) subjects did not reach IBW. There were 8 stunted children who still have not experienced a change in nutritional status until the end of the intervention, the 8 subjects are still undergoing basic treatment for the accompanying disease. ONS intervention is effective in reducing stunting rates, especially in stunted children with infections.

Keywords: *Growth faltering, Oral nutritional supplements (ONS), stunting.*

INTRODUCTION

Growth faltering, or failure to thrive, is characterized by a suboptimal or declining pattern of weight gain, which may result from a multifactorial interplay of inadequate nutrient intake, impaired nutrient absorption, or elevated metabolic demands associated with chronic illnesses or inherited metabolic disorders (Larsen, 2019). A primary indicator of growth faltering is a low weight-for-age z-score (WAZ), which can subsequently impact linear growth as reflected in length/height-for-age z-scores (LAZ/HAZ). Notably, in rural regions of Sri Lanka, approximately 78.5% of children exhibited signs of growth decline beginning before the age of four months (Sithamparapillai et al., 2022), reaching -1 SD at the age of 24 months. While LAZ/HAZ is close to the reference value at birth, it drops drastically until the age of two years, and is stable at z-score -1.5 to 2 SD (Victora et al., 2010).

According to Cliffer et al. (2022), the period between 9 and 11 months of age represents a critical window in infant development, during which growth patterns are most influential in determining future optimal stature; specifically, each additional centimeter gained in body length during this stage is associated with an estimated cumulative increase of 6.71 centimeters in overall height attainment. And when the child experiences a slowdown in growth for two consecutive months, there is a decrease in body length by 1.7 cm (Cliffer et al., 2022).

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Stunting is a form of *growth faltering* (Migang, 2021), due to the provision of inadequate nutrition that is chronic (Mertens et al., 2023)000 days of life (from conception to 2 years of age, meanwhile stunted was characterized as HAZ < -2 SD of the WHO child growth standard based on gender (Isanaka et al., 2019). Globally, 149 million children < 5 years old are declared stunting (UNICEF/WHO/World Bank, 2021), with multifactorial causes, including the low quality of diet and repeated infections (Bhutia, 2014). Inadequate nutrition at the beginning of life, especially the period of the first 1000 days (gestation period up to two years of age) has very fatal consequences, such as decreased intellectual ability, short stature, decreased working capacity and slowdown in development (Khadilkar et al., 2021).

The adult human stature is a multifaceted outcome that reflects not only an individual's genetic makeup but also the various environmental determinants that influence the linear growth trajectory during childhood. Consequently, the growth patterns observed in children can serve as a "reflection" of the environmental conditions prevailing within a given region, particularly those related to nutritional availability and the overall hygiene and sanitation standards of the population (Tanner, 1992; Dewey and Adu-Afarwuah, 2008). Growth has been programmed to occur in the "critical time frame," so that if it is passed for various reasons, it cannot be cured (Migang, 2021).

In light of the detrimental impact of stunting on both individual health outcomes and societal development, the Indonesian government has undertaken a firm commitment to reducing the national stunting prevalence to below the threshold of 15% by the year 2030. To facilitate the reduction and prevention of stunting, the government enacted Minister of Health Regulation (Permenkes) Number 29 of 2019, which serves as a guiding framework for the management of nutritional interventions in children experiencing growth impairments. The aforementioned health regulation delineates the framework for the administration and regulation of oral nutritional supplements (ONS), also referred to as Processed Foods for Special Medical Purposes (Pangan Olahan untuk Kepentingan Medis Khusus or PKMK), specifically designed for children who are at heightened risk of experiencing growth faltering, undernutrition, or wasting. This includes vulnerable populations such as premature infants, those with low birth weight, infants with cow's milk allergies, and children suffering from inherited metabolic disorders. (Menteri Kesehatan Republik Indonesia, 2019). Oral Nutritional Supplements (ONS), also known as Processed Foods for Special Medical Purposes (PKMK), are defined as high-energy, nutrient-fortified, and ready-to-consume food products specifically formulated for the therapeutic management of children over the age of six months who have been diagnosed with acute malnutrition. These supplements adhere to strict criteria, including characteristics such as a soft or crumbly texture, making them easy to ingest without the need for any additional preparation. (WHO and FAO, 2016).

