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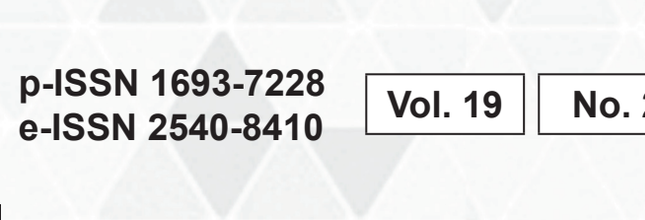

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Media Gizi Indonesia (MGI) that has been published since 2004 is a scientific journal that provides articles regarding the results of research and the development of nutrition including community nutrition, clinical nutrition, institutional nutrition, food service management, food technology, current issues on food and nutrition. This journal is published once every 4 months: January, May, and September.

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INTRODUCTION TO THE EDITOR

Media Gizi Indonesia (MGI) is a scientific journal published regularly every 4 months that provides articles regarding the research and the development of nutrition knowledge including community nutrition, clinical nutrition, institutional nutrition, food service management, food technology, and current issues on food and nutrition. Media Gizi Indonesia provides a variety of scientific articles in the scope of Nutrition and Health.

The recent volume consisted of original research in the field of nutrition throughout the lifecycle, which focuses on child nutrition and adolescent health. To date, child and adolescent nutrition has raised concerns since it manifests to a better quality of life during adulthood. The concern focused on the health impacts of preventable intergenerational nutrition issues in the earlier periods. For that, MGI presents relevant research related to anemia, children's growth, and dietary intervention to the selected population. Besides presenting studies related to child and adolescent nutrition, the current edition of MGI also shows research in food product development to provide better food products to alleviate nutritional problems. Furthermore, original research on food service management among athletes and nursing homes complements this volume.

We do hope MGI scientific journals can leverage the development of a writing culture and communicative scientific studies as well as attract readers and writers to participate in MGI for future issues. Media Gizi Indonesia will maintain its role in providing current, relevant, and topical issues in food and nutrition. Hopefully, the works displayed by MGI can provide benefits and enrich the readers' knowledge.

Editorial Team

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DETERMINANTS OF EXCLUSIVE BREASTFEEDING PRACTICES AMONG MOTHERS OF 6-24 MONTHS-OLD INFANTS IN PADANG CITY, INDONESIA

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ABSTRACT

The practice of exclusive breastfeeding (EBF) can reduce mortality and morbidity rates in children and supports optimal growth and development in children. The practice of EBF is influenced by various predisposing factors, supporting factors and reinforcing factors. This study aimed to evaluate the determinants of exclusive breastfeeding practices among mothers of infants aged 6-24-months in Padang. This case control study conducted at Padang with 200 mothers, consisting of 100 mothers of case groups and 100 mothers of control groups. Maternal and infant characteristics, family characteristics, predisposing factors, supporting factors and reinforcing factors, and exclusive breastfeeding were collected for this study. Chi-square and binary logistic regression were used to the data analysis. The determinants that most influence exclusive breastfeeding are mother's occupation, knowledge about exclusive breastfeeding and parents' support. Results showed that mother's occupation, exclusive breastfeeding knowledge and parents' support were the most influencing determinants for exclusive breastfeeding.

Keywords: *exclusive breastfeeding, knowledge, mothers' occupation, parents' support*

INTRODUCTION

The practice of Infant and Young Child Feeding (IYCF) has a role in managing nutritional problems in infants and toddlers (Raniati et al., 2023). One indicator of the IYCF practice is exclusive breastfeeding (EBF) for six months. The World Health Organization (WHO) and UNICEF suggest that breastfeeding should be started immediately after the child's birth and that exclusive breastfeeding should be continued throughout the child's first six months of life (WHO, 2021). Breastfeeding has a positive impact on children, as in reducing morbidity and mortality due to infections, reducing the risk of disease, regulating growth, development and metabolism, and increasing intelligence (Gartner et al., 2005; Goldman, 2012; Victora et al., 2016). Breastfeeding provides health, economic, and environmental benefits for children, women, and society. In order to safeguard, encourage, and support breastfeeding, financial and political assistance is required (Rollins et al., 2016a).

One of the primary causes of infant morbidity and mortality in developing countries is non-exclusive breastfeeding (NEBF) (Feleke et al., 2021). Infants who do not receive exclusive breast milk will experience malnutrition, which will affect growth or cause inappropriate height (de Onis & Branca, 2016; Fatima et al., 2020). There is a significant relationship between non-exclusive breastfeeding and stunting (Lestari et al., 2018). It is related to growth and development during infancy, in which case NEBF causes the child to be susceptible to greater risk of stunting. NEBF is associated with a higher incidence of infectious diseases, such as diarrhea in infants under six months who are fed foods other than breast milk (Damayanti et al., 2017). An infant's intestinal system, which is still in the process of maturation, is not suitable for food other than breast milk (Lestari et al., 2018). Non-exclusive breastfeeding can also increase the risk of infectious diseases, such as diarrhea and pneumonia in children under five (Karmany et al., 2020; Turin & Ochoa, 2014).

Globally, around 40% of infants are exclusively breastfed, which is expected to increase to 50% by 2025. Although rates of exclusive breastfeeding have grown over the past 20 years,

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there is still a long way to reach UNICEF's goal of 100% global coverage (Jama et al., 2020). As many as 72.04% of children in Indonesia received exclusive breast milk in 2022 (BPS, 2022). This coverage decreased by 0.46% year over year (BPS, 2021). Coverage of exclusive breastfeeding in Padang City in 2022 included 9,065 children (67.7%) (Dinkes Padang, 2022). This coverage was still lower than the national coverage.

Green (1980 cited in in Notoatmodjo , 2010) described two determinants of human behavior: behavioral and non-behavioral causes. Predisposing factors, enabling factors, and factors include support from friends, family, medical personnel, and others (Notoatmodjo, 2010; Oktalina et al., 2015; Purwanti et al., 2022).

The practice of EBF is influenced by various factors such as cultural, socioeconomic, and individual factors related to the baby and mother (Awoke & Mulatu, 2021; Mekebo et al., 2022; Rollins et al., 2016b; Tsegaw et al., 2021). Exclusive breastfeeding is influenced by several external variables, including a support from the government, healthcare professionals, and community; constant advertising of formula milk; sociocultural considerations; and a shortage of facilities for maternity and child health services (Novita et al., 2022). Exclusive breastfeeding can also be caused by nutritional status before and during pregnancy. Fat mobilization to produce breast milk in mothers with malnutrition is lower than in mothers with normal nutritional status. This will cause low breast milk production, which in turn can cause failure in EBF (Umami & Margawati, 2018).

The coverage of EBF in Padang City still needs to be improved. This research aims to evaluate the determinants of exclusive breastfeeding as a step to determine nutritional intervention and nutrition promotion strategies that will be used to increase coverage of exclusive breastfeeding.

METHODS

This case control study was conducted from August to September of 2023 in the working areas of five community health centers in Padang city (Public Health Center Andalas, Nanggalo, Kuranji, Belimbing, and Koto Panjang Ikur Koto). The subjects in this study were mothers who had infants aged 6 – 24 months. This study protocol was approved by the Ethics Committee of Faculty of Public Health, Universitas Andalas No. 46/ UN16.12/KEP-FKM/2023.

A written consent form was issued to mothers who met the inclusion criteria and only those who consented to participate in the study were interviewed. The exclusion criteria for the case group and control group were mothers with severely ill or stillborn babies, and mothers with twins. Mothers who refused to consent for interviews were also excluded from the study. The sample size was calculated using the Lemeshow formula, with a 95% confidence level, a 5% margin of error, and the observed parameter was assumed to be 0.252. After calculation, the minimum sample size for interview was approximately 95 for each group. A 5% attrition was anticipated. Subjects were selected by matching the residence of the case group.

Primary data were collected through interviews and a questionnaire survey. The data collected consisted of subject characteristics, history of exclusive breastfeeding, predisposing factors, enabling and reinforcing factors for exclusive breastfeeding, nutritional status of mother and child, and child's food intake. Maternal nutritional status was measured by measuring body weight and height (Yusni & Meutia, 2019). The mother's body weight was measured using a digital scale (GEA) with an accuracy of 0.1 kg and the mother's height was measured using a microtoise (GEA) with an accuracy of 0.1 cm. The child's weight was measured by subtracting the mother's weight without the child from the mother's weight when carrying the child. The child's body length was measured using a length board. Nutritional status measurements were carried out by trained nutritional enumerators. The nutritional status measurement tool was calibrated every day before data collection. All subjects signed a written agreement and provided informed consent.

The subjects fell in the 20–35 years age and <20 - >35 years category. In terms of nutritional status, the subjects were categorized as either malnourished (< 18.5 kg/m^2 and >25.0 kg/m^2) and normal (18-25 kg/m^2). In terms of parity, the subjects were categorized as either women who

had given birth more than twice and less than twice. In terms of education, the subjects were categorized as either low-educated (not in school, elementary school, junior high school) or high-educated (senior high school and university). In terms of occupation, the subjects were categorized as either working or not working. Monthly household income was categorized as either low or high, based on the subject's average income.

Predisposing factors consisted of knowledge, attitude and self-efficacy of EBF. Exclusive breastfeeding knowledge was categorized as either low or high, based on the subject's average. In terms of EBF attitude, the subjects were categorized as either high or low. The self-efficacy variable consists of mother's desire, mother's belief, and child's satisfaction. Mother's desire and belief were questions about whether there is a feeling of wanting the mother to provide EBF and whether the mother is confident to provide EBF to the child, while child satisfaction was the mother's opinion about the child's satisfaction after getting breast milk from the mother. These three things certainly affect the mother's self-efficacy in providing exclusive breastfeeding.

Enabling factors consisted of the availability of antenatal care (ANC) and EBF information. In terms of ANC, the subjects were categorized as either complete (10 T) and incomplete (< 10 T). Exclusive breastfeeding information was categorized as either ever or never.

Reinforcing factors consisted of husband's support and parents' support. Husband's support was categorized as either low or high, based on the subject's average score. In terms of parents' support, the subjects were categorized as either low or high.

Data were analyzed using the Statistical Program for Social Science (SPSS) version 26.0. The univariate analysis result of each variable is presented in one table as a proportion. Chi-square test was used to see the relationship between subject characteristics and factors that influenced exclusive breastfeeding. A 95% confidence level and a p-value<0.05 were used to assess statistical significance. Binary stepwise logistic regression analysis was used to analyze the determinant factors associated with EBF. Each covariate on the dependent variable where p-value < 0.25 was entered into the logistic regression model. In addition, maternal knowledge and attitude variables were also included in the logistic regression analysis based on theory.

RESULTS AND DISCUSSIONS

A total of 200 mothers were selected as respondents in this study and divided into two groups, EBF and NEBF. The characteristics of the mothers can be seen in Table 1. The maternal age was the age at the time of interview. Table 1 shows that most mothers in the case and control groups were of healthy reproductive age (20 – 35 years). The average maternal age was 30.8 ± 4.9 in the EBF group and 29.9 ± 4.5 in the NEBF group. The optimal productive age for healthy reproduction is between 20 and 35 years. The risk of pregnancy problems and poor pregnancy outcomes such as miscarriage, premature birth, LBW, and anemia will increase at under 20 and over 35 years of age (Rani Sukma et al., 2020). Pregnancy at non-reproductive age indirectly carries the risk of LBW because it is affected by the competition for nutritional requirements fulfilments between the adolescent, immature mother and the fetus and by the mother's physical and mental unpreparedness. Some diseases, including hypertension, diabetes mellitus, and anemia, are related with pregnancy in mothers over 35 and are frequent signs of unplanned or unwanted pregnancies (Widiyanto & Lismawati, 2019).

The mother's nutritional status can influence exclusive breastfeeding. As many as 56% of mothers in the EBF group and 53% in the NEBF group in this study had normal nutritional status. In the EBF group, 56% of mothers had normal nutritional status, 12% were underweight, and 32% were overweight. In the NEBF group, 53% of mothers had normal nutritional status, 9% were underweight, and 38% were overweight. Body Mass Index (BMI) reflects past nutritional status and represents sufficient energy reserves. The mother's fat reserves are used as an extra source of breast milk production (Shofiya et al., 2020).

Most mothers (62% in the EBF group and 72% in the NEBF group) had fewer than two children. Fikawati and Syafiq (2009) found that older mothers with higher parity appeared to

be more likely to practice EBF for six months. Mothers who give exclusive breast milk have better knowledge of exclusive breastfeeding than mothers who do not give exclusive breast milk (George et al., 2022). Psychosocially, women with higher parity may have positive or negative breastfeeding experiences from nursing their previous children, which may influence their self-efficacy to breastfeed their next child (Fikawati & Syafiq, 2009; Huang et al., 2019).

Mother's and father's education can be a factor in exclusive breastfeeding. Most mothers and fathers in both groups had a high level of education. Parental education is the primary factor of children's health and development (Sarkar et al., 2023). A higher level of education tends to provide more opportunities for mothers to provide EBF (Laksono et al., 2021). Father's education is related with EBF (*p*-value=0.050). A high level of father's education can optimize the father's role of a "breastfeeding father" because higher education can increase fathers' effectiveness in supporting EBF (Tresnaasih et al., 2021). Fathers will directly motivate mothers to continue breastfeeding exclusively, give praise, and provide good support to mothers (Mufdililah & Johan, 2019).

Table 1. Respondent Characteristics

Variables	EBF (n=100)		NEBF (n=100)		*p*-value
	n	%	n	%	
Age (years)					
At risk (< 20 - > 35)	15	15	14	14	0.841
Not at risk (20 – 35)	85	85	86	86	
Mean ± SD	30.8 ± 4.9		29.9 ± 4.5		
Nutritional status					
Malnourished	44	44	47	47	0,670
Normal	56	56	53	53	
Parity					
> 2	38	38	28	28	0.133
≤ 2	62	62	72	72	
Mother's education					
Low	13	13	11	11	0.663
High	87	87	89	89	
Husband's education					
Low	25	25	14	14	0.050*
High	75	75	86	86	
Mother's occupation					
No Work	86	86	66	66	0.001*
Work	14	14	34	34	
Husband's occupation					
No Work	0	0	0	0	-
Work	100	100	100	100	
Monthly household income					
Low (< Rp 2.500.000)	36	36	31	31	0.454
High (> Rp 2.500.000)	64	64	69	69	
Distance to health services					
> 3 km	20	20	15	15	0.352
< 3 km	80	80	85	85	
How to get to health services					
Walk	10	10	0	0	0.001*
Using a vehicle	90	90	100	100	
Attending Maternity Classes					
Ever	33	33	23	23	0.115
Never	67	67	77	77	

Variables	EBF (n=100)		NEBF (n=100)		*p*-value
	n	%	n	%	
Complementary feeding information					
Ever	86	86	92	92	0.175
Never	14	14	8	8	
Child's Age (months)					
0 – 6 months	15	15	25	25	
6 – 9 months	25	25	29	29	0.143
9 – 12 months	16	16	16	16	
12 – 24 months	44	44	30	30	
Child's Sex					
Male	54	54	51	51	0.671
Female	46	46	49	49	

Notes: Bivariate Chi-Square Test *significant *p*-value <0·05

Parental occupation can affect attitudes and behaviors in relation to exclusive breastfeeding. Most of the mothers in both groups did not work or played the role as housewives, while all fathers in this study were working. Maternal employment is related with exclusive breastfeeding (p-value=0.001). This result is aligned with the study result of Liu et al. (2013), who found a relationship between maternal employment and exclusive breastfeeding. Parents with higher education levels are less likely to provide EBF than those with lower education (Liu et al., 2013). This may be due to professional preoccupation and higher income that allows for a higher ability to afford complementary foods. However, these study result are still inconsistent.

Most respondents in both groups had a high income (> IDR 2,500,000). The analysis of this study found that household income was not related to EBF practice. This study was not in line with Tewabe et al. (2016), where income was significantly associated with EBF practice. This may be because mothers are psychologically and economically aware of exclusively breastfeeding their infants (Tewabe et al., 2016). In addition, in families with low income, the mother usually contributes to the family income by working, so that the attention to exclusive breastfeeding is reduced (Hartina et al., 2017).

Breastfeeding exclusively is encouraged and supported with easy access to a health facility. Ease of access to health services means that mothers have easy access to healthcare. Health workers who examine mothers during childbirth will have a positive effect on exclusive breastfeeding by mothers to their babies (Fauziah, 2023). Most mothers in this study had easy access to services in terms of distance and means to access health services (Table 2). As many as 52.5% of mothers chose the nearest Community Health Center (Puskesmas) as their preferred health services facility. The World Alliance for Nursing Action suggests that the government and healthcare professionals, among others, must assist nursing mothers to achieve breastfeeding success. Access to health services and support from health workers can affect the success of exclusive breastfeeding. Health resource support from health services that the mother receives influences her decision to breastfeed or not breastfeed her baby (Wibowo, 2016).

Most mothers in both groups received incomplete antenatal care (ANC) services and still many mothers had never attended maternity class. ANC is a preventive obstetric program to prepare mothers and optimize pregnancy outcomes through routine monitoring activities during pregnancy. ANC should be carried out at least six times during pregnancy (Kemenkes RI, 2020). Maternity classes provide pregnant women with a means of learning about health, each attended by a maximum of 10 people face-to-face and guided by health workers, with the aim of increasing knowledge and skills (Novitasari et al., 2020).

Most of the children in both groups were 12 – 24 months old, and the average age was 11.6 months. In the EBF group, 54% children were boys, while in the EBF group 51% were.

Predisposing factors, enabling factors, and reinforcing factors determine a mother's success in breastfeeding. The analysis found that maternal belief (p-value =0.001), child satisfaction (p-value=0.000), and parents' support (p-value=0.001) were associated with exclusive breastfeeding (Table 2). Mothers should feel quite confident in themselves. Seeing other mothers successfully breastfeed gave them the confidence to succeed (Thomas et al., 2015). Furthermore, mothers will be confident to provide EBF if their husbands and parent are motivating and supporting them during the lactation period and they have social support, such as obtaining knowledge and information (Fauziah et al., 2015).

Breastfeeding women with strong self-efficacy outlast those with low self-efficacy after giving birth. First-time mothers are frequently receptive to everything about their babies' health, making them easily provoked by unfavorable presumptions. For example, they may believe that babies will not be sufficiently satisfied if they only receive breast milk or that, at the start of the postpartum period, the mother may only produce little colostrum or may not have released any breast milk (Wulandari, 2020).

Most mothers in this study had received information about exclusive breastfeeding. Of all mothers in this study, 87% received information about EBF from health workers. This indicates that health professionals had an essential part in promoting EBF, including in educating pregnant women (Idris et al., 2020).

The results of the analysis in this study are in line with those of Rosita (2016), who found that there was a relationship between parental support

Table 2. Determinants of Exclusive breastfeeding

Variables	EBF (n=100)		NEBF (n=100)		*p*-value
	n	%	N	%	
Predisposing					
Exclusive breastfeeding knowledge					
Low	30	30	32	32	0.760
High	70	70	68	68	
Exclusive breastfeeding attitude					
Negative	30	30	35	35	0.450
Positive	70	70	65	65	
Self-Efficacy					
Desire					
Yes	100	100	97	97	0.081
No	0	0	3	3	
Belief					
Certain	100	100	89	89	0.001*
Not certain	0	0	11	11	
Infants satisfaction					
Satisfied	100	100	82	82	0.000*
Not satisfied	0	0	18	18	
Enabling					
Antenatal Care (ANC)					
Incomplete	61	61	54	54	0.317
Complete	39	39	46	46	
Exclusive breastfeeding information					
Ever	94	94	95	95	0.756
Never	6	6	5	5	
Reinforcing					
Husband's Support					
Low	53	53	45	45	0.258
High	47	47	55	55	

Variables	EBF (n=100)		NEBF (n=100)		*p*-value
	n	%	N	%	
Parents' support					
Low	60	60	37	37	0.001*
High	40	40	63	63	

Notes: Bivariate Chi-Square Test *significant *p*-value <0.05

and breastfeeding behaviour with p-value =0.001. Mothers who receive support from parents have a higher opportunity to breastfeed exclusively than those who do not receive support from parents (Rosita, 2016).

Table 3 shows that husband's education, mother's occupation, access to health services, mother's belief, infant's satisfaction, knowledge about EBF, and parents' support collectively had an effect of 35% on EBF with Nagelkerke value 0.350; there are still other variables (65%) outside of this study that can be determinants of EBF.

Mothers with high knowledge about exclusive breastfeeding have a higher chance (OR = 2.402) of practicing EBF than mothers with low knowledge. Mothers with higher knowledge are more likely to be better in practice than mothers with low knowledge about exclusive breastfeeding (Mogre et al., 2016). Other studies have also found the same results regarding the relationship between knowledge about EBF and exclusive breastfeeding (Mogre et al., 2016; Sultana et al., 2022).

The result of this study also showed that working mothers (OR=0.383) still had the opportunity to practice EBF. It was found in this study that these mothers worked 7 – 8 hours on average daily. Maternal employment is related with the practice of EBF (Chekol et al., 2017; Tadesse et al., 2019). However, most working mothers in this study (70.8%) did not exclusively breastfeed babies. This might be because working mothers did not have sufficient time to breastfeed their infants during working hours compared to non-working mothers. Non-working mothers usually

Table 3. Determinants of exclusive breastfeeding in 6-24 month old infants

Variables	Adjusted OR	95% CI	p-value
Husband's education			
Low	Reference	0.201 – 1.121	0.089
High	0.474		
Mother's occupation			
No Work	Reference	0.174 – 0.847	0.018*
Work	0.383		
How to get to health services			
Walk	Reference	-	0.999
Using a vehicle	0.000		
Belief			
Not Sure	Reference	-	0.998
Sure	0.000		
Infants satisfaction			
Not satisfied	Reference	-	0.998
Satisfied	0.000		
Exclusive breastfeeding knowledge			
Low	Reference	1.138 – 5.070	0.021*
High	2.402		
Parents' support			
Low	Reference	0.235 – 0.931	0.031*
High	0.468		

Notes: Logistic Regression Test; OR (95% CI) odds ratio (95% confidence interval); *significant p-value <0.05

have flexible working hours compared to working mothers, which might contribute to the relatively higher adherence to EBF practices of non-working mothers than that of working mothers (Zewdie et al., 2022a). Workplace factors may also be equally important in a mother's decision to breastfeed her infant exclusively. Key factors are inadequate duration of maternity leave and lack of maternity policies and facilities that support breastfeeding in the workplace (Abekah-Nkrumah et al., 2020; Zewdie et al., 2022b). Adequate support should be provided to working mothers, including adequate policies and facilities to improve EBF practice (Zewdie et al., 2022b).

The results of this study also showed that if mothers received support from their parents (OR=0.468), they had the opportunity to practice EBF. The social and emotional support from family, including parents, regarding exclusive breastfeeding practice for breastfeeding mothers is important to note. Parents are among the ones closest to the mother that can influence a mother's actions. Lack of informational, instrumental, emotional, and appraisal social support from the family will inhibit EBF behavior (Fadjriah et al., 2021). This study found that parental support played a role in exclusive breastfeeding. Parental support can increase the duration of breastfeeding and play an essential role in providing breast milk. (Aprilia Ningsih et al., 2020). In addition, breastfeeding mothers usually need help and assistance when starting and continuing breastfeeding for up to two years. Parents provide this assistance and help (Mamangkey et al., 2018).