The regulation of ONS designed by The Ministry of Health explains that the ONS must be equipped with the "composition label" and "preparation guidance," as this formula is specifically designed to meet nutritional needs. The formulation must be accompanied by clear indications specifying the target population for which the product is intended, and it must bear the designation "food for specific nutritional uses," in compliance with the general labeling requirements outlined in CODEX STAN 180-1991. Oral Nutritional Supplements (ONS) are classified as specialized formulas for medical purposes, primarily employed for the provision of nutritional therapy in clinical settings. (Binder and Gortsos, 2015).

ONS is defined as processed food that is processed and specially formulated for medical management and diet management in children with certain diseases, including failure-to-thrive, which must be diagnosed by doctors at the health center using anthropometric measurements, and confirmed using the WHO child growth standard 2006 (Menteri Kesehatan Republik Indonesia, 2019). This research was conducted to determine the effect of ONS intervention with a calorie density of 1 ml equivalent to 1 kcal in stunted children aged 1 to 5 years at a private hospital in Surabaya.

METHOD

Research design

This study is an observational analytical study of a quasi-randomized control trial with a pre- and post-test design involving subjects of a total of 20 children with stunting willing to follow the ONS intervention research in achieving optimal growth. Intervention is carried out by treating the disease suffered, nutritional counselling (diet counselling) regarding the adequacy of animal protein intake as stated in the KIA book, and nutritional intervention using oral nutritional supplement (ONS) or high-calorie milk (SGM Optigrow, 1 ml ~ 1 kcal) in accordance with PERMENKES No. 29 of 2019 about overcoming nutritional problems for children due to disease (Shaheen et al., 1999)including arthritis, glomerulonephritis, and certain autoantibodies such as anti-nuclear ribonucleoprotein (nRNP. The diagnosis of concomitant diseases is carried out by a pediatrician consultant for Nutrition and Metabolic Diseases at a Private Hospital in Surabaya. The ONS used contains balanced macro and micronutrient nutrients. This research is part of the research of Widjaja et al. (2023) (https://www.doi.org/10.6084/m9.figshare.22210798.v2) involving 74 children who failed to grow, and the number of stunted children obtained as many as 20 subjects.

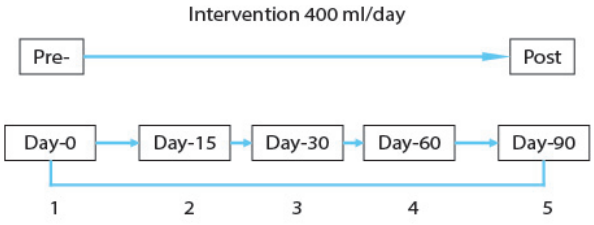

Figure 1. A pre- and post-randomized control trial design flowchart

Information:

1. Parents who agree and sign informed consents allowed the research team (pediatricians and two trained Husada Utama Hospital nurses) to take initial anthropometric data (weight, height, head circumference). Pediatricians prescribed ONS for the subject's consumption for 15 days as many as four boxes of milk @ 400 g which could be redeemed at the hospital dispensary Husada Utama without charge. Consumption is limited to 400 ml/day which is equivalent to 400 kcal/day, assuming the ONS given is able to meet 40% of the subject's daily nutritional needs. Furthermore, parents were asked to come on the 15th day of the intervention to assess compliance, interference reactions, acceptance of smell and taste, and monitor the subject's weight gain and height. Weight measurement was done with the subject in minimal clothing, by opening the attached diapers, accessories, shoes and socks. The weight measurement was taken by two trained nurses who accompanied the researchers using the *Seca baby scale* 354 digital scale for subjects under two years old and the Seca Robusta 813 digital scale for subjects over two years old. Body length was measured using the Seca infantometer 417 for subjects under two years old) and Seca Stadiometer 213 for subjects over two years old. Measurements were taken by two people, one person ensured the child's foot position and posture was correct (feet are clenched, with both heels meeting each other, the position of the head is up), and the other looked at the measurement scale. For any complaints suffered by the subject during administration, parents were free to contact the researcher.
2. On day 15, parents came to monitor the efficacy of the given intervention, by assessing the increase in weight and height of the subject. Parents also again received ONS prescriptions of four boxes @400 g which could be redeemed at the hospital dispensary Husada Utama. Parents were also asked to come back on the 30th and 60th day for weight and height monitoring and ONS prescription to be consumed during 30th days forward.
3. On day 90, parents came to monitor the efficacy of the given intervention, by assessing the increase in weight and height of the subject.

Research subject

The study cohort comprised children between the ages of 1 and 5 years who had been clinically diagnosed with stunting by a pediatrician (the researchers), with the diagnosis based on the assessment of length/height-for-age z-scores (LAZ/HAZ) that fell below the threshold of -2 standard deviations (SD) according to the 2006 World Health Organization (WHO) child growth

standards. The inclusion criteria for the study required that participants did not present with conditions such as fluid retention, organomegaly, the presence of tumor masses, or any congenital anomalies. Additionally, children were excluded from participation if they had been diagnosed with neurological disorders like cerebral palsy, chromosomal conditions such as Down syndrome, hormonal dysfunctions, or other recognized genetic or syndromic conditions.

Research ethics

The research underwent a rigorous ethical review by the designated ethics committee and was subsequently deemed to comply with the seven established World Health Organization (WHO) ethical standards, as affirmed by the Health Research Ethics Committee of the Faculty of Medicine, Airlangga University, Surabaya. The ethical approval was granted under reference number 226/EC/KEPK/FKUA/2021, dated October 4, 2021.

Statistical analysis

The statistical analysis employed in this study encompassed various methodologies, including descriptive analysis, presented as either the mean ± standard deviation (SD) or frequencies (n (%)), followed by the assessment of normality distribution using the Kolmogorov-Smirnov test. Furthermore, comparative analysis was conducted to evaluate differences between pre- and post-intervention measurements using either the paired sample t-test or the Wilcoxon signed-rank test. To assess potential gender-based differences, independent sample t-tests or Mann-Whitney U-tests were applied to compare male and female subjects.

RESULT AND DISCUSSION

The characteristics of the subject are presented in **Table 1**. The average age of the subject of a stunted child is 19.45 (12.00 - 34.00) months, with the male 55% and female 45% According to parents, they took their children to the Husada Utama Hospital Nutrition and Metabolic Diseases Outpatient Installation because they felt that their children did not want to or had difficulty eating, their weight did not increase nor did length.

Parents visited the pediatrician's practice of a nutrition subspecialty because they feel that something is wrong with their child, including not wanting to eat/discomfort to eat (30%), the child's weight does not increase, as well as their body length (5%) and slow weight gain (65%). Physically, the children did not have the symptoms of illness, such as fever, fuss, nausea, vomiting, cold cough, and so on. After performing examinations (physical, complete blood, complete urine, urine culture, thorax) and anamnesis, the doctor (researcher) concluded that the child had tuberculosis infection (45%), urinary tract infection (25%), tuberculosis and urinary tract infection at the same time (20%). The remaining 10%, have been declared cured after undergoing tuberculosis treatment when the research began.

Table 1. Characteristics of stunted subjects

Variable	n (%)
Gender	
- Male	11 (55%)
- Female	9 (45%)
Complaint	
- Don't want to eat/difficult to eat	6 (30%)
- Weight is not up, Body length is not up	1 (5%)
- Weight is hard to go up	13 (65%)
Exclusive history of breast milk 6 month	20 (100%)
Current history of breast milk	
- Dominant breast milk (+ formula)	8 (40%)
- No breast feeding	12 (60%)
Reasons to use the formula	
- Allergies	1 (5%)
- More than 2 years old	4 (20%)
- Grow up to pursue	6 (30%)
- Breast milk does not come out	9 (45%)
Diagnosis	
- Tuberculosis infection	9 (45%)
- Urinary tract infection	5 (25%)
- Tuberculosis and urinary tract infection	4 (20%)
- Recover (Tuberculosis infection)	2 (10%)
Photo thorax	
- Specific lung inflammation	18 (90%)
- Inflammation of bronchitis	1 (5%)
- Infiltrates in the suprahilar and pericardial right	1 (5%)
Route	
- Oral	18 (90%)
- Enteral	2(10%)