CONCLUSION

The factors that most influence exclusive breastfeeding are the mother's occupation, exclusive breastfeeding knowledge and parents' support. Researchers recommend that the target of the intervention is focused on husbands and parents of breastfeeding mothers. Universities can also have a role in community service to promote EBF to the community. In addition, the government needs to focus more on promoting exclusive breastfeeding as a practice.

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ASSOCIATION BETWEEN PICKY EATER BEHAVIOR WITH STUNTING AMONG PRESCHOOL CHILDREN IN SURABAYA

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ABSTRACT

Stunting is one of the main nutritional problems in Indonesia. Stunting in children can be caused by various things. One of the problems is picky eater behavior, which often appears at preschool age. The purpose of this study was to analyze the relationship between picky eater behavior and stunting in preschool children. The study used case control design, and for the sample selection used simple random sampling technique. The population of this study was all students in PG-TK Al Irsyad Surabaya and the sample for each case and control group was 15 respondents. Nutritional status was measured using the parameters of height for age (H/A) and picky eater behavior using the Children's Eating Behavior Questionnaire (CEBQ). Data were analyzed using chi-square test. Most respondents have picky eater behavior and stunting (93.3%), followed by children with picky eater behavior and not stunting (53.3%). The results of statistical tests show that there is a relationship between stunting and picky eater behavior (p-value = 0.035). Additionally, children with picky eater behavior also have a bigger risk of stunting than children who do not (OR 12.250). So it could be concluded that stunting can be caused by various factors, one of which is picky eater behavior. The recommendation for parents to prevent picky eater behavior and stunting is they can try to use responsive feeding technique, so that children can develop good eating habits, and introduce a variety of foods since childhood.

Keywords*: nutritional status, picky eater, preschool children, stunting*

INTRODUCTION

Age 0 – 5 years is the Golden Age Period in growth (Asthiningsih & Muflihatin, 2018; Toghyani et al., 2015). Children's nutritional status is one of the most important things to pay attention to because it is an indicator for maintaining growth. According to the Global Nutrition Report, the prevalence of toddlers experiencing malnutrition globally was 22.2% with stunting nutritional status and 7.5% with malnutrition (Development Initiatives, 2018). Meanwhile, based on Ministry of Health of Indonesia in 2022 and Surabaya Health profile in 2019, the prevalence of stunting or short nutritional status according to Height for Age Z-score (HAZ) was 21,6% and 8.54%, respectively.

Stunting is a nutritional problem caused by various factors and lasts for a long period of time, so that children do not grow up optimally and are characterized by shorter heights than other children of their age (World Health Organization, 2018). Children's nutritional status, including stunting, is influenced by several factors such as maternal nutritional intake since pregnancy, infection disease history, nutritional intake of the children themselves, hygiene and environmental sanitation, parenting patterns, socioeconomic conditions, and food security level (Beal et al., 2018; Septikasari, 2018. One of the frequent eating disorders in preschoolers that may increase the risk of nutritional problems is picky eater behavior. Children with picky eater behavior that has lasted for a long time tend to have a smaller weight and height than children their age (Taylor et al., 2019). Shettiwar and Wade (2019) stated that there was a meaningful correlation between picky eater behavior and children's height growth according to age, with p-value = 0.000.

Picky eater is a term that indicates a child's behavior that tends to be selective in choosing the food to consume, eating less, and not trying a new type of food (Lam, 2015; Taylor et al., 2015). Picky eaters are a set of children who have a selective attitude or avoidance of certain foods,

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can consume food if treated by a particular serving depending on their sensory properties, and have low interest in food. In certain cases, children may experience neophobia or fear of trying new types of food that they have never tried before (Samuel et al., 2018). Children's eating habits are formed by various factors, such as family environment, influences from parents' diet, food provided at home, feeding practices, and media influences (Scaglioni et al., 2018).

Based on Surabaya Health profile in 2019, the prevalence of stunting in the Pegirian Public Health Center Surabaya's work area was one of the highest in Surabaya, which is 17.96%. The effects of stunting in children are such as disruption of brain development, decreased cognitive ability, decreased immunity, decreased productivity, increased risk of non-communicable diseases, like diabetes, obesity, heart disease, and so on (Saadah, 2020). Preliminary studies conducted at PG-TK Al Irsyad Surabaya in 2021, showed 63.8% or quite high prevalence of preschool-aged children having picky eater behavior. This study aims to analyze the relationship of picky eater behavior with stunting at PG-TK Al Irsyad Surabaya, which is still under the working area of the Pegirian Public Health Center.

METHODS

This study used a case-control study design with a sample population of all students, PG-TK Al Irsyad, aged 24 – 59 months. The variables in this study were picky eater behavior, measured with Children's Eating Behavior Questionnaire (CEBQ), and Height for Age Z-score (HAZ) for identified stunting, measured with microtoise. The entire population then went through screening to be categorized into case groups and controls according to HAZ measurements, and obtained the total respondents for each group, which are 52 for controls and 16 for cases. The calculation for minimum sample used Lemeshow's formula (1997) and obtained 15 samples for each category or 30 in total. The sample selection for the case group and control used a simple random sampling method, which are all of the respondents for each groups given a number and then drawn as many samples as needed.

The inclusion criteria for the case group in this study were 24 to 59 month old children with short or very short nutritional status according to HAZ, and for the control group are 24 to 59 month old children who have normal nutritional status according to HAZ. Meanwhile, the exclusions for both the case and control groups are the children who are 60 months old or older

The measurement of nutritional status was done by measuring the height and weight of a child using microtoise and digital scales. Then the child's height and weight data were inputted into WHO Antro applications to be classified according to their nutritional status category. The category used for stunting or HAZ measurements is very short (severely stunted) <-3SD, short (stunting) -3SDs/d <-2SD, normal -2SDs/d +3SD, and high: >+3SD (Kemenkes, 2020).

After the required number of samples were obtained, the study was continued with the scoring of picky eater behavior in 24 to 59-month-old preschool children, using the CEBQ of 35 statements (Njardvik et al., 2018; Wardle et al., 2001). The questionnaire is divided into two categories: 16 food acceptance statements and 19 food avoidance statements The questionnaire was filled out using a Likert scale ranging from 1 (never) to 5 (always). Samples are categorized as picky eaters if food avoidance scores > food acceptance (Tharner et al., 2014).

The data from all collected samples were then processed using SPSS. Data are presented in the form of frequency tables as well as cross-tabulation to analyze the relationship between the picky eater and stunting using the chi-square test. This research has been approved by the Research Ethics Commission of the Faculty of Public Health, Airlangga University, with No. 124/EA/KEPK/2022.

RESULTS AND DISCUSSIONS

Respondents Characteristics

According to Table 1, respondents in this study were mothers of the subjects or toddlers. As much as 70% of respondents' household income is equal to or greater than the Surabaya City Minimum Wage (RMW) in 2023, or as much as Rp. 4,525,479 (Decision of Governor of East

Java Number 188/889/KPTS/013/2022). Then, 19 people or the majority of respondents had higher education (63.3%) and most of the respondents or 10 people (33.3%) were self-employed.

The subjects were preschool-aged children, with a majority aged between 49–59 months (53.3%). Most of the subjects also had picky eater behavior (73.3%) based on the results of the questionnaire scoring that the mother's toddler had completed. Then, nutritional status with height parameters by age or HAZ, was used as the determining category of subjects included in the case or control.

Table 1. Distribution of Characteristics of Research Subjects and Respondents

Characteristics	Nutritional Status			
	Stunting		Normal	
	n	%	n	%
Household Income				
< RMW	5	33.3	4	26.7
≥ RMW	10	66.7	11	73.3
Mother's Last Education				
No Education	0	0	0	0
Elementary School	2	13.3	0	0
Middle High School	0	0	0	0
High School	3	20	6	40
Colleges / Universities	10	66.7	9	60
Mother's Work				
Unemployed	1	6.7	3	20
Self-employed	5	33.3	5	33.3
Employee / Worker	4	26.7	4	26.7
Civil Servants	2	13.3	1	6.7
Police / Military	0	0	0	0
Trader / Merchant	1	6.7	2	13.3
Driver	0	0	0	0
Others	2	13.3	0	0
Children's Age (month)				
24-36	0	0	0	0
37-48	7	46.7	7	46.7
49-59	8	53.3	8	53.3
Picky Eater				
Yes	14	93.3	8	53.3
No	1	6.7	7	46.7

Picky Eater Behavior

The measurement of picky eater behavior was performed using the CEBQ questionnaire. Children are declared to have picky eater behavior if the food avoidance score is greater than food acceptance. Food acceptance has sub-categories, namely enjoyment of food, emotional overeating, desire to drink, and food responsiveness. Meanwhile, the sub-categories of food avoidance are emotional undereating, food fussiness, satiety responsiveness, and slowness in eating (Domoff et al., 2015).

The sub-categories enjoyment of food and food responsiveness are described as the response to the food environment that is formed, usually seen in the nutritional status of children (Jalkanen et al., 2017). The desire to drink describes the desire to consume drinks. The satiety responsiveness describes the response to food satisfaction or the ability to control fullness and hunger (Ayine et al., 2021; Dalton et al., 2015). Slowness in eating can represent the child's interest in eating food, as seen in the duration and speed of eating (Dubois et al., 2022). Food fussiness can be used to view child responses to newly introduced foods (Dubois et al., 2022). Lastly, emotional overeating and emotional undereating sub-categories are used to view children's eating habits as a response to emotional changes experienced (Powell et al., 2017).

Table 2. Distribution of CEBQ Results

Characteristics	Nutritional Status							
	Stunting				Normal			
	Min	Max	Mean	SD	Min	Max	Mean	SD
Food Acceptance								
Enjoyment of Food (4)	9	20	13.60	2.995	8	20	13.93	4.131
Emotional Overeating (4)	4	13	6.53	2.386	4	13	7.73	3.081
Desire to Drink (3)	6	15	9.27	2.685	6	14	9.67	2.610
Food Responsiveness (5)	7	18	11.93	3.390	9	24	14.93	4.234
Food Avoidance								
Emotional Undereating (4)	4	17	11.60	3.869	4	14	10.80	2.908
Food Fussiness (6)	7	27	17.47	5.041	7	28	18.47	6.266
Satiety Responsiveness (5)	10	21	14.27	3.369	7	19	13.40	3.542
Slowness in Eating (4)	4	16	10.33	4.012	6	15	10.80	2.833

Based on Table 2, the average for food acceptance category in the control group or nutritional status normal is higher than the case group, whereas in the food avoidance category, the average group of cases in the emotional undereating and satiety responsiveness sub-categories was higher than the control group. It can be interpreted that, in the case group, children more often have a low appetite or often go down due to emotional conditions. This can also be because stunted children have a risk of developing infectious diseases so their appetite can be disrupted (Sari & Agustin, 2023).

The Relationship between Picky Eater Behavior and Stunting

According to Table 3, the total number of children with picky eater behavior is 22 people, with 14 children with stunting nutritional status (93.3%) and eight normal children (53.3%). Meanwhile, eight children do not have picky eater behavior, seven children have normal nutritional status and one child is stunting.

The results of the chi-square test between variables indicate a significant relationship between the picky eater and stunting (p-value = 0.035). Furthermore, the results showed that the risk of stunting events was greater in children with picky eater behavior than those without, indicated by OR = 12. 250.

Table 3. Association between Picky Eater Behavior with Stunting

Variables	Nutritional Status				*p value*	*OR*
	Stunting		Normal			
	n	(%)	n	(%)		
Picky eater						
Yes	14	93.3	8	53.3	0.035	12.250
No	1	6.7	7	46.7		

The results of this study are in line with Nurmalasari et al.'s (2020) research, which also stated that there is a significant relationship between picky eater behavior and stunting in 2–5 year olds in Central Lampung, with a p value = 0.000. Similarly to the study of Shettiwar and Wade (2019), there is a positive correlation between the behavior of picky eaters and the high growth of children by age, with a p value = 0.000.

This result is not in agreement with a study by Nugroho (2020) that found no significant relationship between stunting and picky eater behavior, as shown by a value = 0.741. Other studies conducted by Thi Bach Yen et al. (2019) found that picky eater behavior has no relation to stunting (value >0.05), but there is a significant relationship with wasting and underweight (value <0.001).

The cause of stunting consists of various factors such as low birth weight, recurrent and persistent infectious diseases, poor diet, long-term

intake of nutritional substances, and household poverty (WHO, 2018). Stunting can occur from the first 1000 days of life or start in the womb until the age of 2 and will continue, especially if a child's nutritional intake continues to be unfulfilled (WHO, 2018). At the age of more than 2 years, stunting children still have the possibility of catching up on growth. However, it is not uncommon for this to fail because the need for nutritional substances is obstructed by unfulfilling food, recurrent infectious disease, economic factors and so on (Scheffler et al., 2021). Therefore, the handling of stunting in the first 1000 days is prioritized, and contributions are needed from various sectors.

Parents' education, especially mothers, is one of the things that are also important to note. According to the research by Utami et al. (2019), parent education, including mother and head of family, both have influence in stunting. This is because the higher the education obtained by both parents, the easier it will be to process and implement the information gained about nutrition and health. Economic factors are also contributing to stunting and malnutrition in children (Septikasari, 2018). This is because families with low economic status have limitations on accessing more complete and diverse sources of nutritional intake (WHO, 2018).

Children's eating habits can be established by their parents' practice of feeding, including pressure, type, amount, and time of eating (Ali & Ahmed, 2022). According to Fernandez et al. *2020), picky eater behavior often occurs in preschoolers and lasts until school age. The picky eater behavior is often considered natural in children because the increasing age of this habit will decrease (Taylor & Emmett, 2019). Selective child's behavior in choosing food if it lasts for a long period of time can result in certain nutritional intakes being inadequate and may cause new nutritional problems.

Children with picky eater behavior that has lasted for a long period of time tend to have less weight and height than children of their age (Taylor et al., 2019). Some nutritional intake in picky eaters also tends to be lower than that of non-picky eaters due to the lack of diversity of food consumed daily. Macronutrients, such as energy, carbohydrates, protein, fat, and also dietary fiber in picky eater children are often found to remain satisfied but lower than those of non-picky eater children (Taylor et al., 2016; Xue et al., 2015).

In Table 2, it was found that most subjects had the highest average enjoyment of food and food fussiness. According to the results of a study conducted by Ferreira et al. (2023), food fussiness is related to the level of consumption of vegetables and fruits, as well as processed fish products. Children tend to enjoy eating energy-intensive sweet and savory foods more, but the content of other nutrients is low (Chao, 2018). Similar to the results of this study, children who behave like picky eaters tend to consume high-calorie snacks and rarely consume vegetables and fruits. Mothers also give milk more often, both formula and UHT, as a solution if children are having trouble eating.

One way to form good children's eating habits is to apply proper feeding practices. Children's eating habits can be established by their parents' practice of feeding, including pressure, type, amount, and time of eating (Ali & Ahmed, 2022; Finnane et al., 2017). Responsive feeding practices are a way of feeding children by applying disciplined and regular routines, such as getting used to eating at the same time every day, eating different foods, eating where they should, and sitting quietly without interruption from gadgets or other toys (Mallan & Miller, 2019).

Responsive feeding can also train children to respond to signals of fullness and hunger, improving their self-feeding ability and getting a good diet. Responsive feeding principles include encouraging children to eat patiently and without coercion, feeding in an appropriate and safe environment, responding to food rejection, teaching children to self-feed slowly, and feeding time being the right time to learn and love between mother and child (Hardianti et al., 2018; Pallewaththa et al., 2021). According to research conducted by Cerdasari et al. (2017) and Hardianti et al. (2018) , applying feeding patterns with responsive feeding techniques can reduce or prevent picky eater behavior in children.

However, there are still remaining controversies about the relationship between picky eater behavior and stunting. Some researchers have different arguments about this topic. This

is because of the different results they obtained about behavior in picky eaters and what they consumed. There are also biases from other factors of stunting, such as mother's diet intake since pregnancy, history of breastfeeding, dietary pattern of children, etc. This study has limitations because it was only conducted on small samples and only in one region.

CONCLUSION

Results in this study show a significant relationship between picky eater behavior in children and stunting or nutritional status according to TB/U <-2SD. Additionally, the results also show that children with picky eater behavior have a greater risk of stunting than non-picky eater children.

Parents and caregivers can create an ideal eating environment, such as using a responsive feeding technique, so that children can imitate and develop good eating habits. Introducing a variety of foods is also important since childhood, it is also necessary to make an interesting serving style of meal so that children are interested in consuming them and increasing their appetite.

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THE RELATIONSHIP BETWEEN BREAKFAST HABITS AND NUTRITIONAL STATUS WITH LEARNING ACHIEVEMENT IN STRADA NAWAR BEKASI JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT

Learning achievement is a form of evaluation based on the results obtained in the process of gaining knowledge. Learning achievement can be influenced by various factors, both environmental and health factors, such as breakfast habits and nutritional status. The aim of this research was to analyze the relationship between breakfast habits and nutritional status with learning achievement in junior high school students. This study was an analytical observational research using a cross-sectional study design. The research was conducted at Strada Nawar Bekasi Junior High School from September to December 2022 with the sample being students from grades VII and VIII. The sample was chosen randomly using proportionate random sampling with a total of 81 students based on inclusion and exclusion criteria. The data collected include height and weight through anthropometric measurements, interviews on breakfast habits using the SQ-FFQ form, and student report cards for the last semester. The data obtained were then tested with SPSS software using chi-square test analysis. The results showed that there were students with good breakfast habits (77.8%), overnutritional status (40.8%), and good learning achievement (48.1%). From this research, it was found that there was a relationship between breakfast habits (p-value = 0.041) and there was no relationship between nutritional status (p-value = 0.190) with learning achievement. It was concluded that good breakfast habits are directly proportional to the student's learning achievement and there is no relationship between nutritional status and student's learning achievement.

Keywords*: breakfast habits, learning achievement, nutritional status, teenagers*

INTRODUCTION

The adolescent phase is one of the stages in the human growth and development cycle as well as a transition phase from child life to adult life, one which is marked by biological and psychological growth and development. Teenagers are the nation's greatest asset and are the hope in achieving the nation's ideals. Teenagers are part of the wheel of the nation's destiny and are considered agents of change so that teenagers are expected to be able to have good performance or achievements and be able to face existing challenges, both now and in the future. Therefore, education is really needed because it is an important key in improving the quality of the nation in the future.

In recent changes to curriculum policy, there has been a focus on promoting children's well-being. However, a common belief in discussions about promoting children's well-being is that it conflicts with or is seen as less important than their academic achievement (Clarke, 2020). Academic abilities during education can be seen from student learning achievements, which can also be a standard for children's success at school. This proves that the development of quality human resources in schools requires development support from health factors, namely nutrition. Nutrition is a factor that can determine the level of health and balance between physical and mental development. Therefore, food and nutrition are essential requirements for humans. Nutrition is crucial for maintaining good health and overall well-being, and is a key aspect of healthcare. The nutritional status of individuals can impact their health outcomes (Kesari & Noel, 2023).

Nutrition has an influence on brain development and behavior, ability to work and productivity, as well as the body's immunity to infectious diseases.

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Usually, someone with good nutritional status tends to tead them to carry out a higher level of activity so that it can support learning achievement. Learning achievement has a close relationship with the level of intelligence, and physical activity is related to overall body health. Physical activity, intelligence and academic achievement are being studied from a multidisciplinary perspective (Gil-Espinosa et al., 2020).

Nutrient intake that is not in accordance with the body's needs will cause health problems, both overnutrition and undernutrition. Insufficient nutritional intake during adolescence can affect students' activities at school, such as getting tired easily, appearing weak, disrupted growth, malnutrition in adulthood, and decreasing achievement at school (Hakim et al., 2014). Malnutrition in children will see them experience changes in metabolism which have an impact on cognitive abilities and brain abilities. Research conducted by Sari (2019) in one of the junior high schools in Padang City stated that the better the students' nutritional status, the better the students' learning achievements. In adulthood, the hippocampus is one of the areas of the brain that experiences a high level of neurogenesis, or the formation of new neurons. This process plays a role in regulating both emotional and cognitive functions in the hippocampus. However, this process can be influenced by various factors, both internal (intrinsic) and external (extrinsic), including nutrition (Melgar-Locatelli, 2023).

Based on data contained in Riskesdas (2018), the prevalence of adolescents in Indonesia who are thin and very thin in the age range 13-15 years is 8,7%, while the prevalence of adolescents in Indonesia with overweight and obese nutritional status in the age range 13-15 years is 16,0%. In West Java Province, the prevalence of adolescents in the 13-15 year age range who have very thin nutritional status is 1,75%, underweight is 6,13%, overweight of 11,96%, and obesity of 4,89%. Furthermore, the prevalence of adolescents in Bekasi City in the age range of 13-15 years who have a very thin nutritional status is 1,56%, thin is 10,12%,overweight by 19,55%, and obesity by 5,73%.

Daily eating behavior can influence a child's nutritional status, including breakfast behavior. Teenagers need breakfast before going to school in order to meet their nutritional needs and as an energy reserve so they can carry out their activities well and concentrate on studying. Breakfast contains carbohydrates that are ready to be used to increase blood glucose. After eating dinner, the body enters a fasting state for 10-12 hours with blood glucose reserves sufficient to be used for activities for two to three hours in the morning, so students need breakfast to provide energy so they don't feel lethargic or weak (Rizkyta & Mulyati, 2014). If blood glucose levels are normal, students will concentrate well, as evidenced by their achievement in learning. However, if the glucose level is not normal, the student's concentration will decrease so that the student can experience fatigue and drowsiness. This can result in not achieving good learning achievement (Hanif, 2016).

Based on data from the 2015 Global School Health Survey in the Indonesian Ministry of Health article (2018), the results showed that the prevalence of teenagers who did not eat breakfast was 62,2% (Hafiza et al., 2020). Many adolescents in developing countries skip breakfast. Breakfast consumption positively affects children and adolescents' academic performance and behaviors, particularly in mathematics and arithmetic (Indriasari et al., 2021). A study among high-school girls in Surabaya observed 58.0% breakfast skippers (Irdiani & Nindya, 2017), and in Makassar it was 41.2% (Amrin, 2014). A 2016 study in Makassar reported that 37.0% of high-school students did not have a daily breakfast (Thasim, 2016). In Indonesia, the reason why many children are accustomed to not having breakfast before going to school is the lack of food availability, the food does not look attractive, the types of food provided are less varied, and time constraints because they have to leave early (Irdiani & Nindya, 2017).