Parents realized something was wrong with their child and tried to find out the cause by going to the doctor. When given medical and supportive advice, parents are willing to fulfill it, namely medical treatment and feeding (complementary feeding) with animal protein content and consumption of high-calorie formulas prescribed by doctors (400 kcal or equivalent to 400 ml per day).. Unfortunately, in the observation, the doctor (researcher) does not see the intelligence quotient (IQ), because of the cost factor of the examination that is impossible to be charged to parents. Maybe if offered the parents would be willing to pay, considering the test is done to see the intelligence potential of the child. Nutritional counseling given to parents is the first step that is part of handling malnutrition in children, although there are some obstacles in practice (Shaheen et al., 1999).

Infection represents one of the primary factors contributing to a child's reluctance to eat, thereby impeding adequate weight gain. In particular, urinary tract infections (UTIs) in children under the age of 5 often present in an asymptomatic form, much like tuberculosis. These infections play a significant role in the manifestation of stunting in pediatric populations, as they induce anorexia, which in turn leads to a stagnation or insufficient progression of weight gain (Mckenna et al., 2022). Manifestations of tuberculosis disease in children vary, depending on the type of tuberculosis, such as the presence of cough and chronic fever, weight loss or failure to grow (Sousa et al., 2019)bivariate and multivariate approaches. Results: It was found that, depending on the tuberculosis type, its manifestations may vary. The logistic regression model considered only pulmonary tuberculosis due to a number of observations and included female sex (95% CI: 1.4-16.3. The prevalence of tuberculosis (TB) within the pediatric population remains significantly high, with an estimated 1.2 million out of 10 million children globally affected, resulting in a concerning mortality rate of 16%. Unlike adults, not all children with TB exhibit the common symptom of persistent coughing; rather, a critical indicator that warrants attention is insufficient weight gain or, in more severe cases, rapid and substantial weight loss. Consequently, nutritional status has been recognized as a pivotal criterion in the assessment and scoring of tuberculosis in pediatric patients (Mckenna et al., 2022).

Table 2. Average of stunted subject's profile

Variable	x (min-maks)
Age, month	19.45 (12.00 - 34.00)
Ideal body weight (IBW), kg	9.44 $\pm$ 1.57
Height age, month	11.73 $\pm$ 5.28
Diameter Mantoux test, mm	7.40 (0.00 – 16.00)
Tuberculosis score	5.75 (3.00 – 9.00)
Age when the complaint occurs, month	5.57 (2.00 - 24.00)
Long time complaint, month	10.65 (3.00 - 36.00)
Birth weight, kg	2.92 (2.25 - 3.60)
Birth body length, cm	49.05 (46.00 - 60.00)

When the doctor (researcher) first suspects the existence of tuberculosis disease, parents often deny the doctor's suspicion, so a follow-up examination is carried out, namely the Mantoux test and thorax examination. The diagnosis of tuberculosis refers to the tuberculosis score determined by the Ministry of Health of the Republic of Indonesia. In cases where parents initially express reluctance, healthcare professionals (researchers) typically encourage them to implement the prescribed nutritional interventions, which include providing high-quality complementary feeding with sufficient animal protein intake, as well as administering oral nutritional supplements (ONS) to support catch-up growth for a duration of two weeks. Should there be no significant improvement in weight gain within this period, parents are then advised to seek a formal diagnosis from a healthcare provider. At this stage, parents are presented with the option to either accept or decline the recommendation. This study, however, specifically includes only those parents who are willing to comply with the physician's guidance.

Another reason parents cannot accept the fact that their child is stunted after a doctor's diagnosis is because they think it is impossible to happen, because their children are agile, active and not sick. According to de Onis and Branca (2016), stunted children are often not recognized in society, where short stature is common, so it is considered normal. The challenges associated with visual identification, coupled with the infrequent and inadequate routine assessments, contribute to

a prolonged delay in the initiation of appropriate treatment for affected children (de Onis and Branca, 2016).