Strada Nawar Junior High School is one of the schools located in a densely populated location in Bekasi City, West Java Province. The road to school is very busy in the morning, causing traffic jams along the road. With the school starting time at 06.55 am, students are required to leave even earlier in order to arrive at school on time and thus avoid traffic jams by skipping breakfast. A preliminary study conducted by researchers on 25

students from Strada Nawar Junior High School revealed that nine students skipped breakfast due to a lack of appetite or time constraints. Among these nine individuals, three students achieved enough learning achievements, four students good learning achievements, and two students very good in their learning achievements. Additionally, data indicated that four students with good learning achievements included one student with poor nutritional status, one with good nutrition, and two classified as obese. Furthermore, 14 students exhibited good learning achievements, comprising seven students with good nutrition, four students classified as obese, one child with undernutrition, and two students with overnutrition. Another seven students demonstrated very good learning achievements, with two classified as good nutrition, three as overnutrition, and two as undernutrition. Based on this background, researchers are interested in finding out the relationship between breakfast habits and nutritional status with the learning achievement of Strada Nawar Bekasi Junior High School students.

METHODS

This research was an analytical observational research that refers to a cross-sectional design with a sample size of 81 junior high school students obtained through proportional random sampling based on the Lemeshow (1997) formula for cross-sectional research design. This research was conducted at Strada Nawar Bekasi Junior High School from September to December 2022. The subjects of this research consisted of students in grades 7 and 8 and were selected using inclusion and exclusion criteria. Inclusion criteria were being healthy, not dieting or fasting, and willing to be a research subject. Meanwhile, the exclusion criterion was students who were not present when the research was conducted.

The independent variables in this study were the breakfast habits and nutritional status of Strada Nawar Bekasi Junior High School students, while learning achievement was the dependent variable. The data collection instruments used in this research include a general personal data questionnaire, form, a semi-quantitative food frequency questionnaire (SQ-FFQ), breakfast habits form, and microtoise as well as digital scales for anthropometric measurements. The results of anthropometric measurements were used to assess students' nutritional status based on body mass index (BMI) by measuring height and weight, which were then recalculated using Z-score. Data related to student learning achievement at Strada Nawar Bekasi Junior High School were collected by recording the average grades obtained from all subjects on student report cards during the last semester of the 2022/2023 academic year.

The collected data were analyzed through SPSS software version 26, employing bivariate analysis, specifically the chi-square test. This analysis aims to evaluate the correlation between breakfast habits and academic performance, as well as the correlation between nutritional status (BMI for Age) and academic achievement. The significance of the relationship between variables was determined when the p-value was < 0,05. This research has been granted permission by the Ethics Commission of the Faculty of Dentistry, Airlangga University with a certificate ethical clearance number 530/HRECC. FODM/VIII/2022.

RESULTS AND DISCUSSIONS

Sample Characteristics Based on Child Characteristics

The sample characteristics observed included gender, age, class and nutritional status. Based on the data collected, the gender frequency is 59.3% male and 40.7% female with the majority aged 13 years (44.4%) as explained in Table 1.

Table 1. Sample Distribution According to Gender, Age, and Class of Strada Nawar Bekasi Junior High School Students

Characteristics	n	(%)
Gender		
Male	48	59.3
Female	33	40.7
Age		
11 years old	11	13.6
12 years old	26	32.1
13 years old	36	44.4
14 years old	7	8.6
16 years old	1	1.2
Class		
VII	41	50.6
VIII	40	49.4

Physiologically, men have a larger brain size than women. In addition, in general, men have better spatial abilities than women and are more active so that men achieve better in areas related to physical strength and agility such as sports or outdoor activities, while women have better verbal abilities than men so that women achieve better in academic matters (Herdiansyah, 2016; Suendang, 2017). In this study, most of the respondents (50.6%) were class VII students. If the class level is higher, respondents will have broader knowledge and understanding (Damara & Muniroh, 2021).

Sample Characteristics Based on Family Characteristics

The family characteristics observed include education level, employment and parental income. The distribution of parents' education and employment levels can be seen in Table 2 which is then reclassified based on father and mother groups.

Table 2. Sample Frequency Distribution Based on Education and Occupation of Parents of Strada Nawar Bekasi Junior High School Students

Characteristics	Father		Mother	
	n	(%)	n	(%)
Education				
Not completed in primary school	0	0	1	1.2
Elementary School	1	1.2	0	0.0
Junior High School	1	1.2	1	1.2
Senior High School	10	12.3	21	25.9
University	69	85.2	58	71.6
Work				
Doesn't work	4	4.9	30	37.0
Traders and Entrepreneurs	27	33.3	22	27.2
Civil servants	17	21.0	6	7.4
Private sector employee	20	24.7	10	12.3
Health Services	1	1.2	7	8.6
Educator	2	2.5	2	2.5
Driver	1	1.2	0	0.0
Others	9	11.1	4	4.9

It can be seen in Table 2, the majority of parents' education at Strada Nawar Bekasi Junior High School, was 85.2% fathers and 71.6% mothers took university level until graduation. The level of parental education can indirectly influence environmental factors in children's growth and development that support student learning achievement. The family environment is the place where children receive the main and first education in life. The way parents educate their children when studying at home can influence the child's learning achievement so that it will differ according to the education the child receives (Wulandari, 2015).

As for employment, most respondents had fathers who worked as traders and entrepreneurs (33.3%) and mothers who did not work or were housewives (37.,0%). Parents' work has an influence on the intensity of time and communication spent with children. Working parents have little time to pay attention, especially to their children's learning activities, so children find it difficult to achieve the expected learning achievements due to lack of support and attention (Bishnoi et al., 2020).

Table 3. Sample Frequency Distribution Based on Parents' Income of Strada Nawar Bekasi Junior High School Students

Family Income	n	(%)
<City minimum wage	3	3.7
1-2x City minimum wage	13	16.0
>2x City minimum wage	65	80.2

Family income was classified according to the amount of the Bekasi City Minimum Wage, West Java Province for 2022 which is contained in the Decree of the Governor of West Java Number: 561/Kep.732-Kesra/2021 concerning Regency/City Minimum Wages in the West Java Province Region for 2022. Based on this group, it was found that 80.2% of households had an income higher than the minimum wage set for the Bekasi City area in 2022, namely IDR 4.816.921,17. Sufficient family income can increase allocations to fulfill daily needs, both primary needs such as purchasing food and secondary needs such as facilities related to children's education which are indirectly related to children's learning achievements (Hardiyanti, 2019).

Relationship between Breakfast Habits and Nutritional Status and Learning Achievement

Based on Table 4, a total of 63 students (77.8%) had good breakfast habits, while five other students (6.2%) had poor breakfast habits.

Table 4. Breakfast Habits, Nutritional Status and Learning Achievement of Strada Nawar Bekasi Junior High School Students

Variables	n	(%)
Breakfast Habits		
Less	5	6.2
Enough	13	16.0
Good	63	77.8
Nutritional status		
Undernutrition	4	4.9
Good nutrition	44	54.3
Overnutrition	33	40.8
Learning Achievement		
Enough	32	39.5
Good	39	48.1
Very Good	10	12.4

The student learning achievement results obtained showed that 48.1% of respondents had good learning achievements, and 12.4% had very good learning achievements. A total of 54.3% had good nutritional status, but 40.8% of respondents had overnutritional status consisting of overweight and obesity.

Based on Table 5, the majority of students with good breakfast habits have good learning achievements (52.4%), while the majority of students who have less good breakfast habits have enough learning achievements (60.0%). From the hi-square test, it was found that there was a relationship between breakfast habits and student learning achievement with a p-value=0.041 and a correlation coefficient (r) of 0.227, which means the relationship between the two variables was very weak.

The majority of students with good learning achievements consist of students with good nutritional status (45.5%), and students with overnutritional status (54.5%). Based on results of the chi-square test, it obtained p-value=0.190, which means there was no relationship between nutritional status and the learning achievement of junior high school students.

Based on the results of this research, it was found that there was a relationship between breakfast habits and learning achievement. Most students who have good breakfast habits can achieve good learning achievements. Eating breakfast is a habit that is carried out regularly in the morning and plays an important role for school-aged children in growth and development as well as in meeting nutritional needs so that they can carry out various activities at school optimally. Even though the breakfast habits of most respondents are good, there are still some respondents who have poor breakfast habits. Several respondents stated the reasons for skipping breakfast, namely being lazy about breakfast, rushing because they were afraid of being late, not being used to breakfast, and feeling nauseous. If a child does not have breakfast, the child will become weak due to lack of food, making it difficult for the child to concentrate on studying. This can have an influence on achieving optimal learning achievement (Verdiana & Muniroh, 2017).

The food consumed every day must be fulfilled both in quantity and quality. Food that is balanced

Table 5. Distribution of the Relationship Between Breakfast Habits and Nutritional Status with Learning Achievement in Strada Nawar Bekasi Junior High School Students

Variable	Learning Achievement						*p value*
	Enough		Good		Very good		
	n	(%)	n	(%)	n	(%)	
Breakfast Habits							
Less	3	60.0	1	20.0	1	20.0	0.041
Enough	8	61.5	5	38.5	0	0.0	r=0.227
Good	21	33.3	33	52.4	9	14.3	
Nutritional status							
Undernutrition	0	0.0	1	25.0	3	75.0	0.190
Good nutrition	19	43.2	20	45.5	5	11.4	
Overnutrition	13	39.4	18	54.5	2	6.1	

Information :
- Malnutrition = $Z \leq -2$ SD
- Good nutrition = -2 SD $< Z <$ $+1$ SD
- Overnutrition = $Z \geq +1$ SD

between quantity and quality will support a person in their activities. A good breakfast consists of foods that are sources of energy, sources of building substances, and sources of regulatory substances. Breakfast is the most important meal of the day. The completeness of the nutritional content in preparing the breakfast menu needs to be considered, namely breakfast must contain nutrients, such as carbohydrates, protein, fat, vitamins and minerals (Delley & Brunner, 2019). Most respondents' breakfast menu consisted of staple foods, side dishes, vegetables and fruit. Most respondents said that their breakfast menu always changes every day. Gibney et al. (2018) stated that many people believe that breakfast is a crucial meal and should be given extra focus, especially for children. Eating breakfast regularly is linked to consuming more essential nutrients, following a healthier diet that includes fruits and vegetables, and consuming fewer sugary drinks. Regulation of the Minister of Health of the Republic of Indonesia Number 41 of 2014 states that the menu provided for students must also be varied, consisting of food sources of carbohydrates in the form of rice, noodles, bread or tubers, side dishes, such as eggs, tempeh, processed meat or fish, vegetables, fruit and drinks.

The results of this research were in line with research conducted by Mahbub and Fatih (2018) which stated that there was a relationship between breakfast habits and learning achievement. There were two benefits of breakfast for students. First, breakfast contains carbohydrates which are used to increase glucose in the blood because normal glucose levels cause better enthusiasm and concentration in learning, which can affect learning achievement. Second, breakfast contributes to the nutrients needed by the body, such as protein, fat, vitamins and minerals (Adolphus et al., 2016). In the morning, glucose stores are used up after the body's metabolic processes throughout the night. Glucose is a source of energy for the brain. Maintaining stable glucose levels is necessary for good cognitive function. Depletion of glucose levels in the morning causes students to start feeling hungry and experience fatigue and decreased cognitive function. If students skip breakfast, students become less concentrated, which can affect learning achievement (Tang et al., 2017).

The amount of food eaten at breakfast is mostly rich in nutrients, but lunch, dinner, snacks or fast food in excessive amounts or which does not comply with the Balanced Nutrition Guidelines will cause nutritional imbalances (Laswati, 2017). Even though students consume a breakfast that is structured with a menu, such as staple foods, animal side dishes, vegetable side dishes, vegetables, and/or fruit, other food consumed by students in a day in greater quantities consists of fast food or snacks, such as fried foods, colored drinks, and soft drinks which results in students having an unbalanced nutritional intake. Not a few teenagers think that by consuming a large amount of food and achieving a full stomach, their nutritional needs are met (Mardalena, 2017). The daily eating habits play a crucial role in influencing the level of nutritional adequacy, considering it is influenced as a whole and not just by a single meal, such as breakfast. Paying attention to a balanced nutritional intake in daily eating habits significantly contributes to determining the level of nutritional adequacy (Renita, 2017).

Nutritional status is a determinant of brain intelligence development, so the role of nutritional status is very important (Verdiana & Muniroh, 2017). Learning disorders or learning disabilities can occur if students experience deficiencies or excesses of nutritional substances, which can have an impact on successful learning achievement. Learning disabilities refer to several disorders that may affect the acquisition, organization, retention, comprehension, or the application of verbal and/or nonverbal information (Al-Mahrezi, 2016). However, the results of this study state that there was no relationship between nutritional status and learning achievement. Nutritional status only contributes 3.57% to concentration levels, which will also affect learning achievement.

Most of the students in this study had good nutritional status, but there were also some students who had overnutritional status. Based on the research results, it was found that students consumed quite a variety of foods. Family income factors as well as the mother's education and employment can determine the food that her family will buy and consume. Most students have mothers who don't work. Differences in available time occur between mothers who work and mothers

who do not work. Mothers who don't work tend to have more time to communicate with their children than mothers who work. This can also affect children's eating patterns. Mothers who do not work can regulate their children's eating patterns by providing a variety of foods, while mothers who work are less able to regulate their eating patterns, so they tend to give children more freedom in managing their eating patterns (Scaglioni et al., 2018). Apart from that, most of the respondents had mothers with the highest level of education, namely tertiary education. Mothers who have formal education will have an impact on the mother's level of knowledge. The higher the level of formal education, the greater the mother's level of knowledge in obtaining and absorbing practical information in formal and non-formal situations. With knowledge, a person will find it easy to absorb information and apply it in daily behavior and lifestyle. Thus, highly educated mothers will have good knowledge in providing children's food needs (Sukandar, 2020). Sufficient family income can contribute to children's growth and development because parents can fulfill children's various needs, both primary needs such as food and secondary needs. The average family income was IDR.15.006.172,84±8.521.111,22, which means that family income was higher than the minimum wage set for Bekasi City in 2022, namely IDR 4.816.921,17. With high income, the family's purchasing power becomes high so that the family's ability to meet food needs is also high so that the types of food purchased tend to be diverse (Arida et al., 2015). Nowadays, parents have the desire to have a healthy lifestyle so that eating preferences and habits are adjusted to the income of a family, so that income also influences kitchen needs, for example, oil. The higher the income, the higher the quality of the oil because the benefit sought is a healthy lifestyle (Pinem & Safrida, 2018).

Based on the research results, it was found that there was no relationship between nutritional status and the learning achievement of Strada Nawar Junior High School students. Fat is more easily stored as a reserve energy supply in adipose tissue. Fat only requires 3.0% of the energy compared to carbohydrates which require 23.0% of the energy to be converted into fat reserves in adipose tissue. Therefore, the habit of consuming fat tends to lead to obesity more quickly than carbohydrates and protein. Schwander et al. (2014) stated that someone who regularly consumes foods high in fat will be at risk of becoming obese, while Schmitt and Gaspar (2023) stated that obesity can disrupt blood flow to the brain because there is an increase in fat deposits resulting in a lack of oxygen in the brain. The impact of lack of oxygen is that it will disrupt learning in the long term and will also hinder learning achievement. If someone is obese or has an increased BMI, that person tends to experience increased feelings of laziness and a decrease in activity and creativity.

The absence of a relationship between nutritional status and learning achievement is due to the existence of other factors that influence learning achievement. Slameto (2015) stated that the factors that influence learning achievement are divided into two, namely internal factors and external factors. Internal factors are factors that originate from within oneself, while external factors are factors that originate from outside oneself, such as factors originating from the school and the surrounding environment. One of the factors that influences learning achievement is time management. Students in this study stated that the schedule set by the school tends to be busy and there are many assignments given by the school so that most of the students' time is spent at school. Time management is the key for students to manage and utilize time according to their needs. If students can manage their study time well and spend some of their time doing other activities, this will have a good impact on their learning achievement. Apart from that, another factor that influences learning achievement is learning motivation. Motivation to learn is a factor that plays an important role because students can develop activity and initiative and can maintain persistence in learning. Motivation to learn can create circumstances that encourage someone to want to do something. In the context of learning, motivation functions as an encouragement that gives rise to learning activities and is directional in the learning process so that a person can achieve the desired goals. Students who have strong motivation will have sufficient energy to carry out learning activities so that learning achievement can be optimal (Sardiman, 2014).

A study stated that there was a relationship between breakfast habits and academic achievement. Students who were accustomed to eating breakfast will have high concentration abilities so that they can improve learning achievement (Ernadi & Ilmi, 2020). Adequate nutrition in children plays a very important role in leading to good body growth. Good body growth includes brain growth and development, which is a determinant of children's intelligence (Maku et al., 2018).

CONCLUSION

Based on the research results, it was found that more than half of the respondents had good breakfast habits and nutritional status. Furthermore, it was found that there was a positive correlation between breakfast habits and study achievement, but there was no relationship between nutritional status and study achievement. Therefore, it is best for schools to provide education regarding breakfast habits and balanced nutrition through assistance from health promoters as well as optimizing the School Health Unit program in schools.

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EFFECTIVENESS OF MORINGA TEMPEH BURGERS IN INCREASING HEMOGLOBIN OF ANEMIC ADOLESCENT GIRLS

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ABSTRACT

Adolescent girls can avoid anemia by maintaining stable hemoglobin levels and consuming foods rich in nutrients and high in iron. Food sources with high iron content that can increase hemoglobin levels include Tempeh and Moringa. Tempeh and Moringa are notable sources of iron. Tempeh provides nutrients such as Fe, vitamin B12, and folic acid, while Moringa leaves contain 28.66 g of protein, 929.29 mg of calcium, 715.22 mg of phosphorus, 9.99 g of iron, and 2.32 mg of zinc per 100 g. This study investigated the effect of Moringa tempeh burgers on hemoglobin levels in anemic teenage girls. Using a quasi-experimental design, 51 anemic girls aged 13-15 were divided into three groups: a control group (K) given tempeh burgers without Moringa, treatment group 1 (P1) given tempeh burgers with 3g of Moringa leaf flour, and treatment group 2 (P2) given tempeh burgers with 12g of Moringa leaf flour. Each group included 17 participants who consumed the assigned burgers for 30 days. Results showed the average hemoglobin level changes before and after the intervention were 0.46 g/dl in K, 0.70 g/dl in P1, and 2.23 g/dl in P2. Statistical tests confirmed significant differences in hemoglobin levels pre- and post-treatment across all groups. The study concluded that Moringa tempeh burgers, particularly those with the highest amount of Moringa leaf flour, were most effective in increasing hemoglobin levels in anemic adolescent girls.

Keywords: *adolescent girls, anemia, moringa tempeh burger, hemoglobin*

INTRODUCTION

Anemia is a global and Indonesian public health problem. Global prevalence in women is 29.9% (WHO, 2019), and according to 2018 *Riskesdas* data, nationally, anemia is 27.2% in women and 20.3% in Men (Ministry of Health, 2018).

Adolescents are said to be anemic when they have hemoglobin levels <12g/dl (WHO, 2021). Adolescent girls have a higher risk of anemia (Ayuningtyas et al., 2020). One of the causes of anemia in adolescent girls is due to menstruation (Misroh Mulianingsih, 2021). Previous research showed that anemia in adolescent girls was higher than in adult women (Sari et al., 2022). In other research, adolescent girls who live in boarding schools are more likely to experience anemia due to a lack of knowledge, parental control, and ability to provide healthy food (Eka, 2018).

Adolescent girls can avoid anemia by maintaining stable hemoglobin levels (Junita & Wulansari, 2021) and consuming foods rich in nutrients and high in iron (Nisa et al., 2020). Several literatures have found that food sources with high iron content that can increase hemoglobin levels include tempeh (Rahayuni et al., 2020) and moringa (Hasniar et al., 2019).

Tempeh contains several nutrients, including Fe, vitamin B12, and folic acid. These three nutritional values in tempeh can increase blood hemoglobin (Pinasti et al., 2020).

Moringa leaves (*Moringa oleifera*) are local plants with rich nutrition content and food-rich nutrition. In 100 g, moringa leaves contain 28.66 g of protein, 929.29 mg of calcium, 715.22 mg of phosphor, 9.99 g of iron, and 2.32 mg of zinc (Irwan, 2020). Based on the Indonesian DKBM, moringa leaves contain 7.00 per 100 g of iron, this amount is more than the iron contained in

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beef, which is 3.00 per 100 g. On the other hand, moringa leaf flour can contain 28.66 g of calcium, 603.77 mg of protein, 12.84mg of phosphor, 264.96 mg of potassium, and 20.49 mg of iron (Manggara & Shofi, 2018). Research conducted by Fadliyah (2018) stated that giving chocolate cookies containing 8 g of moringa leaf flour to 19 teenagers during 30 days of treatment could increase Hb levels from before treatment 9.41+0.84 g/dl to 12.36+1 .51 g/dl after treatment.

Another research conducted by the author was to determine the effect of adding moringa leaf flour to tempeh burgers. The results of this research show that the nutritional content of tempeh burgers without the addition of moringa leaf flour is 2.41 mg of iron, 1.76 mg of folic acid, and 0.70 mg of vitamin C. After adding 3 g of moringa flour, the iron value increased to 2.51 mg (4.14%) and folic acid value to 1.78 mg (1.13%). Meanwhile, 12 g of moringa leaf flour increased the iron value to 2.98 mg (23.6%) and folic acid to 1.90 mg (7.95%). The conclusion of this research shows that moringa leaf flour can increase the levels of iron and other minerals in tempeh burger products (Ningrum et al., 2023).

This follow-up research aims to analyze the effectiveness of giving moringa tempeh burgers to anemic adolescent girls in increasing hemoglobin levels.

METHODS

This research used a quasi-experimental pre-test and post-test control group design. This research was conducted at the Khairukum Islamic Boarding School, Daar el Manshur Islamic Boarding School, Mafaza 4 Islamic Boarding School, and Darut Tafsir Al Husaini Islamic Boarding School in Depok City in July - August 2022.

A total of 282 adolescent girls from four Islamic boarding schools were the sample in this study. The inclusion criteria in this study were adolescent girls studying at junior high school aged 13-15 years, having a hemoglobin level <12g/dL, living in an Islamic boarding school, and following the research procedures by signing informed consent. Exclusion criteria include adolescent girls who are sick during screening or intervention, such as tuberculosis, worms disease, HIV, and malaria, based on a doctor's diagnosis and who are allergic to tempeh and moringa.

Calculation of sample size was using the Sastroasmoro formula (2014):

$$n = 2 \left(\frac{(Z_\alpha + Z_\beta)s}{X_1 - X_2} \right)^2$$

Where:

n = sample size
Zα = alpha significance/confidence level
Zβ = conventional beta value/power
S = Standard deviation
X1-X2 = expected clinical differences (Sastroasmoro, 2014)

Alpha significance/confidence level used in this study was 95% (Zα = 1.65) or α = 0.05 with conventional beta value (power) 90% (Zβ = 1.28), standard deviation 1.105 and clinical difference value of 1,27g/dl (Novianti et al., 2019). The sample size calculation above shows that the number of subjects in this study was 13 subjects per group, so the total in the three groups was 36 subjects. Anticipating the possibility of dropping out or being lost to follow-up is around 20%, and corrected using the calculation formula n'=n/(1-f), n' is the final sample size after correction, n is the calculated sample size, and f is the estimated number of drops out (Sastroasmoro et al., 2014). The result of this calculation is n'=13/(1-0.2)= 16.25 rounded up to get 17 subjects in each group with a total number of subjects in the three groups of at least 51 subjects.