Table 3 presents the efficacy and compliance of parents to the therapy given. From anthropometric status, almost 100% of parents managed to give ONS as a nutritional therapy to grow to at least 75% per day of the prescribed volume (or the equivalent of at least 300 kcal). Throughout the 90-day therapeutic intervention, a noteworthy improvement was observed in both body weight and height/length, which was subsequently reflected in various growth parameters, including weight-for-age, height-for-age (or body length-for-age), and weight-for-height (or weight-for-body length) z-scores. The total body weight gain of the stunted subjects for 90 days intervention was 0.82 $\pm$ 0.51 kg, or an average per month of 0.27 $\pm$ 0.17 kg. Meanwhile, the average of increase of height in 90 days of intervention is 3.31 $\pm$ 1.26 cm or 1.10 $\pm$ 0.42 cm/ month. For the WAZ parameter, the average increase for 90 days is 0.38 $\pm$ 0.67, and LAZ/HAZ 0.45 $\pm$ 0.53.

The effectiveness of Oral Nutritional Supplements (ONS) in individuals at risk of malnutrition is largely contingent upon the patient's adherence to the prescribed regimen, which, in turn, is influenced by factors such as the sensory attributes and tolerance of the ONS product. The sensory experience of taste is shaped by a variety of elements, including residual or aftertaste, visual appeal, overall comfort during consumption, duration of intake, ease of preparation, olfactory characteristics, flavor profile, temperature, viscosity, and the volume of the product consumed. In this case, patient preference is an important factor for compliance (Uí Dhuibhir et al., 2019)but the degree to which individual perceptions of palatability influence dietitian clinical decision making is unclear. This study aimed to explore factors that influence dietitians' ONS clinical practice, evaluate dietitian hedonic preferences and overall impression of specific ONS products, and study phenylthiocarbamide (PTC. Patient acceptance of ONS intervention provided in this study is 100% acceptable, both in terms of taste and aroma.

Growth faltering, especially stunting, occurs considerably in the first 1000 days of life (from pregnancy to the age of two years), because some parents' behavior is wrong, one of which is breastfeeding (complementary feeding), which can cause stunting to adulthood (Zhang et al., 2021). A suboptimal pattern of complementary feeding, characterized by inadequate quality and insufficient animal protein content, leads to diminished concentrations of essential amino acids in the bloodstream, thereby impeding growth via the principal regulatory pathway—the mechanistic target of rapamycin complex 1 (mTORC1) pathway. This pathway, which plays a critical role in growth regulation, is highly sensitive to the availability of amino acids, and any deficiencies in these nutrients can significantly disrupt its function. The mechanistic target of rapamycin complex 1 (mTORC1) serves as a pivotal integrator of various physiological signals, including nutrient availability—particularly proteins and amino acids—growth factors, oxygen levels, and energy status. Through these inputs, mTORC1 orchestrates the regulation of multiple critical processes, including chondral plate growth, skeletal muscle development, myelination within

Table 3. Observation result of stunted child growth parameters

Variables	Day 0	Day 30	Day 60	Day 90
Weight	8.61 (6.53 – 11.65)	8.92 (6.88 – 12.00)[a]	9.23 (7.00 – 12.27[b]	9.43 (7.27 – 12.20)[c]
WAZ	-2.20 [-3.53 – (-1.02)]	-2.10 [-3.38 – (-0.74)]	-1.83 [-3.13 – 0.96][b]	-1.82 [-3.06 - 0.16]
Body length	75.35 (66.00 – 87.50)	76.57 (68.00 – 89.50)	77.68 (69.00 – 90.00)[b]	78.65 (71.50 – 90.10)[c]
LAZ/HAZ	-2.76 [-3.60 – (-2.01)]	-2.63 [-3.48 – (-1.94)][a]	-2.42 [-3.31 (-1.56)]	-2.31 [-2.97 – (-1.07)]
WLZ/WHZ	-1.21 [-2.73 – (-0.09)]	-1.11 [-3.09 – (0.40)]	-.98 [-2.49 – (0.82)]	-0.94 [-2.17 – 0.96]

Noted: WAZ, Weight for age z-score; LAZ, length for age z-score; HAZ, Height for age for age z-score; WLZ, weight for length z-score; WHZ, weight for height z-score

[a,b,c]statistically difference using paired sample T-test and Wilcoxon signed-rank test