The research began by making moringa tempeh burgers with three different moringa leaf flour concentrations: 0g (control), 3g, and 12g. The selection of the moringa tempeh burger product was obtained through the Hedonic Organoleptic Test which had been carried out previously, to find out the moringa tempeh burger with the most preferred formulation by research respondents, namely the moringa tempeh burger product with the addition of 3g and 12g of moringa leaf flour.

Moringa tempeh burgers were analyzed to find the nutritional value at the Center for Agro-Based Industry (*Balai Besar Industri Agro)* in Bogor. The nutritional value calculated includes analysis

to check energy, carbohydrates, fat, protein, Fe (iron), vitamin C, vitamin B9 (Folic Acid), and crude fiber.

Research subjects filled out informed consent, personal biodata, and parental consent before the research began. This research has received approval from the Ethics Commission of the Faculty of Medicine, Sebelas Maret University, Surakarta, with Number 51/UN27.06.11/KEP/EC/2022.

This research was carried out for 30 days, giving each subject moringa tempeh burger 100g daily. Moringa tempeh burgers were served during the first break or around 10 a.m. The dose given was moringa tempeh burger in tempeh petty dough and additional amounts of moringa flour (97 g tempeh and 3 g moringa flour for P1 and 88 g tempeh and 12 g moringa flour for P2), while the control group was given tempeh burgers without moringa leaf flour). In all treatments, they were given an additional 1 Fe tablet per week and moringa tempeh burgers were given for 30 days (Yuniwati et al., 2018). Giving deworming medication (Albendazole 400mg) to research subjects before starting to consume moringa tempeh burgers was done to ensure nutritional intake was not absorbed by worms (Ministry of Health, 2016).

Several secondary data such as subject characteristics in the form of age, parent's income, weight, height, nutritional status, study concentration and hemoglobin levels were collected by researchers to support the research results. Data on body weight and height were measured using tools and presented in the form of a Z-Score (BMI/U). 4) Nutrient intake data were obtained through direct interviews with respondents using a 24-hour food recall, during the pre-test and post-test and the Semi-Quantitative Food Frequency questionnaire (SQ-FFQ) which was conducted on the 15th day of the study. 5) Learning Concentration was obtained by direct interviews with respondents through questionnaire forms given on the pre-test and post-test on day 30. Blood sample data for hemoglobin examination before the research (pre-test) and after the research (post-test) was carried out by officers health and tested at the Bogor Regional Health Laboratory (LABKESDA).

SPSS Version 25 was used to carry out statistical tests. Normality tests used the Kolmogorov Test because the sample size was >50. Analysis before and after treatment used a paired test; the Wilcoxon test should be used if the data are not normally distributed. Data analysis to differentiate the effects of the three groups was tested using the one-way ANOVA test and ended with a post hoc test with the Tukey HSD test to see the location of the differences.

RESULT AND DISCUSSION

The characteristics of the research subjects were 13 - 15 years old and came from four Islamic boarding schools in the Depok City area, West Java. The subjects were 51 anemic adolescent girls,

Table 1. Respondent Characteristics Source: Secondary Data (2022)

	Control		P1		P2		p
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	
Age (years)							
13	5	29.4	3	17.6	3	17.6	
14	5	29.4	5	29.4	5	29.4	0.906
15	7	41.2	9	53.0	9	53.0	
Total	17	100	17	100	17	100	
Nutritional Status (IMT/U)							
Normal	11	64.7	14	82.4	13	76.5	
Overweight	4	23.5	3	17.6	4	23.5	
Obesity	2	11.8	0	0.0	0	0.0	
Total	17	100	17	100	17	10	0.292

consisting of 11 people aged 13 years, 15 people aged 14 years, and 25 people aged 15 years. The subject's education level was MTs or equivalent to junior high school.

Based on the table above, subjects in all intervention groups have various characteristics. This is in accordance with the results of the Chi Square test, namely that there is no difference between subjects in groups K, P1 and P2 with a value of p = 0.903 (p > 0.05) which means the subjects are homogeneous. This confirms the assumption of experimental studies where the baseline characteristics of the subjects are evenly mixed.

The Effect of Giving Moringa Tempeh Burgers on Increasing Hemoglobin

The Kolmogorov normality test had been carried out previously with pre-test results sig ρ = 0.020 (ρ > 0.05) and post-test sig ρ = 0.156 (ρ > 0.05), which means the pre-post was normally distributed, then continued with the paired t-test. The results show sig ρ = 0.000 (ρ < 0.05). It means that there is a significant difference between Hb levels before and Hb levels after treatment.

Giving moringa tempeh burgers was able to increase hemoglobin levels significantly in the treatment group. In the control and P1 treatments there was an increase in the average hemoglobin level but the hemoglobin level was still classified as mild anemia, while in the P2 group there was an increase in the hemoglobin level above the normal threshold, namely > 12 g/dL. This is in accordance with previous research that found that administering moringa leaf extract for 14 days can increase hemoglobin levels with an increase of 0.9 g/dL (p<0.05) (Hastuty & Medan, 2022).

The highest mean Hb level was in the P2 group (2.23 g/dL). These results are in line with other research that drinking moringa leaf tea for two weeks can increase hemoglobin by 1.3 g/dl (Hastuti & Novita 2022). Research conducted by Khofifah and Mardiana (2023) stated that consuming moringa leaf biscuits in teenagers could increase hemoglobin levels by 1.25 g/dl for 30 days, whereas in this study the largest increase was 2.23 g/dl for 30 days. This can explain that the moringa tempeh burger product is more effective in increasing hemoglobin levels.

CONCLUSION

Providing moringa tempeh burgers daily during snack time for 30 days increased hemoglobin levels in anemic teenage girls in four Islamic boarding schools in Depok City.

Islamic boarding school students should not only rely on snacks or moringa tempeh burgers but also change their healthy lifestyle by applying the principles of balanced nutrition. By doing so, female students can get sufficient nutrition, including iron, vitamin C, animal protein, folic acid, and vitamin B12. Adequate nutrition can support adolescent girl's health, help them focus more on studying, and prevent anemia.

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Table 3. The Effect of Giving Moringa Tempe Burgers on Hemoglobin

Group	n	Before	After	Δ Mean ± SD	ρ
		Mean ± SD	Mean ± SD		
Control	17	10.48 ± 1.32	10.95 ± 1.15	0.46 ± 0.37	0.000*
P1	17	10.49 ± 1.16	11.19 ± 1.05	0.70 ± 0.43	0.000*
P2	17	10.58 ± 0.87	12.81 ± 0.67	2.23 ± 0.67	0.000*
				0.000**	

Where:
Δ : The difference in hemoglobin levels before and after intervention
*) : Paired t-test result
**) : One Way Anova result

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RELATIONSHIP OF SWEET CAFFEINATED BEVERAGES CONSUMPTION AND SLEEP QUALITY WITH NUTRITIONAL STATUS IN ADOLESCENTS

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ABSTRACT

Overnutrition is more common among adolescents. In Indonesia, lack of physical activity, poor quality of sleep due to daily schedules, and the consumption of sweet, fatty, and fast foods are the main contributing factors. This study aimed to analyze the relationship between the frequency of consumption of sweet caffeinated beverages and sleep quality with nutritional status in adolescents in high school 5 Tambun Selatan. This study used quantitative research with observational analysis using a cross-sectional design. The sample consisted of 101 individuals randomly chosen by a simple random sampling method. Data were collected using the Food Frequency Questionnaire and Pittsburgh Sleep Quality Index with the determination of the nutritional status of adolescents obtained from Z-score BMI/U. The Chi-Square test results indicated significant correlations exist between the frequency of sweet caffeinated beverages consumption and nutritional status (p=0.045) but no significant correlations were found between sleep quality and nutritional status (p=0.797) in adolescents in high school 5 Tambun Selatan.

Keywords*: adolescents, frequency of sweet caffeinated beverages consumption, nutritional status, sleep quality*

INTRODUCTION

Overnutrition is a common problem among adolescents (Utami, 2017). It occurs when there is an energy imbalance in the body caused by excessive food intake that is imbalanced by sufficient exercise, which leads to excessive fat storage and characterized by non-ideal body weight (Christianto, 2018). Overnutrition can have health consequences, including degenerative diseases such as diabetes, coronary heart disease, stroke, gallstones, and more. Overnutritioned adolescents have a 70% chance of becoming overweight or obese adults (Suryani et al., 2018).

Based on national Riset Kesehatan Dasar data, the prevalence of overweight and obesity among adolescents aged 16-18 years in Indonesia based on BMI/U has increased, namely overweight from 5.7% to 9.5% and obesity from 1.6% to 4% in the period 2013-2018. In West Java, the prevalence of overweight also increased from 6.2% to 10.9% and the prevalence of obesity increased from 1.4% to 4.5% among adolescents aged 16-18 years based on BMI/U. Meanwhile, according to the results of Riset Kesehatan Dasar West Java in 2018, the percentage of adolescents aged 16-18 years with overweight and obesity prevalence based on BMI/U in Bekasi Regency was 9.06% and 4.11%, respectively.

Lifestyle changes are of the factors leading to overnutrition among adolescents in Indonesia and include less physical activity, such as watching television and using gadgets excessively. Also, the consumption pattern of sweet, fatty, fast foods and beverages is a lifestyle of adolescents today. Adolescents prefer these foods compared to vegetables and fruits (Widianto et al., 2017). Caffeinated foods and beverages that are commonly available on the market are popular in current lifestyles. The consumption patterns of sugary foods and beverages among adolescents are influenced by the amount of pocket money that they receive from their parents. As the amount of pocket money increases, so does the amount of food and drink consumed (Sartika et al., 2022).

According to Rachmawati (2017), caffeine is found in coffee, carbonated drinks, tea, energy drinks, and chocolate drinks. Melizza et al. (2021) reported that coffee is one of the most popular beverages among the world's population. Recently,

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modern cafes have made coffee consumption not only limited to the elderly and adults, but younger generations have started making it a habit (Ardiani & Subrata, 2021). In 2016, the National Coffee Association reported that there was a notable increase in daily coffee consumption among adolescents between the ages of 18 and 24, from 36% to 40%.

Currently, caffeinated beverages are generally not consumed to fulfill the nutritional needs of the body, but rather to follow trends due to environmental influences and social media developments (Pramelani, 2020). Caffeinated beverages are commonly served in large glasses or cup with a volume ranging from 250 to 754 milliliters (Putri, 2022). The beverage has a minimum of 8.79 grams of sugar per 200 ml of cup (Rosanti, 2021). According to Kadita and Hartanti (2017), regular consumption of coffee with sugar and milk in large quantities can have an impact on daily energy intake. Moreover, these beverages often contain additional ingredients like palm sugar, jelly, boba or pudding. According to Min et al. (2017), boba, made from tapioca starch, contains 78 calories and 7 grams of sugar per 60 grams, jelly contains 212 calories and 12 grams of sugar per 50 grams, and pudding contains 54 calories and 18 grams of sugar per 80 grams.

Safitri et al. (2021), found that the calories in seven samples of boba milk tea had exceeded 300 kcal, which is almost equivalent to the calorie content of two portions (100 grams) of rice (360 kcal). Given that the Indonesian Dietary Guideline recommends limiting sugar consumption to 10% of total energy intake or a maximum of 200 kcal from sugar for a daily energy requirement of 2,000 kcal, drinking boba milk tea would result in an excess of 100 kcal in the body (Kemenkes, 2018). Similarly, the findings of Kim and Yong (2017) suggest that coffee consumption ≥3 times/day may potentially increase body mass index, with the effect being more pronounced in women. Manja et al. (2020) conducted research that indicates a significant relationship between caffeine consumption and obesity (p=0.000). The study found that excessive caffeine intake can contribute to weight gain and increase the risk of developing obesity.

In addition to caffeinated beverages, a person's nutritional status can be affected by sleep quality. A good quality of sleep is achieved when a person has sufficient sleep duration (Shakina et al., 2021). According to Keswara et al. (2019), the prevalence of poor sleep quality in Indonesian adolescents is 63%, with less than seven hours of sleep duration every night. Putra's (2017) study showed that poor sleep quality affects nutritional status due to increased consumption in a person. This relationship between sleep quality and body mass index is significant (p = 0.000), with Purnamasari et al. (2021) finding that there is a significant correlation between sleep quality and BMI. The study showed that samples with poor sleep quality predominantly had an overweight BMI, while samples with good sleep quality predominantly had a normal BMI.

The study aims to conduct research on the relationship between the frequency of consuming sweet caffeinated beverages and sleep quality with nutritional status in adolescents in Bekasi Regency, which is located at high school 5 Tambun Selatan, because there has been no research targeting high school students in Bekasi Regency, which has a high prevalence of obesity and overweight.

METHODS

The study was conducted as a quantitative research using an analytical observational design through a cross-sectional approach at high school 5 Tambun Selatan in March 2023. The Health Research Ethics Commission of Muhammadiyah Prof. Dr. Hamka University approved this research with number 03/23.03/02337. A sample of 101 individuals was used in the study by the simple random sampling technique based on the list of student's identification number. The participants of the study were students of high school 5 Tambun Selatan, who were between the ages of 15 and 18 years old, and who were willing to be research subjects by signing the informed consent form.

The study examined the independent variables of sweet caffeinated beverage consumption frequency and sleep quality, with nutritional status as the dependent variable. Subject characteristics (age, gender, grade, pocket money, and parents'

educational background) were used as supporting variables in this study.

The frequency of consumption of sweet caffeinated beverages was collected using a food frequency questionnaire (FFQ), which assessed the frequency of consumption over the past month. The FFQ includes a list of eight types of sweet caffeinated beverages. The form has been validated for high school 6 Tambun Selatan which is located in the same region. Consumption frequency was classified as frequently (>6 times/week) or rarely (1-6 times/week). This classification was based on modifications from research that also used a sample of high school students (Saidah et al., 2017). Sleep quality data were collected using the Pittsburgh Sleep Quality Index (PSQI), which assesses sleep quality over the past month. The PSQI questionnaire assessed seven components of sleep through nineteen questions. These components included subjective sleep quality, sleep latency, sleep duration, effective sleep duration, sleep disturbances, use of medication, and daytime concentration disturbances. A PSQI total score greater than five is considered poor, while a score of five or less is considered good (Pujiati, 2018).

Nutritional status was determined by calculation of the BMI/U z-score using the WHO AnthroPlus software based on direct measurement of the weight and height of the subjects using calibrated digital scales and microtoise. Nutritional status was classified into two categories: overnourished (z-score BMI/U >+1 SD) and not overnourished (z-score BMI/U -3 SD to +1 SD).

Microsoft Excel 2016 and SPSS version 22.0 were used for data processing and analysis. Editing, coding, processing, and cleaning were the primary stages of data processing in this study. This study used univariate and bivariate analysis. Univariate analysis was used to determine the frequency distribution of subject characteristics (age, gender, grade, pocket money, parents' educational background), frequency of sweet caffeinated beverages consumption, sleep quality, and students' nutritional status. Bivariate analysis was used to determine the relationship between two studied variables: frequency of consuming sweet caffeinated beverages with nutritional status, as well as sleep quality with nutritional status, using the Chi-Square test.

RESULTS AND DISCUSSION

The characteristics of the subjects, including age, gender, grade, pocket money, and the educational background of their parents, are shown in Table 1. According to the table, the majority of students were 17 years old (34.7%) and the majority were female (59.4%). Grade XII students dominated the sample (34.7%), and college graduates constituted the highest percentage in terms of parental education (59.4%). Students with pocket money ≥Rp.20,000 were 78.2% and students with pocket money <Rp.20,000 were 21.8%.

Table 1. Subject Characteristics

Subject Characteristics	n	(%)
Age		
15 years old	21	20.8
16 years old	34	33.7
17 years old	35	34.7
18 years old	11	10.9
Gender		
Male	41	40.6
Female	60	59.4
Grade		
X	33	32.7
XI	33	32.7
XII	35	34.7
Pocket Money		
High (≥Rp.20.000)	79	78.2
Low (<Rp.20.000)	22	21.8
Parents' Educational Background		
Elementary School	3	3.0
Junior High School	2	2.0
Senior High School	36	35.6
College Graduate	60	59.4
Total	101	100.0

The majority of students in SMAN 5 Tambun Selatan receive a high category of pocket money, an amount of pocket money ≥Rp. 20.000 per day. Pocket money is one of the factors associated with overnutrition, and the amount received may influence purchasing behavior by increasing the purchase of snacks or food due to the higher amount of pocket money provided (Sartika et al., 2022).

Regarding the educational background of the parents, most of them (59.4%) have graduated from

university, while 35.6% have finished senior high school, 3% only completed elementary school and 2% completed junior high school. Education is one benchmark of knowledge about nutritious food and proper preparation of food. Parents' comprehension of fulfilling their children's nutrition improves with higher education levels (Juliantara & Purwo, 2021).

Table 2. Frequency Distribution of Sweet Caffeinated Beverages Consumption, Sleep Quality, and Nutritional Status among SMAN 5 Tambun Selatan Students

Variable	n	(%)
Frequency of Sweet Caffeinated Beverages Consumption		
Frequently (>6 times/week)	51	50.5
Rarely (1-6 times/week)	50	49.5
Sleep Quality		
Good (Score ≤5)	34	33.7
Poor (Score >5)	67	66.3
Nutritional Status		
Overnourished (BMI/U >+1 SD)	31	30.7
Not Overnourished (BMI/U -3 SD sd +1 SD)	70	69.3
Total	101	100.0

According to Table 2, 50.5% of students consume sweet caffeinated beverages frequently (>6 times/week) and 49.5% of students consumed sweet caffeinated beverages rarely (1-6 times/ week). The consumption of caffeinated sugary beverages among adolescents had risen due to the variety of beverage products that currently contain caffeine, such as energy drinks and soda, in addition to coffee and tea (Gera et al., 2016). The availability of sweet caffeinated beverages is also supported by advertising that claims these beverages can increase energy and inhibit aging, so these sweet caffeinated beverage products are popular among adolescents, which results in high caffeine intake among adolescents (Temple et al., 2017).

Based on the analysis, students of high school 5 Tambun Selatan who frequently consumed sweetened beverages with caffeine were more than those who rarely consumed sweetened beverages with caffeine. According to the researcher's observation, this could be related to the existence of modern coffee shops nearby and the availability of these beverages in school canteens and minimarkets, so that adolescents can easily access these sweet caffeinated beverages. The most widely consumed caffeinated sweetened beverage is brewed tea with sugar. This beverage is readily available at home and is also offered in school canteens, making it the easiest beverage for students to access.

According to Table 2, 66.3% of students have poor sleep quality while the remaining 33.7% have good sleep quality. Several factors, such as health status, lifestyle, diet, environmental factors, and academic stress, affect an individual's sleep quality. The environmental factor, especially a noisy environment, can make it difficult for individuals to sleep and lead to a desire to gather with friends and engage in activities until late at night (Foulkes et al., 2019).

Based on the analysis, most students at high school 5 Tambun Selatan have a poor sleep quality. According to the researcher, this is due to the high level of activity at school. Sonda et al. (2021) conducted a study by interviewing high school students and found that they are heavily involved in learning, assignments, extracurricular activities, and are active members of school organizations, so the findings of this study are supported by previous research. In addition to school activities, some students engage in nightly activities such as using the gadgets and watching Korean-drama, so the activities during the day make students have difficulty sleeping.

According to Table 2, 30.7% of students with a z-score BMI/U >+1 SD had one nutritional status distribution, while 69.3% of students within a z-score BMI/U range of -3 SD to +1SD had another. Many adolescents are currently overnourished. Causal factors contributing to overnutrition include genetics, age, gender, sleep duration, insufficient physical activity, unhealthy dietary habits, environmental factors, socioeconomic status, and parental education (Rachmayani et al., 2018). However, based on the results of the analysis, most students in high school 5 Tambun Selatan were not overnourished.

Researchers have identified several factors that influence students who are not overweight. One of them is parental education, which is a key indicator of knowledge about good nutrition and

proper food handling. Parents with higher levels of education are well-prepared to understand and ensure their children's nutritional needs are met (Juliantara & Purwo, 2021).

Another reason why adolescents are not overweight is their lack of knowledge about dietary patterns and behaviors. The food pattern is related to the type, amount and composition of food consumed daily (Sambo et al., 2020). Meanwhile, nowadays adolescent eating behaviors refer to unhealthy behaviors where adolescents are afraid of looking fat, so they tend to follow strict diets, reduce food intake by skipping breakfast, and endure hunger (Pujiati et al., 2015).

The results showing the association between the frequency of sweet caffeinated beverages consumption and sleep quality with nutritional status among students of high school 5 Tambun Selatan can be seen in Table 3.

Table 3. Association between Frequency of Sweet Caffeinated Beverages Consumption and Sleep Quality with Nutritional Status

Variable	Nutritional Status				*p value*
	Overnourished		Not Overnourished		
	n	(%)	n	(%)	
Frequency of Sweet Caffeinated Beverage Consumption					
Frequently	11	21.6	40	78.4	0.045
Rarely	20	40.0	30	60.0	
Sleep Quality					
Good	11	32.4	23	67.6	0.797
Poor	20	29.9	47	70.1	

Based on Table 3, the Chi-Square test analysis revealed a significant association between the frequency of consumption of sweet caffeinated beverages and the nutritional status of high school 5 Tambun Selatan students (p=0.045). Meanwhile the majority of students who frequently consume sweet caffeinated beverages are not overnourished. This study is similar to the research in Bandung which found that the consumption of sweet caffeinated beverages does not affect students' weight because sweet caffeinated beverages are consumed just enough or increase students' energy intake, but not until consumed excessively. The most commonly consumed sweet caffeinated beverages in this study were packaged tea and brewed tea (Akhriani et al., 2016).

According to the study results, students who infrequently consume caffeinated sweetened beverages were more likely to be overweight or obese. This is not only due to the consumption of sweetened beverages, but also to the consumption of sweet foods, fatty foods, and instant or fast foods, which are very popular among adolescents. According to the 2018 Riset Kesehatan Dasar data, the consumption of sweet foods between the age of 15-19 years in Indonesia ranks fourth after the age group below compared to other age groups. In addition, the consumption of fatty foods for this age group in Indonesia was the highest among all age groups. Furthermore, the 2018 Riset Kesehatan Dasar survey also reported that the proportion of instant food consumption habits at the age of 15-19 years in Indonesia ranks second after the age group 10-14 years compared to other age groups.

Fast food is widely accessible but lacks the essential nutrients necessary for adolescents, which makes it nutritionally insufficient and unable to provide adequate satiety, which can increase the risk of overnutrition and other health problems (Pamelia, 2018). Sulistyowati et al. (2019) found that there was a significant relationship between the consumption of fast food and the nutritional status of high school students in high school X, East Jakarta. The study involved an analysis of students' food consumption containing high energy, which identified pizza, burgers, nuggets, sausage, hot dogs, fries, fried chicken, and instant noodles as the most common choices. Interviews with respondents suggested that these foods are appealing because of their flavors, affordability, and rapid preparation. Nowadays, adolescents enjoy convenient access to fast food due to the fast processing and serving methods and the proliferation of places that offer these foods and beverages, such as restaurants, supermarkets, mini-markets, and fringe food and beverage places (Ufrida & Sugeng, 2022).

Based on Table 3, the Chi-Square test analysis indicated no significant association between sleep quality and nutritional status among students of high school 5 Tambun Selatan (p=0.797). The majority of students have good or poor sleep quality and are not overnourished. This

is similar to the research of Nabawiyah et al. (2021) which states that there is no association between sleep quality and nutritional status in santriwati at Pesantren Gontor Putri 1 where it is stated that santriwati have the habit of sleeping after 10.00 PM. The survey results show that the typical student has similar sleep patterns to the aforementioned statement.

Another study conducted by Rodhiyah (2022) found that there was no significant association between sleep quality and nutritional status among students of Tarbiyah Islamiyah Islamic Boarding School in Tanjung Agung. Similarly, Fibriana's (2019) study also revealed no association between sleep quality and nutritional status. However, this study does not line up with the findings of Khasan's (2017) study that there is an association between sleep quality and nutritional status. Inadequate sleep in adolescents disrupts the balance of leptin and ghrelin hormones, leading to an increase in ghrelin and appetite, ultimately affecting their nutritional status.

Several factors affect nutritional status. These include stress, physical activity, environment, genetics, and diseases, which have not been studied. Genetics of parents are among the factors that impact nutritional status. The research conducted by Maritasari and Resmiati (2019) indicates that obesity is more common in students who have both parents who are obese, compared to students who have one parent who is obese or both parents who are not obese. In addition, diseases can also have an impact on nutritional status. This is in line with the study of Nurwijayanti et al. (2019), which shows that there is a significant association between infectious diseases and nutritional status because the presence of infectious diseases worsens the nutritional status of individuals.

Academic stress among adolescents also affects nutritional status. According to research carried out by Indrasti et al. (2022), there exists a positive correlation between academic stress and obesity. Stress is linked to overeating tendencies, in which individuals tend to consume more food than usual when stressed, thus triggering changes in nutritional status (Wijayanti et al., 2019). This is one of the limitations of the study because it did not analyze through other factors besides sweet caffeinated beverages consumption and sleep quality to nutritional status.

CONCLUSION

There exists a significant association between frequency consumption of sweet caffeinated beverages and nutritional status with a p-value of 0.045 and there is no association between sleep quality and nutritional status with a p-value of 0.797 in students of high school 5 Tambun Selatan. Future researchers should continue research by developing variables and pay attention to other factors related to research variables supported by appropriate instruments such as the use of Semi Quantitative Food Frequency Questionnaire to assess energy intake and nutrients specifically in individuals.

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DOUBLE BURDEN OF MALNUTRITION AMONG WOMEN OF REPRODUCTIVE AGE AND ITS ASSOCIATED FACTORS IN MAKASSAR DISTRICT

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ABSTRACT

The double burden of malnutrition, especially on women, continues to increase, including in Makassar City, Indonesia. The prevalence of malnutrition is quite high based on BMI category in the adult female population aged >18 years in Makassar City, namely thin (8.64%), fat (14.33%), and obese (29.75%). This study aims to compare factors related to undernutrition and overnutrition status in women of childbearing age (WUS) in Makassar District. This research is a cross-sectional study of suburban women aged 16–44 years at the Bara-baraya Community Health Center, Makassar District using a quota sampling technique for two months. Anthropometric measurements were carried out to determine nutritional status, calorie and protein intake were measured using a 24-hour recall questionnaire, and a structured questionnaire to determine the characteristics of respondents. The statistical test used is the Chi Square test. The prevalence of undernutrition, normal and overnutrition in the WUS group was 8.3%, 46.9% and 44.8%, respectively. There is a significant relationship between energy intake (p=0.032), dietary diversity (p=0.025), nutritional knowledge (p=0.029), and education (p=0.009) with nutritional status in women of childbearing age. No significant relationship was found between protein intake, occupation, economic status and age with nutritional status among women of reproductive age (p>0.05).

Keywords: double burden, malnutrition, reproductive age, women

INTRODUCTION

The Millennium Development Goals (MDGs) encompass eight objectives, two of which pertain to the health status of women. Specifically, the fifth objective seeks to enhance maternal health and decrease maternal death by 75%, while the fourth objective wants to reduce infant mortality by 50%. (UNDP, 2015). There are numerous elements that contribute to the attainment of targets pertaining to maternal and newborn mortality. The nutritional state of mothers prior to, during, and following pregnancy significantly influences the achievement of this objective. (UNDP, 2015).

Nutritional issues are becoming more prevalent among women. In Indonesia, the incidence of overnutrition and overweight is on the rise at a higher rate than the incidence of undernutrition and underweight is declining (Suryani et al., 2017). In 2010, the incidence of undernutrition in Indonesia was observed to be 19%, whereas the prevalence of overnutrition was recorded at 14%. In the year 2020, there was a decline in the prevalence of undernutrition to 10%, as well as a rise in the prevalence of overnutrition to 25%. There has been a notable rise in the frequency of overweight among women aged 18 years and above in Indonesia. In 2007, the prevalence was 19%, which rose to 30% in 2013, and then declined to 29.5% in 2018. Based on the 2018 Riskesdas report, the adult female population aged over 18 years in Makassar City has a significant prevalence of malnutrition, as indicated by the BMI (Body Mass Index) category. Specifically, the prevalence of undernutrition is 8.64%, overnutrition is 14.33%, and obesity is 29.75% (Kemenkes RI, 2018).

Internal and external factors exert effect on the etiology of undernutrition and overnutrition. Internal variables encompass various elements originating from the individual or family, including genetics, obstetrics, and sex. Nutrition, medications, environment, and disease are examples of external variables (Paramata & Sandalayuk, 2019). An individual's nutritional status is impacted by their patterns of intake. The individual may experience health issues if their consumption patterns do not align with their needs. Unbalanced dietary patterns that do not align with individual nutritional requirements can lead to an imbalance in caloric

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intake within the body, resulting in nutritional deficiencies (Alam et al., 2020). According to the framework established by the United Nations Children's Fund (UNICEF), there exists an indirect relationship between nutritional status and many factors such as socioeconomic status, household food security, utilization of health services, and women's awareness about health and nutrition. (UNICEF, 2020)

Obesity is primarily caused by two factors: food consumption and physical exercise. According to the UNICEF conceptual model, obesity is influenced by intermediate factors and basic factors, which encompass women's knowledge and other socioeconomic aspects (UNICEF, 2017). Women in the reproductive age group are a susceptible demographic that is a primary focus for health advancement. Women who are affected by malnutrition, particularly those who suffer from chronic energy deficit (CED), will face a cumulative impact on both themselves and future generations. (UNICEF, 2017).

This study seeks to investigate the correlation between many parameters, such as socioeconomic status, energy and protein consumption, dietary variety, and nutritional knowledge, and the nutritional status of women in their reproductive years. The study's originality is derived from its comprehensive methodology in identifying and assessing the various elements that contribute to the dual burden of malnutrition among women in their reproductive years.

METHODS

The present study is an observational investigation employing a cross-sectional methodology, focusing on women within the reproductive age group. In the Makassar District region, the research was carried out at the Bara-Baraya Community Health Center. The selection of Makassar District as the research site was based on its notable female population density inside Makassar City, which stands at 20,093 individuals per square kilometer. The study was carried out from August to September 2021.

The inclusion criteria for women of reproductive age in this study encompassed women between the ages of 16 and 44, residing in the Bara-Baraya health center region, and expressing their willingness to participate as responders. The investigation excluded women with specific medical conditions, including a prior diagnosis of diabetes mellitus, hypertension, cancer, HIV/AIDS, and pregnancy. The research area employed a quota sampling strategy for a duration of two months. Women of reproductive age who visit the healthcare facility between August and September 2021 were surveyed regarding their consent to participate in the study. Potential participants who express their consent were interviewed and anthropometric assessments were conducted. The anthropometric measures encompass the assessment of body weight and height through the utilization of digital scales, as well as the evaluation of the precision of the tools employed by microtools. The process of data collection was conducted by an enumerator who possessed expertise in nutrition education and had undergone training provided by the researchers.

Table 1. Recommendations for energy and protein intake

Age Group	Breast-fed		Non Breast-fed	
	Energy (Kcal)	Protein (gram)	Energy (Kcal)	Protein (gram)
16–18 yo	2490	79	2125	75
19–29 yo	2615	76	2250	65
29–49 yo	2515	77	2150	65

The independent variables in this study include energy and protein intake, food diversity, education, employment, economic status, nutritional knowledge, and age. The dependent variable is nutritional status. The nutritional status is classified into three categories: underweight (BMI <18.5 kg/m2), normal (BMI 18.5–22.9 kg/m2), and overweight (BMI ≥23 kg/m2) (World Health Organization, 2015).

Energy and protein intake data were gathered on two weekdays using an hour recall questionnaire. Food intake calculation was with NutriSurvey software. A comparison was made between the energy and protein intake of the respondents and the recommended energy and protein intake for women of reproductive age, as determined by the Indonesian Recommended Dietary Allowance (RDA). This comparison was particular to each age group and is presented in

Table 1 (Minister of Health Regulation No. 28 of 2019. Recommendations for Nutritional Adequacy Rates in Indonesia, 2019). In addition, the calorie and protein consumption was categorized into three groups: insufficient, sufficient, and excessive, according to the criteria employed in the 2014 Total Indonesian Diet Survey (Kementerian Kesehatan RI, 2014).

Insufficient energy intake was defined as being below 70% of the recommended dietary allowance (RDA), sufficient when consuming between 70%-130% of the RDA, and excessive if it was over 130% of the RDA. Protein intake was classified as insufficient if it was less than 80% of the RDA, sufficient if it was between 80%-120%, and excessive if it was over 120% of the RDA. During the process of conducting food recall interviews with participants, researchers utilized a Food Photo Book, which had been previously employed in the national research conducted for the Indonesian Total Diet Survey by the Indonesian Ministry of Health in 2013. This tool was employed to ensure a consistent level of perception regarding portion size, food type, and quantity.

The Individual Dietary Diversification Score (IDDS) questionnaire was used to quantify dietary diversification. The consumption of nine food groups—starchy foods, green vegetables, vitamin A-rich fruits and vegetables, other fruits and vegetables, offal, meat and fish, eggs, nuts and seeds, and milk and its processed products—allows for the evaluation of each person's unique food diversity. Food diversity was divided into three classes: low diversity (defined as having at least three food groups), medium diversity (defined as having at least four food groups), and high diversity (defined as having at least six food groups) (Andadari & Mahmudiono, 2017).

Through organized questionnaire-assisted interviews, information regarding age, nutritional awareness, work experience, education, and economic status was gathered. A standardized questionnaire was used to measure nutritional knowledge, which was divided into two categories: inadequate (< Median) and sufficient (≥ Median). Tertile 1 denotes low economic status, tertile 2 denotes medium economic status, while tertile 3 means high economic position (Ningrum et al., 2023).

Software for data analysis was SPSS 26. A 95% confidence level was used for both analytical and descriptive data analysis. The characteristics of the respondents, including age, education, occupation, nutritional status, energy and protein intake, dietary diversity, nutritional knowledge, and economic status, were presented using descriptive analysis. The association between energy intake, protein intake, dietary diversity, nutritional knowledge, education, employment, economic status, and age with nutritional status in women of reproductive age was examined using bivariate analysis using Chi Square and Fisher's Exact tests.

RESULT AND DISCUSSION

The study included 96 women of reproductive age, with a median age of 26 years. Up to 70% of women had completed college or have another higher education degree. About 57.3% women were unemployed. Overall, 46.9% of women had normal nutritional status (BMI 18.5–22.9 kg/m2). A majority (59.4%) of women consumed an acceptable amount of calories (80%–120%, exceeding the RDA >120%). However, a significant proportion (63.5%) had an inadequate intake of protein (less than 70% RDA, considered adequate if less than 70–130% RDA). Approximately 51% had a moderate level of dietary diversity, meaning they consumed 3-4 food groups per day. A majority of the participants in the study (54.2%) demonstrated adequate nutritional knowledge, whereas 42% of them fell within the tertile 2 economic position or demonstrated a medium economic status. (Table 2).

The findings from the bivariate analysis revealed a statistically significant association between energy intake and nutritional status (p=0.032). This study demonstrates that a higher proportion of women (54.2%) exhibit adequate nutrition compared to those with insufficient nutrition. The research revealed that there was no statistically significant correlation between protein intake and the nutritional status of WUS (p=0.207). Nevertheless, research indicates that women of reproductive age who have a satisfactory nutritional state are more prone to having a lower protein consumption rate of 50.5%. A strong correlation exists between the variety of food available and

Table 2. Characteristics of women in reproductive age in Makassar District

Variables	p-value
Age Group	
16–18 yo	5 (5.2)
19–29 yo	59 (61.5)
30–49 yo	32 (33.3)
Education Status	
Low	7 (7.3)
Moderate	18 (18.8)
High	71 (74.0)
Working Status	
Working	41 (42.7)
Not working	55 (57.3)
Nutritional Status	
Undernutrition	8 (8.3)
Normal nutritional status	45 (46.9)
Overnutrition	43 (44.8)
Energy intake (kcal)	
Insufficient	35 (36.5)
Sufficient	57 (59.4)
Excessive	4 (4.2)
Protein intake (gram)	
Insufficient	61 (63.5)
Sufficient	31 (32.3)
Excessive	4 (4.2)
Dietary diversity	
Low (Score <3)	0 (0.0)
Medium (Score 3–4)	49 (51.0)
High (Score >4)	47 (49.0)
Nutritional Knowledge	
Inadequate	44 (45.8)
Sufficient	52 (54.2)
Economic status	
Low	26 (27.1)
Medium	42 (43.8)
High	28 (29.2)

Notes: Bivariate Chi-Square Test *significant *p*-value <0.05

an individual's nutritional status (p=0.025). The majority of women with higher nutritional status (51.0%) adhered to a daily consumption of 3-4 food groups. Furthermore, the bivariate analysis revealed a strong correlation between nutritional knowledge and nutritional status (p=0.029). A significant proportion of water users (WUS) with higher nutritional status had lower levels of nutritional understanding. There exists a strong correlation between education and the prevalence of over-nutrition status (p=0.009). Furthermore, a majority of research participants (74.0%) who experienced overweight status possessed education levels falling within the medium and high categories. Table 3 below demonstrates that there was no significant correlation between economic position (p=0.146) and age (p=0.425) with nutritional status in women of reproductive age.

This study showed a substantial correlation between women of reproductive age's calorie intake and nutritional status. The study's conclusions demonstrated that overweight or underweight women of reproductive age were more likely to fall into the inadequate and sufficient energy intake groups. Good food access puts a person at risk for obesity or overweight, whereas poor food access puts a person at risk for undernutrition or underweight (Amirullah et al., 2020).

Each person's nutritional intake determines their current state of nutrition. It is well-established that a variety of factors impact nutritional status, yet these aspects are interrelated (Laswati, 2017). The major and secondary factors are what affect how the body uses nutrients. Conditions that impact food intake are primary issues because the food ingested does not have the right composition. Nutrient deficiencies resulting from the body's poor use of available nutrients are secondary factors (Stefani & Hanifah, 2022). In addition, lifestyle and surroundings might also have an impact on nutritional status (Kazaks & Stern, 2013).

One major element influencing how one's health is shaped is their nutritional state. A balanced intake of food that meets the body's needs for nutrients results in a condition known as nutritional status. Women of reproductive age have important nutritional needs, particularly before, during, and after pregnancy (Ainia & Notobroto, 2018).

The study's findings revealed no correlation between protein consumption and nutritional status. There is a negative correlation between the nutritional status among women of reproductive age and their protein intake. The study did not investigate the sources of protein intake, specifically whether it was derived from vegetable protein or animal protein. The field of nutritional science acknowledges that the use of food sources rich in vegetable protein, such as legumes, soybean products, tofu, and tempeh, as well as vegetables and fruits, can contribute to the maintenance of nutritional balance when ingested in a well-

balanced way. These findings do not provide a direct explanation for the inverse relationship between protein intake and the risk of obesity.

The nutritional status of an individual is directly influenced by their food intake. In addition to meal timings and portion sizes, it is imperative to consider the composition of the food ingested, since it has the potential to impact an individual's body weight. Insufficient intake of food, both in terms of amount and variety, can directly influence an individual's body weight. Individuals who consume food that meets the recommended caloric intake may encounter weight gain if their dietary choices are characterized by elevated levels of sugar and fat (Martony, 2020).

The findings of this study also indicated a substantial correlation between food diversity and nutritional status. The attainment of optimal nutritional status is contingent upon the consumption of nutritious food, necessitating careful consideration of both the quality and quantity of ingested food. An individual with a diverse dietary pattern, characterized by the ingestion of high-calorie foods, may experience elevated calorie intake, hence potentially resulting in heightened nutritional status or overweight (Melani, 2016). Consistent with prior studies, it was shown that women of reproductive age with normal nutritional health had a higher level of food diversification intake, albeit not statistically significant (Melani, 2016).

The present study revealed a statistically significant correlation between nutritional knowledge and nutritional status among older women. Additionally, it observed a propensity for a higher proportion of women with appropriate nutritional knowledge to exhibit such knowledge. This finding aligns with a study conducted in Lagos, which suggests that those with a high level of knowledge are more likely to exhibit good nutrition (Fasola et al., 2018). The influence of nutritional knowledge on food intake and subsequent impact on nutritional status has been demonstrated by Septiani et al. (2021). An individual's views and behavior around food will shape their food preferences and ultimately affect their nutritional consumption (Lestari, 2020).

There was no observed correlation between work status and both economic status and nutritional status in the present investigation. The study revealed that 50.9% of women who had a higher nutritional status were employed, and most women with a higher nutritional status had a moderate to high economic position. This finding contradicts prior research that suggests a favorable correlation between body weight, obesity, education, and per capita expenditure (Nugraha et al., 2021). Residents with higher incomes often exhibit consumption patterns characterized by an increased intake of food and beverages, resulting in a greater influx of energy into their bodies (Rachmi et al., 2017).

According to this study, there is a strong correlation between education and nutritional status. A majority of women within the reproductive age group who possess improved nutritional status have educational attainment levels falling within the medium and high categories. The correlation between obesity and educational attainment has been observed, albeit with varying directions across different regions (Safitri & Rahayu, 2020). Numerous studies conducted in India, Sri Lanka, Indonesia, and many African nations have demonstrated a significant correlation between educational attainment and the likelihood of developing obesity (Khusun et al., 2015; Rai, 2015; Somasundaram et al., 2019). Divergent findings were observed in the United States and France, wherein a negative correlation was observed between educational attainment and the likelihood of obesity (Drewnowski et al., 2014). The observed phenomenon is believed to be attributed to variations in the Human Development Index (HPI) between these nations. In underdeveloped countries, there is a correlation between educational attainment and obesity, but in industrialized countries, there is an inverse relationship between education and obesity (Safitri & Rahayu, 2020).

The present study has not identified a significant correlation between age and nutritional status. Unlike prior studies, the present research revealed a correlation between age and nutritional status, albeit with distinct measuring methods employed (Kusparlina, 2016). The present investigation employed upper arm circumference measurements, whereas the aforementioned study utilized body weight and height as indicators of

Table 3. Factors related to nutritional status among women of reproductive age in Makassar District

Variables	Under Nutrition	Normal Nutrition Status	Over Nutrition	n	*p*
	n (%)	n (%)	n (%)		
Energy intake					
Insufficient	2 (5.7)	14 (40.0)	19 (54.3)	35	
Sufficient	4 (7.0)	31 (54.4)	22 (38.6)	57	0.032**
Excessive	2 (50.0)	0	2 (50.0)	4	
Protein intake					
Insufficient	5 (8.2)	25 (41.0)	31 (50.8)	61	
Sufficient	2 (6.5)	19 (61.3)	10 (32.3)	31	0.207
Excessive	1 (25.0)	1 (25.0)	2 (50.0)	4	
Dietary diversity					
Low	0 (0.0)	0 (0.0)	0 (0.0)	0	
Medium	2 (4.1)	19 (38.8)	28 (57.1)	49	0.029*
High	6 (12.8)	26 (55.3)	15 (31.9)	47	
Nutritional knowledge	2 (4.5)	16 (36.4)	26 (59.1)	44	0.029*
Inadequate	6 (11.5)	29 (55.8)	17 (32.7)	52	
Education					
Low	0 (0.0)	6 (85.7)	1 (14.3)	7	
Moderate	1 (5.6)	3 (16.7)	14 (77.8)	18	0.009**
High	7 (9.9)	36 (50.7)	28 (39.4)	71	
Working status					
Working	4 (7.3)	23 (41.8)	28 (50.9)	55	0.348
Not working	4 (9.8)	22 (53.7)	15 (36.6)	41	
Economic status					
Low	0 (0.0)	12 (46.2)	14 (53.8)	26	
Medium	7 (16.7)	18 (42.9)	17 (40.5)	42	0.146
High	1 (3.6)	15 (53.6)	12 (42.9)	28	
Age group					
16–18 yo	0 (0.0)	4 (80.0)	1 (20.0)	5	
19–29 yo	5 (8.5)	27 (45.8)	27 (45.8)	59	0.425
30–49 yo	3 (9.4)	14 (43.8)	15 (46.9)	32	

Notes: Bivariate Chi-Square Test *significant *p*-value <0.05

nutritional health. It is important to acknowledge that an individual's nutritional health is directly impacted by their activity. Knowledge and the environment exert an influence on behavior (Lestari, 2020). One limitation of this study is the single-time nature of the data collection process, which limited the ability to establish a clear cause-and-effect relationship between several parameters associated to nutritional status in women of reproductive age.

CONCLUSION

A notable correlation exists between energy consumption, dietary diversity, nutritional literacy, and educational attainment with regards to the nutritional condition among women of reproductive age. In the Makassar area, a lack of substantial correlation was seen between protein consumption, occupation, economic position, and age with regard to the nutritional condition of women in reproductive age

RECOMMENDATION

Subsequent investigations should encompass the examination of physical activity, environmental conditions, attitude, and body image considerations, as these variables significantly influence an individual's nutritional state. The collection of data at a single point in time might have an impact on research findings, making it difficult to establish obvious cause and effect linkages. The findings of this study just demonstrate the impact of many factors associated with the nutritional condition of women in reproductive age, and the data collection is limited, as it only captures intake data for one 24-hour period.

The research is anticipated to yield valuable insights for the development, monitoring, and evaluation of initiatives targeting women of reproductive age.

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THE EFFECT OF NUTRITIONAL COUNSELING USING ONLINE MEDIA (*NUTRILOVE*) ON THE NUTRITIONAL KNOWLEDGE OF PREGNANT WOMEN

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ABSTRACT

Anemia in pregnant women is a nutritional problem that has not yet been solved. The cause of anemia is directly due to the unavailability of sufficient nutrients in the body and indirectly caused by a lack of knowledge of pregnant women. This study aimed to determine the difference in the knowledge of pregnant women with lecture method counseling using the educational media Nutrilove website. This type of research is a quasi-experimental non-randomized control group pre-test post-test design. The sample consisted of 24 pregnant women in Wandanpuro Bululawang Village who were divided into 2 groups, the control group consisted of 12 pregnant women who were not given any intervention and the intervention group consisted of 12 people who were given lectures using the Nutrilove website media. The knowledge score was carried out 2 times, before and 3 weeks after the intervention and grouped into 3 categories, good, sufficient, and poor. Statistical tests used paired sample t-test and independent t-test. There was a significant difference in knowledge before and after intervention (p=0.005) and a significant difference in the knowledge of pregnant women between the control group and the treatment group (p=0.001). The counseling method using the Nutrilove website media can increase pregnant women's knowledge about the importance of consuming iron and folic acid in preventing anemia.