[s]tatistically different between day 0 and day 30[th]

[s]tatistically different between day 30[th] and day 60[th]

[s]tatistically different between day 60[th] and day 90[th]

both the central and peripheral nervous systems, as well as cell growth and differentiation in the small intestine. Additionally, it plays a significant role in hematopoiesis, iron metabolism, and the regulation of organ size, with some of these processes being modulated through the Hippo signaling pathway. The organs involved in growth and development are intricately connected to the occurrence of stunting in children and its associated comorbidities, including anemia, cognitive impairments, environmental enteric dysfunction, and reduced immunity to infectious diseases. In the context of amino acid deficiency, the mechanistic target of rapamycin complex 1 (mTORC1) is inhibited, leading to a suppression of protein and lipid synthesis as well as cellular proliferation. When amino acid concentrations fall below optimal levels, mTORC1 becomes diffusely distributed within the cytosol and is rendered inactive. To restore mTORC1 activation, the body initiates an autophagic process, wherein damaged proteins and cellular components are selectively transported to lysosomes for degradation, resulting in the release of free amino acids into the cytoplasm. This autophagy mechanism functions as a protective response, mitigating the adverse effects of amino acid scarcity and maintaining cellular homeostasis. By inducing the degradation of proteins, the body is able to replenish its amino acid reservoir, thus making essential nutrients available once more. Furthermore, in conditions of amino acid scarcity, other signaling molecules, including growth factors and energy signals, are unable to compensate for the deficiency of amino acids, rendering them ineffective in activating mTORC1 (Soliman et al., 2021). Some ONS studies show good efficacy in maintaining and improving child growth parameters (Pham et al., 2020; Khadilkar et al., 2021; Khanna et al., 2021).

Studies have demonstrated that children experiencing stunting exhibit significantly reduced concentrations of essential amino acids, including tryptophan, isoleucine, leucine, valine, methionine, threonine, histidine, phenylalanine, and lysine, with tryptophan being particularly affected. This deficiency is concomitant with a decline in the levels of non-essential proteinogenic amino acids, biogenic amines, amino acid metabolites, and sphingolipids, in addition to alterations in the composition of glycerophospholipids (Semba et al., 2016). A study involving 23 stunted children aged 2-5 years showed that the intake of essential amino acids in stunted children was lower than that of non-stunted children, and only histidine, isoleucine, and methionine levels showed significant differences (Maulidiana and Sutjiati, 2021). However, the limitations of this study are that did not measure the level of essential amino acids in the subjects.

Table 4 shows the efficacy of ONS in reducing the incidence of stunting in children under five years old. Within 90 days of the intervention, the number of normal children became five (an increase of 25%) from the previous absence, while stunting increased to 14 from 12 (an increase in the incidence of two people), due to the increase from severely stunting status to stunting. Meanwhile, severely stunted children decreased by 35% (from

Table 4. Decrease in stunting rate in 90 days of ONS intervention

Variable	Pre-	Post-	Δ	p-value
Weight for age *z-score*				0.058[1]
- Normal-weight	6 (30%)	11 (55%)	+5 (+25.00%)	
- Underweight	12 (60%)	8 (40%)	-4 (-20.00%)	
- Severely underweight	2 (10%)	1 (5%)	-1 (-5.00%)	
Body length for age or height for age *z-score*				0.001[1]
- Normal-stature	0	5 (25%)	+5 (+25.00%)	
- Stunted	12 (60%)	14 (70%)	+2 (+10.00%)	
- Severely stunted	8 (40%)	1 (5%)	-7 (-35.00%)	
Body length for height or height for age *z-score*				0.157[1]
- Good nutrition	0	19 (95%)	+19 (+95%)	
- Wasted	17 (85%)	1 (5%)	-16 (+80%)	
- Severely wasted	3 (15%)	0	-3 (-15%)	

[1]Wilcoxon signed-rank test

Table 5. Comparison of parameters by gender

Variable	Male (n=11)	Female (n=9)	p-value
Pre-weight	9.37 (7.30 – 11.65)	7.66 (6.53 – 9.40)	0.007[1]
Post-weight	10.26 (7.90 – 12.20)	8.40 (7.90 – 12.20)	0.006[1]
Δ weight	0.89 (-0.06 – 2.07)	0.73 (0.35 – 1.34)	0.509[1]
Pre-weight for age	-2.25 [-3.53 – (-1.02)]	-2.13 [-2.97 – (-1.07)]	0.743[1]
Post-weight for age	-1.79 (-3.06 - 0.16)	-1.85 [-2.90 – (-0.83)]	0.873[1]
Δ weight for age	0.46 (-1.30 – 1.65)	0.29 (-0.13 - 0.99)	0.557[1]
Pre-height or body length	79.36 (70.00 – 87.50)	68.02 (66.00 – 75.00)	0.002[1]
Post-height org body length	82.05 (72.50 - 90.10)	74.50 (71.50 - 79.50)	0.004[1]
Δ height for body length	2.69 (1.00 - 5.00)	4.05 (2.50 - 6.00)	0.011[1]
Pre-height for age or body length for age	-2.70 [-3.60 – (-2.02)]	-2.83 [-3.44 – (-2.01)]	0.605[1]
Post- height for age or body length for age	-2.23 [-2.97 – (-1.07)]	-2.40 [-2.74 – (-1.92)]	0.453[1]
Δ height for age or body length for age	0.47 (-0.64 - 1.76)	0.42 (0.00 - 0.78)	0.870[1]
Pre-body length for height or height for age *z-score*	-1.38 [-2.73 – (-0.12)]	-1.01 [-1.91 – (-0.09)]	0.157[1]
Post- body length for height or height for age *z-score*	-0.93 (-2.17 - 0.96)	-0.95 (-1.87 - 0.23)	0.970[1]
Δ body length for height or height for age *z-score*	0.45 (-0.78 - 1.75)	0.06 (-0.59 - 0.56)	0.159[1]

[1]*Independent sample T-test*

eight people to one person). The change of stunting to normal or severely stunting to stunting occurs for 54.55 days (min-max 30-90 days). In this study, ideal body weight achievement occurred in nine (45%) subjects, while 11 (55%; six male and five female) subjects did not reach ideal body weight.

Table 6 shows a significant difference in the acceleration of weight gain and height in stunting children by gender. Weight change (Δ Weight) in both sexes did not differ significantly, but height gain (Δ body length for height) showed greater increase in girls than boys, 2.69 (1.00 - 5.00) vs. 4.05 (2.50 - 6.00) cm, p=0.011. Boys have a lower HAZ than girls in infancy until the age of 29 months, this puts boys at greater risk of stunting than girls (24.5 vs. 19.4%), because boys receive complementary feeding early at the age of 2-3 months (frequency > 1 time) (Bork dan Diallo, 2017). Other authors found that the growth rate in boys exceeded that of girls in the first year (up to 12 months of age), but the growth rate was the same until the age of five years (Ayatollahi et al., 2015).

This research shows that there are eight stunting children who still have not experienced a change in their nutritional status until the end of the intervention. The eight subjects are still undergoing basic disease treatment that accompanies it, namely tuberculosis (four people) and urinary tract infection (two people), and a combination of tuberculosis and urinary tract infection at the same time (two people). The interaction between *undernutrition* and infection is reciprocal, where *undernutrition* causes the child to be vulnerable to infection, and the infection causes *undernutrition* (Faulk et al., 1974), by inhibiting the speed of growth that triggers stunting (DeBoer et al., 2017). The infection also induces an acute response (Sederquist et al., 2014) and the production of proinflammatory cytokines caused by infection directly affects bone *remodeling* which is important for bone elongation growth (Stephensen, 1999), and also inhibits *chondrogenesis* (Uauy, 2013). Proinflammatory cytokines such as interleukin (IL)-1β, IL-6 and *tumor necrosis factor-alpha* (TNF-α) cause bone damage, in addition to limiting nutrient intake by causing anorexia in children (Hossain et al., 2019).

CONCLUSION

Oral nutritional supplements (ONS) intervention effective in reducing stunted rates in children under five years old, especially in stunting children with infections, that is in line with the Indonesian Government commitment to reduce stunting.

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CONFLICT OF INTEREST

The author states that there is no conflict of interest against any party

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