Keywords: folic acid, iron, knowledge, pregnant women, website

INTRODUCTION

Meeting the nutritional needs of pregnant women needs to be done appropriately because pregnant women who lack nutritional intake will affect the fetus which will have a negative effect on both the mother and the fetus in the womb. Unmet nutrient intake for pregnant women will have harmful impacts on the mother, one of which can cause anemia. Anemia is a nutritional problem that can be experienced by all age groups ranging from toddlers, adolescents, pregnant women, and the elderly. Based on WHO data in 2019, the global prevalence of anemia is 36.5% in pregnant women. According to Riskesdas (2018), the prevalence of anemia in pregnant women in Indonesia reached 48.9%. This percentage increases when compared to Riskesdas data in 2013 which showed the percentage of anemia in pregnant women in Indonesia was 37.1%. The causative factors of anemia can be different for each age group. In general, anemia is caused by the unavailability of nutrients in the body that play a role in the formation of red blood cells. The biggest cause of anemia in Indonesia is lack of iron, folic acid, and vitamin B12 (Citrakesumasari, 2012).

Anemia is caused directly due to lack of consumption of nutrients, especially iron and folic acid. Indirectly, anemia is caused by lack of knowledge in pregnant women. Various efforts have been made in preventing and overcoming the occurrence of anemia in pregnant women. The government provides blood added tablets (TTD) which is prioritized for at least 90 days during pregnancy because the prevalence of anemia in pregnant women is still high. Another effort that has been made to prevent anemia in pregnant women is by providing counseling and education about nutrition for pregnant women to enable them to change eating habits to be healthier and more balanced. Counseling that has been carried out to increase knowledge in pregnant women uses leaflets, turning sheets, booklets, and animated videos.

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As many as 30% of pregnant women in Wandanpuro Village are included in high-risk pregnant women, one of which is caused by anemia. Pregnant women have received counseling at posyandu with leaflet media about the importance of consuming blood-added tablets during pregnancy, but the number of pregnant women suffering from anemia has not decreased.

Based on the above background, researchers are interested in conducting research on differences in nutritional knowledge of pregnant women before and after counseling with *online media* (*nutrilove website*) about the importance of iron and folic acid consumption in preventing anemia in Wandanpuro Village, Bululawang District.

METHOD

This type of research is *quasi-experimental* with *a non-randomized control group pretest-posttest design*. The research was conducted in Wandanpuro Village, Bululawang, Malang Regency. The population in this study was all 31 pregnant women. The sample needed in this study was 24 people who were used using the Slovin formula. Sampling using *purposive sampling techniques* that meet the inclusion requirements is then taken randomly. Inclusion criteria include pregnant women with a gestational age of less than 36 weeks, having a smartphone that is able to access the internet, being able to read and communicate well, and being willing to follow the entire series of research. The exclusion criteria are pregnant women who are sick and cannot participate in research, move house, and drop out because they do not participate in complete activities.

The independent variable in this study is the knowledge of pregnant women, while the dependent variable is counseling using the Nutrilove website media. Data collection through interviews with the help of questionnaires includes data on the characteristics of pregnant women (name, mother's age, gestational age, mother's education, and mother's occupation) and knowledge of pregnant women. The mother's knowledge questionnaire consists of 30 questions. The level of knowledge of mothers is grouped into good if the respondent's score > mean score + 1 SD, enough if the score is -1 SD < the respondent's score < the mean score + 1, and less if the respondent's score < the mean score - 1.

The data were analyzed using the paired t-test statistical test with a meaning limit of α=0.05. The analysis was used to determine the difference in the value of knowledge before and after education was given in the treatment group and without education in the control group. Furthermore, an independent t-test was carried out to determine the difference in knowledge between the control group and the treatment group. This research has received ethical approval from the Poltekkes Research Ethics Commission of the Ministry of Health Malang Number 650/KEPK-POLKESMA/2022.

RESULTS AND DISCUSSION

The characteristics of pregnant women are seen in Table 1. The average age of the control group respondents was 29 years with the youngest pregnant women 23 years old and the oldest 36 years old. The treatment group had an average age of 29 years with the youngest pregnant women 24 years old and the oldest 38 years old. The majority of pregnant women aged 26-35 years in the control group were seven people (58.3%) and in the treatment group as many as nine people (75%).

The gestational age of pregnant women was mostly in the range of 25-35 weeks in the control group (50%) and balanced in the gestational age range of 13-24 weeks and 25-35 weeks in the treatment group (41.7%).

Most respondents had a high school education level with details of 58.3% in the control group of seven people and 50% in the treatment group of six people. The majority of pregnant women had jobs as housewives with details of 83.3% in the control group and 75% in the treatment group.

The distribution of knowledge levels of pregnant women before and after intervention can be seen in Table 2. The level of knowledge of respondents in the control group before treatment was given as many as three people with good knowledge (25%), seven people with sufficient knowledge (58.3%), and two people with less knowledge (16.7%). After three weeks without treatment, the level of knowledge of pregnant

Table 1. Characteristics of pregnant women respondents in Wandanpuro Bululawang Village

Characteristic	Control Group		Treatment Group	
	n	%	n	%
Mother's Age				
17-25	4	33.3	2	16.7
26-35	7	58.3	9	75
36-45	1	8.3	1	8.3
Sum	12	100	12	100
Gestational Age				
1-12 weeks	1	8.3	2	16.7
13-24 weeks	5	41.7	5	41.7
25-35 weeks	6	50	5	41.7
Sum	12	100	12	100
Mother's Last Education				
Graduated from elementary school	1	8.3	0	0
Graduated from Junior High School / equivalent	2	16.7	2	16.7
High school graduation/ equivalent	7	58.3	6	50
College	2	16.7	4	33,3
Sum	12	100	12	100
Mother's Work				
IRT	10	83.3	9	75
Teacher	0	0	1	8,3
Private	1	8.3	1	8,3
Self employed	1	8.3	1	8,3
Sum	12	100	12	100

women in the control group was in the good category of one person (8.3%), seven people with sufficient knowledge (58.3%), and four people with less knowledge (33.3%).

The level of knowledge of pregnant women in the treatment group before being given the intervention was good as much as one person (8.3%), enough as many as nine people (45%), and less as many as two people (16.7%). Meanwhile, after being treated in the form of education using the Nutrilove website media, an increase in knowledge was obtained in pregnant women, namely the number of pregnant women with good knowledge increased to six people (50%) and enough knowledge as many as six people (50%).

Increased knowledge before and after the intervention due to respondents' compliance in reading articles and understanding the material on the Nutrilove website provided. The increase in knowledge itself is influenced by several factors, namely, education, personal experience or others, mass media and the environment (Notoadmojo, 2012). Knowledge indicators are the results of obtaining information from all questions to pregnant women about the importance of iron and folic acid consumption listed on the questionnaire. Respondents' nutritional knowledge was assessed in answering 30 questions asked in the knowledge test. Each statement is given a score of 1 (one) if the respondent's answer is correct and 0 (zero) if the respondent's answer is incorrect. Once calculated, the correct score is divided by the total score and multiplied by 100. The highest score is 100 (if all respondents' answers are correct) and the lowest score is 0 (zero).

Questions are asked related to the understanding of anemia, the characteristics of anemia, how to overcome anemia, understanding iron and folic acid, the benefits of iron and folic acid, the need for iron and folic acid, foods containing iron and folic acid. Respondents' answers are scored and scored. The results are divided into three, namely good, sufficient, and less as can be seen in Table 2.

Before the intervention in both the control group and the treatment group of 24 people, respondents answered the most wrong questions about how to prevent anemia in pregnant women, foods that are not sources of folic acid, and the

Table 2. Distribution of knowledge of pregnant women before and after the intervention

Knowledge Level	Control Group				Treatment Group			
	Before		After		Before		After	
	n	%	n	%	n	%	n	%
Good	3	25	1	8.3	1	8.3	6	50
Enough	7	58.3	7	58.3	9	75	6	50
Less	2	16.7	4	33.3	2	16.7	0	0
Sum	12	100	12	100	12	100	12	100

adverse effects of folic acid deficiency during pregnancy. There were 21 mothers who answered incorrectly (87.5%) and only three mothers answered correctly (12.5%).

On the question of how to prevent anemia in pregnant women, mothers who answered incorrectly came from mothers with the age group of 17-25 years as many as five people (23.8%), 14 mothers came from the age group of 26-35 years (66.7%), and two came from the age group of 36-45 years (9.5%). On the question of food ingredients that are not sources of folic acid, mothers who answered incorrectly aged 17-25 years were five people (23.8%), 14 people aged 25-36 years (66.7%), and two aged 36-46 years (9.5%). On the question of the adverse effects of folic acid deficiency during pregnancy, mothers who answered incorrectly aged 17-25 years were as many as six people (28.6%), 26-35 years old 14 people (66.7%), and 36-46 years as many as two people (9.5%). An individual's actions or behavior will change with age. The older a person is, the more mature he will be in performing actions (Notoatmodjo, 2012).

Of the 21 respondents who answered incorrectly on the question of how to prevent anemia in pregnant women, one person had an elementary school education (4.8%), four people had a junior high school education (19%), 10 people had a high school education (47.6%), and six people had a college education (28.6%). On the question of food ingredients that do not contain folic acid, 21 respondents answered incorrectly as many as one person with elementary school education (4.8%), three people with junior high school education (14.3%), 11 people with high school education (52.3%), and six people with college education (28.6%). In the case of the adverse effects of folic acid deficiency on pregnant women, as many as one person with elementary school education (4.8%), four people with junior high school education (19%), 11 people with high school education (52.3%), and five people with college education (23.8%). The higher a person's knowledge, the better they will be compared to a low level of education (Notoatmodjo, 2012).

Pregnant women who answered incorrectly on the question of how to prevent anemia were mostly housewives as many as 16 people (76.2%), teachers as many as one person (4.8%), private as many as two people (9.5%), and self-employed as many as two people (9.5%). In the matter of foodstuffs that are not sources of folic acid, the majority as housewives as many as 18 people (85.7%), teachers one person (4.8%), private one person (4.8%), and entrepreneurs one person (4.8%). The majority of mothers who answered incorrectly about the adverse effects of folic acid deficiency and pregnant women work as housewives as many as 17 people (81%), private as many as two people (9.5%), and self-employed as many as two people (9.5%).

After the intervention, there was an increase in knowledge in the treatment group. Of the 12 people in the treatment group, eight (66.7%) had an increase in correct answers. Pregnant women who experienced an increase in answering questions to be correct had a high school education of 6 people (50%), S1 as many as one person (8.3%), and S2 as many as one person (8.3%). The education level of respondents is one of the factors that affect the knowledge of pregnant women. According to Notoatmodjo (2014), the factor that has the greatest influence on a person's knowledge is education, because someone with a high education can give a more rational response to the information received (Damayanti & Sofyan, 2022).

However, the education level of respondents varies from elementary school, junior high school, high school, and college so that mothers' knowledge is not only influenced by education but also influenced by other things, one of which is individual experience, namely exposure to information provided through the Nutrilove website. Researchers conducted research for three weeks, every week researchers monitored pregnant women two times to ask whether they had read the content on the website and conducted questions and answers and discussions related to the content of the content at the end of the week. Through questions and answers and discussions carried out, these can help pregnant women to better understand the content on the website so that the level of knowledge of pregnant women in the treatment group increases.

Table 3 shows that the average knowledge score in the control group during the pre-test was 33.90 with a standard deviation of 12.709 and the

Table 3. Average knowledge score of respondents before and after counseling

Variable	Group	Pretest	Posttest	Δ1	P
		Average ± SD	Average ± SD		
Knowledge	Control	33.90 ± 12.709	31.66 ± 11.335	2.24	0.217
	Treatment	39.44 ± 11.530	53.34 ± 15.960	13.9	0.005
	Δ2	5.54	21.68		
	P	0.275	0.001		

post-test mean was 31.66 with a standard deviation of 11.335. The value of knowledge before and after without treatment decreased by 2.24. Based on the results of the paired t-test in the control group, there was no significant difference in the average knowledge score between the pre-test and post-test (p = 0.220).

The average knowledge score in the treatment group during the pre-test was 39.44 with a standard deviation of 11.530. After the intervention, the average knowledge score became 53.34 with a standard deviation of 15.960. The value of knowledge before and after the intervention using the Nutrilove website increased by 13.9.

The paired t-test results showed a significant difference in the average knowledge score between the pre-test and post-test (p = 0.005) in the treatment group. These results prove a significant difference before and after counseling with the Nutrilove website media on the knowledge of the importance of folic acid and iron consumption in preventing anemia in pregnant women.

The results of the independent t-test showed that, between the control group and the treatment group, there was no significant difference (p = 0.274) in the value of knowledge of pregnant women at the time of the pre-test with the difference in the pre-test value of the control group and treatment of 5.54. Meanwhile, during the post-test, the knowledge value of pregnant women between the control group and the treatment group showed a significant difference (p = 0.001) with a difference in knowledge value of 21.68. This shows a significant difference in knowledge between the treatment group given counseling with the Nutrilove website media and the control group.

Based on Table 3, there was no significant change in the knowledge value of pregnant women between pre-test and post-test in the control group because the control group was not given any education by the researcher so that there was no change in knowledge in pregnant women. Pregnant women who are members of the control group may still not have awareness and interest in the questions given. This is due to the absence of stimulus given to the control group so that there is no learning process that can affect in increasing maternal knowledge. This was evidenced when conducting interviews, researchers offered and invited respondents to gather at the meeting place because there would be counseling about the importance of iron and folic acid consumption in preventing anemia but they were not willing because they were not interested in coming to participate in this counseling activity. Even after filling out the pre-test, respondents did not have the initiative to ask questions related to the questions asked in the pre-test questions.

Apart from the source of information on the Nutrilove website, the same information is also provided in other sources either through websites, booklets, or other information media that are already available. However, it is possible that, because the absence of awareness and interest affects low curiosity, the knowledge value of pregnant women in the control group has not changed significantly. Because there was no stimulus given to pregnant women in the control group carried out by researchers and there was no interest or initiative to seek information from other sources, the level of knowledge was still not reached.

The difference in knowledge with the Nutrilove website media in pregnant women on the importance of iron and folic acid consumption in preventing anemia in the treatment group and the significant difference between the knowledge of pregnant women in the control and treatment groups proves that the Nutrilove website can

affect the difference in the level of knowledge of pregnant women.

This is in line with research (Aljraiwi,2017) with female student respondents at Princess Nourah bint Abdulrahman University which stated that the use of website-based learning media makes it easier for respondents to learn because website applications can be accessed anytime and anywhere with various media such as personal computers, smartphones, and tablets. The research also stated that respondents who used learning media with websites provided feedback and were good and more active in asking questions compared to respondents who study conventionally or without using websites. Likewise, in this study, the treatment group had greater initiative to ask questions than the control group.

In research by DeBar et al. (2008), as many as 50% of respondents used website media with the aim of finding information related to healthy diet and exercise for teenagers. This is characterized by increased calcium consumption and increased physical activity of respondents after utilizing website media. This is supported by research by Moradi et al. (2017) in female high school students who stated that the average score of students' knowledge and behavior increased after being given an intervention using website media about efforts to prevent anemia.

Astutik et al. (2021) also stated that there was a significant increase in the knowledge of postpartum mothers on infant and child feeding using the website in the Peristi Inpatient Room of RSUD Sidoarjo. This research is supported by (Farikhah,2021) who states that educational media that lined up infographics and web with balanced nutrition material show a good response rate as shown by changes in knowledge, intake, attitudes, and practices of balanced nutrition in IAIN Kudus students. The research is also in line with Aisfa (2020) who states that there is an increase in the value of knowledge before and after education using the Stunting Early Detection (DDS) website on the knowledge of mothers about stunting under five at the Bareng Health Center. Ernawati et al. (2022) stated that there was an increase in knowledge, attitudes, and behavior among respondents of young women at SMA 12 Makassar using the website *She Smart* about anemia education.

This study is not in line with research by Abuidhail et al. (2019) which stated that there was no significant increase in knowledge in third trimester pregnant women who were given education using prenatal websites about breastfeeding education when compared to the control group. However, this prenatal website contributes to improving the self-efficacy of breastfeeding. This is not in line with research by Huang et al. (2007) which stated that pregnant women with a gestational age of 29-36 weeks who were given a website-based educational intervention had a higher knowledge score about breastfeeding compared to the control group who were not given the intervention. In addition, web-based breastfeeding education also has a significant influence on the attitude of pregnant women.

Counseling using the Nutrilove website media can help respondents understand the material because of the direct recognition of objects through the senses of the eyes and ears. Knowledge is the result of knowing that occurs after sensing a certain object (Notoadmodjo, 2014). The more senses used, then the better the object's acceptance of the material delivered (Wulandari, 2017 in Handayani et al., 2022). The introduction of material through the Nutrilove website is a stimulus that is then received by pregnant women into availability for action. Pregnant women in the treatment group have awareness and interest in participating in counseling activities. Because of the awareness and interest, they have curiosity and start learning because they feel they need the information provided in the article on the Nutrilove website. Finally, with the support of facilities in the form of this website, it has an effect on individuals in the form of changes in knowledge (Khomsan &; Firdaus, 2022).

These results were obtained because the counseling method with the Nutrilove website can help stimulate the sense of sight because it presents information that has been prepared to be conveyed and discussed together during the meeting. In addition, the existence of counseling media helps pregnant women respond to information according to the perceiving power of the five senses. Pregnant

women can also access the media provided, namely the Nutrilove website wherever they are so that the information received by mothers is maximized. This is evidenced by interviews through the WhatsApp application whether the website has been used by mothers at home and all mothers in the treatment group use the website well as evidenced by the activity of re-reading articles on the website when at home and questions and answers between pregnant women and researchers related to the information discussed on the Nutrilove website via WhatsApp.

According to Notoatmodjo (2012), educational media can generate interest in the intended target, achieve many targets, facilitate the provision of health information, facilitate the receipt of information appropriately by objects, motivate objects to carry out the messages that have been conveyed, and help to reinforce the knowledge gained so that it is stored longer in memory.

CONCLUSION

There is an influence of nutrition counseling on the knowledge of pregnant women between before and after intervention in the treatment group with the Nutrilove website media.

Suggestions: the posyandu can apply counseling using the Nutrilove website media as a new counseling medium in increasing the knowledge of pregnant women. In addition, it is necessary to conduct research on other variables such as attitudes, behavior, and consumption levels using the Nutrilove website extension media to determine their influence on these variables.

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ENHANCEMENT OF SPORTS NUTRITION KNOWLEDGE AND ENERGY INTAKE AFTER SPORTS NUTRITION EDUCATION FOR COMBAT ATHLETES

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ABSTRACT

Providing nutrition and food support is necessary for enhancing and maximizing athletic performance in individuals engaged in sports activities. This study aimed to examine the impact of sports nutrition education on combat athletes' sports nutrition knowledge and nutritional sufficiency. This quantitative study used a quasi-experimental design, explicitly utilizing a pretest-posttest control group design. The study included a total of 76 participants, who were categorized into two groups: intervention and control. Each group consisted of 38 athletes. The data were analysed using SPSS. The Independent T-Test and Paired T-Test determined if the data followed a normal distribution. The Mann-Whitney and Wilcoxon Signed Rank tests were employed if the data did not follow a normal distribution. The nutrition education intervention comprised seven weekly materials sent to the intervention group. The findings indicated significant nutritional knowledge differences (p=<0.001) between the intervention and control groups. Additionally, there were significant differences in the sufficiency of energy intake (p=0.029) within the intervention group. The study's findings indicated that nutrition education significantly affected the intervention group's sports nutrition knowledge and energy intake adequacy. Additionally, the nutrition education intervention significantly affected the sports nutrition knowledge of the control group. Athletes' enhanced understanding will positively affect their ability to satisfy energy requirements.

Keywords: adequate energy intake, athletes, healthy lifestyle, nutrition education, nutrition knowledge

INTRODUCTION

Providing athletes with specific nutrients and foods that cater to their requirements is essential to enhance and optimize athletic performance (Kerksick et al., 2018). Athletes require macronutrients, including energy, protein, and carbs, in significant amounts. These nutrients are essential for athletes due to their high activity levels, intense training, and the body's requirement to enhance muscle growth (American Dietetic Association et al., 2009).

Previous research demonstrated that most athletes need assistance meeting their specific nutrient requirements. Inadequate nutrient intake among athletes in fulfilling their nutritional requirements can stem from various issues, including a lack of familiarity with sports nutrition (Jagim et al., 2019). Approximately 46% of Australian athletes are limited in sports nutrition, including weight management, macronutrients, micronutrients, supplements, and other relevant topics (Jenner et al., 2018).

Athletes typically receive knowledge regarding sports nutrition indirectly from those in their immediate circle, such as parents, friends, and coaches (Torres-McGehee et al., 2012). Frequently, they also acquire information from their smartphones over the internet; however, although obtaining information is easily accomplished nowadays, the supervision of athletes' nutritional status should be conducted by nutritionists or healthcare professionals. Nevertheless, cell phones provide remote monitoring for nutritionists and aid athletes in tracking their food intake and weight management (Kustiawan et al., 2022).

Likewise, athletes participating in weight-sports such as combat or martial arts such as karate, muaythai, judo, and others must manage their body weight. Monitoring fat mass is essential for maintaining a balanced body composition and weight. The purpose of conducting these body composition measurements is to utilize them as assessments and interventions for athletes (Campa et al., 2021). Only a select few athletes intentionally engage in rapid weight loss prior to a

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match or tournament. Combat athletes commonly employ strategies to lose weight, such as restricting food and hydration intake, engaging in intense physical activity, or utilizing saunas and hot baths to induce profuse sweating (Pettersson et al., 2013).

Nikolaidis (2014) conducted a study revealing that a mere 6% of athletes had a high level of proficiency in sports nutrition knowledge, whereas the remaining 45.6% scored below the mean. In comparative research examining nutrition education interventions over four weeks, it has been observed that the group receiving instruction through the extension approach demonstrates a more significant improvement in knowledge than the group not receiving such education (Zeng et al., 2020).

Athletes' knowledge of sports nutrition can positively affect their dietary choices. Previous study on athletes indicates that a higher level of nutritional knowledge is associated with a preference for fruits, vegetables, and high-carbohydrate diets (Alaunyte et al., 2015). This study aimed to determine the effect of sports nutrition education on combat athletes' sports nutrition knowledge and nutritional sufficiency. Similar research has yet to be discovered on combat athletes thus far. The use of sports nutrition education interventions aims to enhance nutritional awareness and fulfil the specific dietary requirements of combat athletes.

METHODS

Research Type and Design

This study employed a quasi-experimental approach, namely a pretest-posttest control group design, to gather quantitative data. The intervention group received dietary education by distributing informational leaflets, counselling sessions, and group discussions. The control group received solely booklet material for nutrition instruction.

Intervention Procedure

The intervention was administered over seven weeks, with seven weekly sessions from March to April 2023. The sports nutrition education intervention covered the following topics:

Table 1. Intervention Materials

Meeting	Topic	Methods	
		Intervention Group	Control Group
1	Basic Nutrition Science	Booklet media provision, counselling and group discussion Duration: 30-45 minutes	Booklet media provision
2	Preparation period nutrition		
3	Competition nutrition		
4	Post-match nutrition		
5	Body composition and body image		
6	Hydration		
7	Supplementation		

Source: WAVE project, modified (Wong et al., 2018)

Nutrition education interventions were conducted by experienced sports nutritionists who have previously assisted athletes in the National Sports Week (PON).

Research Location and Sample

The study was undertaken at the KONI East Java Province. The participants in this study were combat athletes who satisfied specific criteria, including being between the ages of 16 and 25, having received official education on sports nutrition, and being willing to participate in the study's survey at its conclusion. The exclusion criteria for this study encompassed athletes who were experiencing injuries or undergoing pharmacological therapy, athletes with infectious or other long-standing medical conditions.

A sample calculation was performed in this investigation using the Chow et al. (2017) formula. The study included 76 athletes separated into two intervention groups and a control group, with a sample size ratio of 1:1. There were 38 athletes in both the intervention and control groups.

Data Collection

The data-collecting procedures involved administering online surveys to respondents through Google Forms. The questionnaires consisted of inquiries regarding respondent characteristics and sports nutrition expertise.

Subsequently, interviews were conducted to gather 2x24h food recall data. Two rounds of data collection were conducted to assess sports nutrition knowledge and dietary intake through two 24-hour food recalls before and after the implementation of the sports nutrition education intervention.

The Abridged Nutrition for Sport Knowledge Questionnaire (ANSKQ) was employed as the basis for the sports nutrition knowledge questionnaire. The ANSKQ was adapted and translated into Indonesian to enhance comprehension. The ANSKQ has 34 comprehensive inquiries regarding knowledge in sports nutrition, with response options including agree/disagree/unsure or high/low/not sure or sufficient/not sufficient/not sure or yes/no/not sure.

A 48-hour food recall interview was undertaken to gather data on nutritional sufficiency. The interview took place over two days that were not consecutive. The data collected were obtained from a single weekday and a single weekend. The food recall data for two consecutive 24-hour periods were analysed using the Nutrisurvey 2007 software. The mean of the two outcomes from the 24-hour food recall was computed, and the proportion of calorie, carb, protein, and fat adequacy was subsequently determined and compared to each participant's requirements.

Data Analysis

The data were subjected to descriptive and comparative analysis to identify differences in nutritional awareness and adequacy of intake. Before analysis, the data underwent a Kolmogorov-Smirnov normality test to assess normal distribution. The normality test results indicated that the variables of nutritional awareness, adequate calorie intake, carbs, protein, and fat exhibited a non-normal data distribution. Therefore, the Mann-Whitney test and Wilcoxon signed rank test were employed.

The study has received ethical approval from the ethics commission of the Faculty of Dentistry, Airlangga University, Surabaya, with the reference number 090/HRECC.FODM/II/2023.

RESULTS AND DISCUSSION

Combat athletes or martial arts athletes participate in sports that primarily involve tactics such as kicking and punching (Vertonghen et al., 2014). The participants in this study encompassed individuals aged 16 to 25 years, from youth to early adulthood. The average age of athletes in the intervention group was 19.34 ± 2.44 years; on the other hand, in the control group, the average age was 20.5 ± 2.54 years, providing insight into the optimal age range for professional athletes.

Table 2. Characteristics of Respondents

Respondent Characteristics	Intervention Group		Control Group	
	n	(%)	n	(%)
Age				
Mean ± SD	19.39 ± 2.44		20.5 ± 2.54	
Gender				
Male	19	50.0	16	42.1
Female	19	50.0	22	57.9
Sport Branch				
Kempo	0	0	15	39.5
Kurash	0	0	10	26.3
Taekwondo	0	0	13	34.2
Judo	15	39.5	0	0
Karate	16	42.1	0	0
Muaythai	7	18.4	0	0
Length of time as an athlete				
Mean ± SD	8.94 ± 3.47		10.28 ± 2.88	
Education Level				
Senior High School	20	52.6	10	26.3
College	14	36.8	26	68.4
College Graduate	2	5.3	2	5.3

The age distribution of participants in this study aligns with previous research on combat athletes, specifically young judo athletes, with an average age of 20 ± 1.3 years (Radovanovic et al., 2012). Additional research was conducted on karate athletes between the ages of 16 and 30, as documented by Rynkiewicz et al. (2010). The period of youth is considered a prime time for athletes, frequently encompassing the age range of roughly 20 years. This phase is widely recognized as the most fruitful period for athletes to reach their peak performance and attain the highest level of success (Farapti et al., 2019).

The study included a more significant proportion of female athletes, precisely 41 individuals (53.94%), with 19 individuals in the intervention group and 22 in the control group. Out of 35 athletes, male athletes accounted for 46.05% and significantly preferred combat sports (Farapti et al., 2019). Nevertheless, combat sports

do not impose specific limitations based on gender; both male and female combat athletes frequently undergo the same training regimens and adhere to similar routines.

Female athletes frequently need more diets due to more understanding of nutrition and misconceptions about proper nutrition. Inadequate nutrition can lead to the development of the Female Athlete Triad in female athletes, which consists of poor energy availability, menstruation abnormalities, and low bone mass (Hoogenboom et al., 2009). Male and female athletes must comprehensively understand sports nutrition to prevent nutritional issues stemming from a need for more information.

Adequate nutrition is crucial for the growth and development of athletes (Heikkilä et al., 2019). Comprehending the significance of daily food intake in promoting performance, health, and post-competition recovery necessitates a sufficient understanding of nutrition (Birkenhead & Slater, 2015). Athletes with lengthier training camp experience possess sufficient expertise in sports nutrition. Certain athletes acquire nutritional guidance from nutritionists and their coaching staff (Torres-McGehee et al., 2012)). Nevertheless, some athletes continue to depend on friends, family, and magazines to acquire nutritional information and understand the specific nutrients required for athletes. Athletes with specific dietary objectives will adhere to a diet to enhance their performance and achieve an ideal body composition (Andrews et al., 2016).

Most respondents were college-level athletes, specifically 40 individuals (52.63%). Typically, individuals who are engaged in higher education or are enrolled as students possess a greater comprehension of the significance of nutritional information and the adoption of appropriate dietary patterns (Berliandita & Hakim, 2021). Individuals with greater levels of education tend to possess better memory and concentration abilities than those with lower levels of education (Tam et al., 2022).

Sports Nutrition Knowledge

A thorough understanding of nutrition is essential for making informed choices when

Table 3. The Differences in Nutrition Knowledge Score between Intervention Group and Control Group Before Sports Nutrition Education Intervention

Variable	Mean ± SD		*p-value*
	Intervention Group	Control Group	
Sports Nutrition Knowledge[a]	35.55 ± 12.3	32.79 ± 10.5	0.422

[a]using Mann Whitney test
*there are significant differences (p<0,05)

Table 4. The Differences in Nutrition Knowledge Score between Intervention Group and Control Group after Sports Nutrition Education Intervention

Variable	Mean ± SD		*p-value*
	Intervention Group	Control Group	
Sports Nutrition Knowledge[a]	50.79 ± 12.0	43.84 ± 5.6	**0.025***

[a]using Mann Whitney test
*there are significant differences (p<0,05)

Table 5. The Differences in Sports Nutrition Knowledge Score Before and After Nutrition Education Intervention in Each Intervention Group and Control Group

Variable	Intervention Group	*p-value*[b]	Control Group	*p-value*[b]
	Mean ± SD		Mean ± SD	
Knowledge Level				
Before	35.55 ± 12.32	**<0.001***	32.79 ± 10.56	**<0.001***
After	50.79 ± 12.09		43.84 ± 5.62	

[b]using the Wilcoxon Signed Ranks Test
*there are significant differences (p<0.05)

selecting food. In the absence of knowledge regarding certain food items and their nutritional content, athletes may need help making informed decisions about their diet due to the effect of food and its potential individual advantages (Wansink et al., 2005).

Athletes benefit from having a good understanding of nutrition and consuming high-quality meals (Heaney et al., 2011).

Table 3 indicates no statistically significant difference between the intervention and control groups, as evidenced by a p-value of 0.422 (p>0.05). Nevertheless, Table 4 demonstrates significant differences between the intervention and control groups following the nutrition education intervention, as indicated by a p-value of 0.025 (p<0.05). Based on the mean score, the intervention group outperforms the control group.

This study examined combat athletes and revealed significant differences in sports nutrition knowledge between the intervention and control groups after implementing nutrition education interventions. Both groups exhibited a p-value <0.05, indicating statistical significance (Table 5). This study aligns with the findings of Foo et al. (2021), who demonstrated that a 7-week nutrition education intervention conducted through classroom discussions resulted in a significant 8.3% improvement in athletes' nutritional knowledge.

Prior studies have also demonstrated comparable findings, specifically an augmentation in nutritional comprehension following nutrition education interventions among adolescent athletes participating in diverse sports such as dancing, swimming, and football (Heikkilä et al., 2019). Utilizing booklet media for nutrition education interventions in the control group can help enhance nutritional knowledge. This study aligns with prior research conducted by Afandi (2020) on sports athletes. The study's findings indicate a significant improvement in athletes' nutritional awareness following the provision of a pocketbook (p <0.05) (Afandi & Siregar, 2020).

The enhancement in sports nutrition knowledge in the intervention and control groups can be attributed to using practical approaches and media. The intervention group exhibited a 4.19-point increase in mean sports nutrition knowledge score compared to the control group after the nutrition education intervention (Table 5).

The findings of this study are consistent with prior research conducted by Zeng et al. (2020). The study revealed a noteworthy enhancement in sports nutrition knowledge among the intervention group following nutrition education through lectures or counselling methods (p<0.01), as opposed to groups that solely received educational media (Zeng et al., 2020).

Adequate Intake

Athletes need an ideal training system that includes the availability and adequacy of nutrients specific to their sport to achieve maximum performance. Athletes have a fundamental requirement for meeting their nutritional needs. These nutrients play a vital role in the body's physiological functioning, supplying energy during physical activities such as training, competition, and recovery. This includes both post-training and post-competition recovery periods (Suniar, 2002).

The present study determined the effect of nutrition education interventions on disparities in nutrient intake sufficiency between the pre-intervention and post-intervention periods. Nutrition education interventions are targeted initiatives that aim to assist individuals in altering their dietary patterns and enhancing their

Table 6. The Differences in Adequate Intake between Intervention Group and Control Group Before Sports Nutrition Education Intervention

Variable	Mean ± SD		*p-value*
	Intervention Group	Control Group	
Energy [a]	79.18 ± 22,2	74.47 ± 24.3	0.124
Carbohydrates [a]	64.21 ± 24,5	63.68 ± 23.6	0.975
Protein[a]	80.55 ± 25.2	76.68 ± 29.5	0.499
Fat [a]	109.55 ± 40.1	96.66 ± 38.2	0.146

[a]using the Mann Whitney test
*there are significant differences (p<0.05)

Table 7. The Differences in Adequate Intake between Intervention Group and Control Group after Sports Nutrition Education Intervention

Variable	Mean ± SD		*p-value*
	Intervention Group	Control Group	
Energy[a]	88.03 ± 19.1	71.50 ± 25.4	**0.001***
Carbohydrates[a]	60.58 ± 23.2	64.79 ± 24.9	0.636
Protein[a]	87.84 ± 21.1	72.53 ± 28.0	**0.011***
Fat[a]	97.34 ± 20.2	87.21 ± 37.8	**0.038***

[a]using the Mann Whitney test
*there are significant differences (p<0.05)

understanding of nutrition (Murimi et al., 2017); according to a systematic review conducted by Bentley et al. (2020), athletes' dietary patterns changed for the better following the administration of sports nutrition education interventions. Positive dietary behavior was observed among the participants.

Table 6 shows that, before the intervention, there was no significant difference in the adequacy of intake in both groups; energy, carbohydrate, protein, and fat had a p-value >0.05.

Following a 7-week nutrition education intervention, significant differences in the adequacy of calorie, protein, and fat consumption were seen between the intervention and control groups, as demonstrated by a p-value < 0.005 (Table 7).

The findings of the adequacy of energy intake demonstrated significant positive differences in the fulfilment of adequate energy intake in the intervention group; namely, there was an increase in adequate energy intake. Meeting the energy requirements is crucial for various purposes, including enhancing bodily function, determining the necessary macro and micronutrient intake, and influencing changes in an athlete's body composition (Thomas et al., 2016).

The initial mean sufficiency of energy intake among athletes in the intervention group was 79%. Following nutrition instruction, this figure climbed to 88% (Table 8). The findings of this study align with previous research conducted by Rossi et al. (2017) on the impact of a 12-week nutrition education intervention. Specifically, the initial data collection revealed that athletes' energy consumption was below the recommended intake.

However, after the intervention, there was a significant increase in the consumption of adequate energy intake compared to before the intervention (Rossi et al., 2017).

Table 8. The Differences in Adequate Intake Before and After Nutrition Education Intervention in Each Intervention Group and Control Group

Variable	Intervention Group	*p-value*[b]	Control Group	*p-value*[b]
	Mean ± SD		Mean ± SD	
Energy				
Before	79.18 ± 22.2	**0.029***	74.47 ± 24.3	0.402
After	88.03 ± 19.1		71.50 ± 25.4	
Carbohydrates				
Before	64.21 ± 24.5	0.469	63.68 ± 23.6	0.916
After	60.58 ± 23.2		64.79 ± 24.9	
Protein				
Before	80.55 ± 25.2	0.141	76.68 ± 29.5	0.361
After	87.84 ± 21.1		72.53 ± 28.0	
Fat				
Before	109.55 ± 40.1	0.077	96.66 ± 38.2	0.243
After	97.34 ± 20.2		87.21 ± 37.8	

[b]using the Mann Whitney test
*there are significant differences (p<0,05)

No significant differences were revealed in the levels of carbs, protein, and fat in the intervention and control groups before and after the nutrition education intervention (Table 8).

The sufficiency of carbohydrate nutrition was reduced from 64% to 60%. According to Urdampilleta et al. (2020), consuming carbs in the right amount and type before exercising can help prevent hypoglycemia and sustain performance. The carbohydrate intake declined in the intervention group as athletes preferred consuming higher amounts of protein (Table 7). Athletes, particularly during recovery, require protein intake as it is the primary approach to minimize muscle loss and expedite healing in case of injury (Turnagöl et al., 2021). Multiple studies have discovered a correlation between weariness in athletes and a decrease in muscle glycogen. This mechanism's presence necessitates heightened glucose needs in athletes. Athletes frequently struggle to meet this increased demand, leading to insufficient carbohydrate consumption (Pendergast et al., 2000).

The study found no significant difference in the protein consumption of combat athletes before and after the sports nutrition intervention in both groups. Nevertheless, the intervention group observed a rise in the mean adequacy of protein intake compared to the control group, which encountered a decline in the mean. Athletes, particularly during recovery, require protein intake as it is the primary approach to minimize muscle loss and expedite healing in case of injury (Turnagöl et al., 2021). A protein intake of 2.3 grammes per kilogramme per day has been demonstrated to decrease muscle loss caused by injuries, according to a study by (Mettler et al., 2010)

The mean fat intake in both the intervention and control groups dropped; however, there was no significant difference in the extent of this decline. After implementing a nutrition education intervention in the intervention group, the mean fat intake reached a satisfactory level (97%). In contrast, there was a slight drop in the control group, resulting in a minor deficiency (87%). The classification of nutrient intake adequacy is based on the following categories: above requirements (>120%), mean (90-119%), mild deficit (80-89%), moderate deficit (70-79%), and severe deficit (<70%) (Gibson, 2005). Physical activity can enhance the muscles' capacity to utilize fat as a source of energy. Hence, the consumption of fats is also crucial for athletes. However, the specific kind and quantity are still undetermined—excessive consumption of fat results in the accumulation of excessive fat reserves. According to Kemenkes RI (2021), the recommended fat mass range for male athletes is 9-12%; on the other hand, it is 14-24% for female athletes.

The energy requirements of each athlete vary based on parameters such as basal metabolic rate, activity levels, kind of exercise, intensity of exercise, and length of exercise. Inadequate meal planning for athletes can lead to complications for them. Athletes' dietary preparations are not limited to a single phase of training. Meal arrangements are continuously implemented daily. Athletes' diet is tailored to their training time, ensuring that the nutritional therapy aligns with the desired goals. The meal arrangements for athletes are categorized into three distinct periods: the preparation period, the match period, and the recovery period (Penggalih et al., 2019).

An inherent disadvantage of this study is the absence of blinding during the research process, as the intervention is directly administered to each group. Thus, it permits the introduction of bias in the study. The control and intervention groups in weight management have distinct requirements, which can introduce bias into the results of the 24-hour food recall.

CONCLUSION

Following a nutrition education intervention, combat athletes significantly enhanced their understanding of sports nutrition and achieved higher nutritional sufficiency. A 7-week nutrition education intervention combining booklet media and material delivery, counselling and group discussion methods enhances combat athletes' sports nutrition knowledge, food preferences, and nutritional adequacy more effectively than solely providing booklet media without material delivery.

It is advisable to maintain an active involvement in education on sports nutrition to

ensure that athletes have a deeper understanding of the subject and develop a mentality that emphasizes the significance of nutrition in enhancing performance.

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EVALUATION OF ASHITABA (*ANGELICA KEISKEI*) CRACKERS FORMULATIONS AS A-GLUCOSYDASE ENZYME INHIBITORS

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ABSTRACT

One of the global health issues is diabetes mellitus, characterized by elevated blood glucose levels. The absorption of glucose in the body occurs through the digestion of carbohydrates by the enzyme α-glucosidase, which is responsible for hydrolyzing carbohydrates into sugar. Ashitaba (Angelica keiskei) is a herbal plant from Japan and has long been utilized in traditional medicine for its various health benefits and preventive properties against multiple diseases. This plant has also been cultivated in Indonesia, including Trawas Mojokerto, East Java. This study aims to develop ashitaba crackers and evaluate their potential α-glucosidase inhibitory activity to develop safe and effective natural products to assist in managing diabetes more efficiently. This research was conducted from July to September 2022. Two formulations of fresh ashitaba leaves were used (12% CAST 1 and 18% CAST 2 of 100 g of flour). Based on the results of this research, chemical composition tests showed that the carbohydrate and dietary fiber content in CAST 1 were higher than those in CAST 2. Protein, lipid, water, and ash content in CAST 2 had higher values than in CAST 1. Flavonoid content and inhibitory activity test results of ashitaba crackers showed significant differences between the two formulation groups regarding flavonoid content and percentage inhibition against the α-glucosidase enzyme. Both flavonoid content and inhibitory activity in CAST 2 were higher than in CAST 1. Ashitaba crackers with the best formulation in this study, based on flavonoid levels and their ability to inhibit α-glucosidase enzyme, were identified as CAST 2.

Keywords: *Ashitaba Crackers, α-glucosidase inhibitor, flavonoids*

INTRODUCTION

Diabetes mellitus is a chronic disease often associated with various serious complications, including heart disease, kidney dysfunction, vision impairment, and nervous levels in the body system disorders (Cao et al., 2019). One of the global health issues is diabetes mellitus, characterized by elevated blood glucose. The primary approach to managing diabetes mellitus is controlling blood glucose levels.

The glucose absorption process in the body occurs through the digestion of carbohydrates by the enzyme α-glucosidase, which is responsible for hydrolyzing carbohydrates into simple sugars. This mechanism leads to an increase in blood glucose levels, especially after meals. Inhibitors of α-glucosidase (AGIs) from various plant sources are currently trending due to their ability to inhibit α-glucosidase activity, resulting in a reduction in the hydrolytic cleavage of non-reducing ends of dietary oligosaccharides and a diminished release of α-glucose. This inhibits carbohydrate digestion and glucose absorption in the small intestine. This mechanism plays a crucial role in controlling postprandial hyperglycemia, representing a modern therapeutic approach to stabilize blood glucose levels in diabetic patients, especially in type 2 diabetes (Hossain et al., 2020).

In recent years, there has been a growing interest in the use of natural substances as alternative treatments for diabetes. Ashitaba has emerged as one of the alternative herbal plants for prevention and therapy in controlling blood glucose in patients with diabetes mellitus. Previous research conducted by Fu et al. (2023) indicates the potential of ashitaba fermentation extract in obese rats to reduce blood glucose, improve glucose tolerance, and enhance insulin sensitivity.

Ashitaba (Angelica keiskei) is a herbal plant from Japan and has long been utilized in

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traditional medicine for its various health benefits and preventive properties against multiple diseases. This plant has also been cultivated in Indonesia, including Trawas Mojokerto, East Java. Ashitaba is characterized by its fresh green leaves with a finger-like shape. Belonging to the Umbelliferae family, it is also known as "Tomorrow's Leaf" due to its ability to regrow after harvesting. Angelica keiskei is rich in chalcones, flavonoids, coumarins, and other bioactive compounds. These active compounds seem responsible for ashitaba's potential in various biological activities, including anti-tumor, antioxidant, liver protection, antibacterial, and antiviral properties (Fu et al., 2023).

One form of ashitaba utilization in this study is in the form of ashitaba crackers. The development of ashitaba cracker products has the potential as a healthy snack alternative with additional benefits in controlling blood glucose levels and inhibiting α-glucosidase enzyme. Therefore, this research is aimed at the development of ashitaba crackers, the examination of flavonoid levels in the product, and the evaluation of the inhibitory capabilities of ashitaba crackers against the α-glucosidase enzyme. The expected outcome of this study is to provide a meaningful contribution to the advancement of products derived from natural and safe ingredients, demonstrating efficacy. Furthermore, these products hold the potential to aid the management of blood glucose levels and the prevention of hyperglycemia.

METHODS

The primary material utilized in this research was the ashitaba leaves derived from the ashitaba plant (Angelica keiskei), obtained from cultivation in the Trawas plantation, Mojokerto.

In this study, an experimental method was employed in the laboratory using a completely randomized design with two treatments, namely the administration of ashitaba leaves (CAST 1 = 12% and CAST 2 = 18% of the weight of the flour used) as the raw material for crackers. The experimental units conducted were the ashitaba crackers, which were further analyzed. Ashitaba crackers were processed in the Processing Laboratory of the Nutrition Study Program at UIN Sunan Ampel Surabaya. Chemical characteristic tests were conducted at the Saraswati Indo Genetech Laboratory in Bogor. Flavonoid content tests on Ashitaba crackers were performed at the Pharmacy Laboratory of Airlangga University. The inhibitory activity of the α-glucosidase enzyme was analyzed at the Tropical Biofarmaka Study Center Laboratory, IPB University.

The obtained data were processed using Microsoft Excel and SPSS. For the initial data, a normality test using the Shapiro-Wilk test was conducted for all chemical characteristic data, flavonoid content, antioxidant activity, α-glucosidase enzyme inhibitory activity, and sensory tests. If the obtained data were normally distributed, statistical analysis was then carried out using the T-test with a significance level of $p < 0.05$. Conversely, for non-normally distributed data, the non-parametric Mann-Whitney test was conducted.

Processing Ashitaba Crackers

The primary raw materials used for making ashitaba crackers in this study are sorghum flour and arrowroot starch, which have a lower glycemic index than wheat flour. Two formulations of fresh ashitaba leaves were added, namely 12% (CAST 1) and 18% (CAST 2) of 100 g of flour. Thus, both types of crackers share the same basic raw material formulation, and the difference lies in the added ashitaba leaves. The proportions of ashitaba leaves were chosen based on a study conducted by Ohnogi et al. (2012, where a significant reduction in BMI, visceral fat, and total fat was observed in pre-metabolic syndrome patients given 6.1 g of dried ashitaba flour.

The utilization of the mentioned formulation was adopted and modified from a study conducted by (Ohnogi et al., 2012), where there was a significant decrease in BMI, visceral fat, and total fat among patients prone to metabolic syndrome who were administered ashitaba powder twice a day, each time with a dosage of 3.1 g. Therefore, the full daily dosage of ashitaba powder was 6.2 g. This dosage was subsequently adjusted in the current research for the formulation of ashitaba crackers to be 12% and 18% (12 g and 18 g) of fresh leaves per 100 g of flour used, considering the potential nutrient loss during the processing.

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Table 1. Formulation of Ashitaba Crackers

Ingredients	Proportion of Ashitaba Leaves	
	CAST 1 (12%)	CAST 2 (18%)
Sorghum Flour (g)	70	70
Arrowroot Flour (g)	30	30
Sorbitol Sweetener (g)	2.5	2.5
Water (ml)	40	40
Olive Oil (g)	10	10
Butter (g)	20	20

Table 1 shows the components of ashitaba crackers formulated in this study.

The stages in the ashitaba crackers processing were obtained and modified (Cauvain, 2015), followed by preliminary research and the formulation conducted independently by the researcher. The first step in making ashitaba crackers is to crush fresh ashitaba leaves, which have been sorted and thoroughly washed, using a blender. Dry ingredients are mixed according to the formulation before being combined with wet ingredients such as margarine, water, and virgin olive oil. Once the dough is formed, the blended fresh ashitaba leaves are added and mixed. The next step involves molding the dough into portions, weighing 12 grams when wet. Subsequently, the crackers are baked at 160ºC for 20 minutes. The dry weight for each cracker after baking is 8 grams.

Generally, the process of making ashitaba crackers can also be observed in Figure 1.

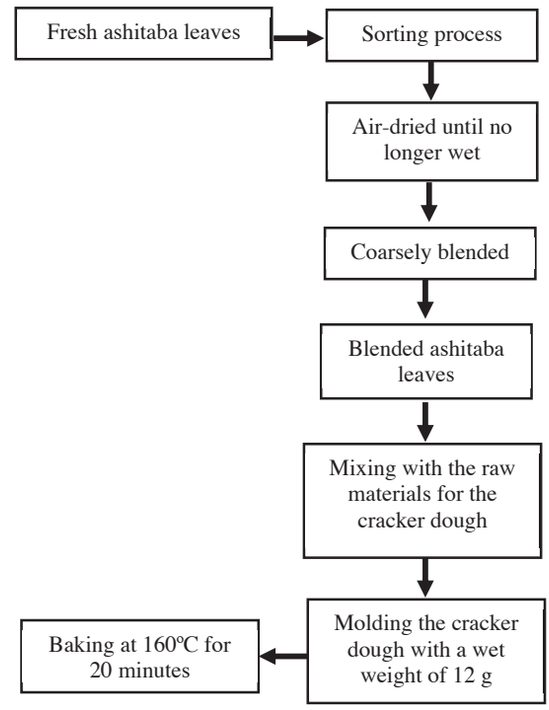

Figure 1. Ashitaba Crackers Manufacturing Procedure

Carbohydrate Analysis

The carbohydrate content was calculated using the by-difference method, which involves subtracting the sum of the four components, water content, protein, fat, and ash, from 100%.

Protein Analysis

The protein content analysis was performed using the titrimetric method. The protein content can be calculated using the formula derived from the titration results of the protein sample, as follows:

$$\text{Protein Content} = \frac{(A-B)\times N\times 0.014\times 6.25}{Weight\ of\ Sample} \times 100\%$$

Note:

A = ml of NaOH for blank titration; B = ml of NaOH for sample titration; N = Normality of NaOH.

Analysis of Lipid Content

The fat content analysis in this study was conducted using the Weibull method. A total of 2 grams of the sample was weighed using a beaker, then 30 ml of 25% HCl was added along with 20 ml of water and some boiling stones. The beaker was then covered and heated to boiling for approximately 15 minutes. Subsequently, filtration was carried out while hot until no more acid reaction occurred. Next, using filter paper dried in advance at 100-105°C, it was placed into a filter paper thimble and extracted with hexane or other fat solvents for 2-3 hours at approximately 80°C. The hexane solution was then distilled, the extracted fat was dried at 100-105°C, then cooled,

and the result was weighed. The drying process was repeated several times until a constant weight was achieved. The fat content was then calculated using the following formula:

$$\% \text{ Lipid Total} = \frac{W1-W2}{W} \times 100\%$$

Where:

W: Sample weight (g); W1: Fat flask weight after extraction (g); W2: Fat flask weight before extraction (g)

Water Content Analysis

The moisture content analysis in this study uses the SNI method. The initial step in this analysis involves weighing 1-2 g of the sample in a bottle with a lid, and the weight of the bottle is recorded. Subsequently, the sample is dried in an oven at 105°C for 3 hours. Once completed, the sample bottle is cooled in a desiccator to prevent moisture absorption from the surrounding air. Then, multiple weighings are performed until a stable or constant weight is obtained. The total moisture content is calculated using the following formula

$$\% \text{ Moisture Content} = \frac{W}{W1}\ x\ 100\%$$

Where:

W: Sample weight before drying (g); W1: Weight loss after drying (g)

Ash Content Analysis

Ash content analysis is conducted using the SNI method. The procedure involves weighing 2-3 grams of the sample into a known-weight porcelain crucible. It is then heated and incinerated in a muffle furnace at a maximum temperature of 500°C until complete incineration (occasionally, the furnace door can be slightly opened to allow oxygen to enter). The crucible containing the incinerated sample is cooled in a desiccator, then weighed several times until a constant weight is obtained. The percentage of ash content can be calculated using the following formula:

$$\% \text{ Ash Content} = \frac{W2-W1}{W} \times 100\%$$

Note:

W: Sample weight before incineration (g); W1: Weight of the sample + crucible after incineration (g); W2: Weight of the empty crucible (g).

Dietary Fiber Analysis

The analysis of dietary fiber is conducted using the enzymatic gravimetric method. The principle of the gravimetric method for dietary fiber involves determining the total soluble dietary fiber and insoluble dietary fiber. The first step is to weigh a sample of 15 g and place it in an Erlenmeyer flask. The sample is then added to 25 ml of 0.1 M sodium phosphate buffer pH six and stirred. Then, the thermal amylase enzyme is added and incubated for 15 minutes at 100°C and allowed to cool. The sample is then added to water to adjust the pH to 1.5, and then 100 mg of pepsin is added and incubated again at 40°C for 60 minutes. Next, the pH is adjusted to 4.5 with HCl and filtered using a crucible. The insoluble dietary fiber in the form of residue is then washed using 2x10 ml of 95% ethanol and 2x10 ml of acetone, followed by drying in an oven at 105°C and incineration at 550°C for 5 hours in a muffle furnace. The soluble dietary fiber in the form of filtrate is then adjusted to a volume of 100 ml, added with 95% ethanol, and allowed to settle for 1 hour. Then, it is filtered using a crucible and washed with 2x10 ml of 95% ethanol and 2x10 ml of acetone. It is then dried in an oven at 105°C and incinerated at 550°C for 2 hours in a muffle furnace. The calculation of dietary fiber content can be done using the following formulas:

$$\text{insoluble dietary fiber} = \frac{(K2-K1)-(C2-C1)}{W} \times 100$$

$$\text{Soluble dietary fiber} = \frac{(K4-K3)-(C4-C3)}{W} \times 100$$

Total dietary fiber = serat pangan terlarut + serat pangan tidak terlarut

Where:

K1: weight of empty filter paper (g); K2 : weight of filter paper residue (g); K3: Weight of empty filter paper (g); K4: Weight of filter paper filtrate (g); C1: Weight of empty crucible (g); C2: Weight of crucible residue (g); C3: Weight of empty crucible (g); C4: Weight of crucible filtrate (g); W: Sample weight.

Analysis of Total Flavonoid

In the analysis of total flavonoid compounds, sample preparation was conducted by first extracting ashitaba crackers using the maceration method with 70% ethanol as the solvent. After extraction, the liquid sample was then analyzed using the spectrophotometer method.

A 10 µL solution of the ashitaba cracker extract was placed into a 96-well transparent polystyrene microplate, followed by the addition of 120 µL distilled water, 10% aluminum chloride (10 µL), 1 M potassium acetate (10 µL), and absolute methanol (60 µL). The mixture was then incubated at room temperature for 30 minutes. Absorbance was measured using a microplate reader at a wavelength of 415 nm. A calibration curve was prepared using a quercetin standard solution with concentrations of 100, 200, 300, 400, and 500 ppm following the same procedure. Total flavonoids were expressed in quercetin equivalents (mg QE/g) using the equation:

$$C = \frac{c \times FP \times V}{m}$$

Where: C = Total flavonoids (mg QE/g); c = Flavonoid concentration (mg/L); DF = Dilution factor; V = Sample volume (L); M = Sample weight (g)

Analysis of α-Glucosidase Enzyme Inhibition

The α-glucosidase enzyme inhibition assay was conducted using the spectrophotometer method. Ten µL of 0.1 U/mL α-glucosidase (yeast maltase, dissolved in 0.2 M PBS, pH = 6.8) was added to each well of a 96-well plate containing 0.2 M PBS (pH = 6.8) up to a total volume of 150 µL. The solution mixture was then incubated in the dark at 37ºC for 10 minutes. Subsequently, 50 µL of 3 mM PNPG (4-nitrophenyl α-D-glucopyranoside) was added to each well and incubated at 37ºC for 10 minutes. Following this, 50 µL of 1 M Na2CO3 was added. The solution with 50 µL of 1 M Na2CO3 added before PNPG served as the blank, and PBS without the sample was used as the control. Acarbose was used as the positive control. Optical density was then measured at a wavelength of 405 nm. The α-glucosidase inhibition was calculated using the following formula:

$$Inhibitory\ rate\ \% = \frac{(ODc - ODcb) - (ODs - ODsb)}{ODc - ODcb} \times 100\%$$

OD represents the absorbance of the sample, Odsb is the absorbance of each sample, Odc is the absorbance of the control, and Odcb is the absorbance of the blank control (Luo et al., 2012).

RESULTS AND DISCUSSIONS

Crackers are a popular snack due to their likable taste, long shelf life, and relatively affordable price (Nicole et al., 2021). Healthy foods that contain fiber, antioxidants, low sugar content, and appropriate fat content contribute to maintaining blood glucose and preventing diabetes complications (Njapndounke et al., 2021). Figure 3 below shows the resulting ashitaba crackers from these two formulations.

The formulation of crackers in this study uses the main ingredients of sorghum flour and arrowroot starch, which are gluten-free and have a low glycemic index. Additionally, the primary focus of this research is the incorporation of ashitaba leaves as a crucial ingredient expected to contribute to the development of healthy crackers.

Chemical Characteristics Analysis

Crackers are products made from dough containing yeast or not, through fermentation or not, with low-fat content, generally without adding sugar, and typically have high moisture content (Cauvain, 2015).

Based on Table 2 of the formulations for the two types of ashitaba crackers, there is a significant influence on the proximate nutrient content ($p<0.05$). The carbohydrate and dietary fiber content in CAST 1 is higher than in CAST 2, at 64.57±0.67% and 7.19±0.065%, respectively. Meanwhile, the protein content (7.49%±0.048%), fat (22.98±0.53%), water content (6.29±0.139%), and ash content (2.71±0.066%) show higher values in CAST 2 compared to CAST 1. The protein content in ashitaba crackers has met the Indonesian National Standard (SNI), which specifies a minimum protein content of 5% for crackers. The

Table 2. Results of Chemical Characteristics Analysis of Ashitaba Crackers

Parameters	CAST 1 (%)	CAST 2 (%)
Carbohydrates	65.01	60.80*
Protein	7.31	7.28
Lipid	19.33*	22.91
Water Content	5.40*	6.35
Ash Content	2.96*	2.67
Dietary Fiber	7.16*	6.28

Note: (*) indicates significant difference (p<0,05)

higher water content in CAST 2 is suspected to arise from the difference in the amount of fresh ashitaba leaves added to the dough. Additionally, water is added to the dough during the production of both formulations. The difference in water content of the crackers can also be observed in crackers with 100% wheat flour as the main ingredient without any substitutions, which has a lower water content of 3.94% (Seftiono et al., 2019). However, the moisture content in dry foods such as biscuits, according to SNI 2973-2011, is maximally set at 5% (BSN, 2011). Nevertheless, when compared to other gluten-free cracker products, as seen in the study on cladode flour crackers by Dick et al. (2020), which falls within the range of 6.43-7.39%, the moisture content in the current research's ashitaba crackers, especially in the CAST 2 formulation, appears to exceed the recommended limit. Another study by Rico et al. (2019) on the moisture content of teff cereal crackers showed a range of 11.8% for brown teff crackers, 12.47% for white teff, and 8.32% for crackers formulated with rice.

Analysis of Total Flavonoids and α-Glucosidase Enzyme Inhibition

The results of the analysis of the inhibitory activity against the α-glucosidase enzyme in this study are expressed as the percentage of inhibition. In contrast, the flavonoid content is expressed in mg/g. The statistical test results in Table 3, using the T-test for flavonoid content and inhibition percentage of ashitaba crackers, indicate a significant difference between the two formulation groups regarding flavonoid content and the inhibition percentage against the α-glucosidase enzyme. Both flavonoid content and inhibition

Table 3. The Influence of Different Formulations of Ashitaba Crackers on Flavonoid Content and α-Glucosidase Enzyme Inhibition Activity

Formulation	Flavonoid (mg/g)	Inhibition Activity (%)
CAST 1	0.275 ± 0,050	0,045 ± 0,001
CAST 2	0.550 ± 0,057	0,271 ± 0,006
p-value	0.00*	0.00*

Note: (*) Indicates a significant difference (p < 0.05)

activity in CAST 2 are higher than in CAST 1, with values of 0.550 ± 0.057 mg/g flavonoid and 0.271 ± 0.006% inhibition against the α-glucosidase enzyme, respectively.

Based on the results of the analysis, it is also evident that the higher the flavonoid content in the cracker formulations, the higher the inhibition percentage. This result suggests that the inhibitory activity of ashitaba crackers is likely due to the presence of flavonoid compounds derived from adding ashitaba leaves. This is in line with the results conducted by Luo et al. (2012) in the analysis of compounds present in ashitaba extract using PNPG (4-nitrophenyl α-D-glucopyranoside) as a substrate that releases p-nitrophenol through hydrolysis by α-glucosidase enzyme; the study identified eight flavonoid derivative compounds exhibiting excellent inhibitory activity against α-glucosidase compared to the acarbose control. Over 100 types of bioactive compounds in ashitaba, including flavonoids, coumarins, phenolic compounds, acetylenes, sesquiterpenes, diterpenes, and triterpenes, have been identified (Kil et al., 2017). Flavonoid compounds in ashitaba, such as quercetin and isobavachalconere, are known for their effective inhibitory activity against glucosidase enzymes (Luo et al., 2012).

Enzyme α-glucosidase plays a crucial role in the catabolism of starch, glycogen, and disaccharides in the digestive tract. One way to control blood glucose levels is by inhibiting the activity of this enzyme, leading to a reduction in the carbohydrate metabolism rate in the intestines. The enzyme acts on the α-1,4 glycosidic bond, breaking down starch and disaccharides into glucose. Inhibiting this enzyme is essential for lowering blood glucose levels after meals, making

it a valuable target for diabetes management (Magaji et al., 2020).

The study conducted by Ohkura et al. (2018) reveals that leaves, stems, and roots of ashitaba contain various nutrients such as vitamin A, vitamin K, dietary fiber, and bioactive compounds, including chalcone, flavonol, and coumarin. Maronpot (2015) as well as Caesar and Cech (2016) assert that ashitaba powder contains several types of chalcone flavonoid compounds, with the most physiologically active compounds being 4-hydroxyderricin and xanthoangelol. These chalcone flavonoid compounds are known for their antioxidant, anti-inflammatory, anti-angiogenic, anti-diabetic, and anti-obesity properties.

Based on the flavonoid content in ashitaba, it is suspected that these flavonoids play a role in the regulation of blood glucose by inhibiting both alpha-glucosidase and alpha-amylase enzymes. In the treatment of diabetes mellitus, inhibition of enzymes responsible for the absorption and metabolism of carbohydrates, such as α-amylase and α-glucosidase, can be performed. These enzymes work in the absorption of glucose in the intestine. Inhibiting the breakdown of carbohydrates due to the action of these enzymes can prevent the postprandial increase in blood glucose levels (Kabré et al., 2023).

CONCLUSION

Ashitaba crackers have the potential to be developed as a healthy alternative snack, especially in efforts to prevent hyperglycemia and complications of diabetes mellitus. The results of this study show favorable proximate levels in ashitaba crackers. Additionally, ashitaba crackers contain flavonoids and exhibit inhibitory activity against the α-glucosidase enzyme, as demonstrated in in vitro tests, although further testing is required for conclusive findings.

The limitation of this research is the absence of a comparison between ashitaba crackers made from ashitaba leaf extract to assess various proximate nutrient characteristics, flavonoid levels, and the inhibitory capability against the α-glucosidase enzyme. A suggestion for future research is to create different formulations using ashitaba leaf extract and alternative low glycemic index flour types for further comparison.

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STUNTING PERCEPTION AMONG STAKEHOLDERS: A QUALITATIVE STUDY

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ABSTRACT

Majene Regency had the highest prevalence of stunting in West Sulawesi province in 2018. Addressing this issue requires an integrated approach involving various stakeholders. Understanding their perceptions of stunting is crucial. This study aimed to analyze stakeholders' perceptions of stunting using a Quasi-Qualitative method with a descriptive approach. Data were collected through in-depth interviews, focus group discussions, and observations. Stakeholders responsible for specific and sensitive nutrition interventions in Majene District were selected via purposive sampling. These included the Health Office, Education Office, Women's Empowerment and Child Protection Office, Ministry of Religion, Regional Development Planning Agency, and nutrition officers at the Sendana I Public Health Center. The results revealed differing perceptions among stakeholders about the causes, impacts, prevention, and control of stunting. They viewed stunting as a failure to thrive due to chronic malnutrition, with impacts such as growth disorders, low cognitive abilities, and reduced competitiveness. Each stakeholder had a unique perspective on stunting prevention and management based on their job duties. The study concluded that differing perceptions among stakeholders regarding stunting's causes, impacts, and management stemmed from their varied knowledge and responsibilities. Achieving a common understanding among stakeholders is essential to effectively control stunting through a convergent approach.

Keywords: perception, stakeholders, stunting

INTRODUCTION

Nutritional status in Indonesia, especially for toddlers, is still a problem, including malnutrition and stunting. Good nutrition during 1000 days of early life nutrition is crucial in terms of brain development and physical growth. Stunting or stunted body growth is a form of malnutrition characterized by height for age below the standard deviation (<-2 SD) (WHO, 2005).

Stunting indicates chronic malnutrition and the mother's height that is passed on to the baby which has an impact on the birth length of the baby (Permatasari & Sumarmi, 2018). Stunting in toddlers is the mayor indicator for assessing child welfare and an accurate reflection of social inequality. Indonesia is among the 34 countries in the world that contribute 90 percent of the world's nutritional problems (stunting). Stunting describes the incidence of malnutrition in children under five that lasts for a long time. The impact is not only physical but also on cognitive function, learning achievement, and economic productivity as adults. Failure to thrive that occurs due to malnutrition during the golden period will harm the next life is difficult to repair (Bhutta et al., 2013; Prendergast & Humphrey, 2014).

Many factors cause stunting in children under five years old, and these factors are related to one another. According to the UNICEF framework, there are three main factors that cause stunting, namely unbalanced food intake, Low Birth Weight (LBW), and a history of the disease (Ergin et al., 2007).

Unbalanced food intake is included in inappropriate exclusive breastfeeding which is caused by limited healthy food that can be consumed (Wiyogowati, 2012). The nutritional status of pregnant women affects the health and development of the fetus. Impaired growth in the womb can cause low birth weight. Research in Nepal shows that babies with low birth weight have a higher risk of becoming stunted (Paudel

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et al., 2012). Birth length is also associated with the incidence of stunting. Research in Kendal shows that babies with short birth lengths have a high risk of stunting in toddlers (Meilyasari & Isnawati, 2014). Another factor associated with stunting is the intake of exclusive breastfeeding for children under five. Research in Southern Ethiopia proved that toddlers who did not receive exclusive breastfeeding for six months had a high risk of stunting (Turyashemererwa et al., 2009).

The prevalence rate of stunting in Indonesia is still above 20%, meaning that it has not reached the WHO target is below 20%. West Sulawesi Province is the second highest prevalence of stunting under five in Indonesia (41.8%), most commonly found in Majene district (44.89%) (Kementerian Kesehatan RI, 2018). The high prevalence of stunting in Indonesia is a concern in efforts to achieve the global target to reduce by 40% the number of stunted under-five children by 2025 (World Health Assembly, 2012). So that the convergence of interventions that combine specific and nutrition-sensitive interventions becomes a necessity to be implemented, to control various complex causes of stunting.

Implementation of these two intervention strategies requires good nutrition governance through sustained political commitment, the ability to coordinate cross-sectoral actions and cooperate effectively in the same arena, and allocate resources (Chaparro & Sethuraman, 2014).

Building nutritional governance is highly dependent on the perceptions of all parties involved to ensure program harmonization and alignment in efforts to control stunting, as happened in the Philippines where the knowledge and beliefs of health workers are consistent with providing services at health centers (Sen et.al, 2020). Unfortunately, there are still measly studies that qualitatively explores perceptions of stunting among stakeholders, especially at the regional level. Therefore, a study on the perceptions of stakeholders who are responsible for implementing specific and nutritionally sensitive interventions is needed to overcome the prevalence of stunting in children under five, especially in Majene District, West Sulawesi Province This study was aimed to investigate the perception of stakeholders about causes, impact, preventing, and control of stunting.

METHODS

This study used a Quasi-Qualitative method with a descriptive approach. This study was conducted in August and September 2020 in Majene Regency as one of the highest stunting prevalence in West Sulawesi after obtaining ethics approval from the health research ethics committee, Faculty of Medicine, Hasanuddin University (No:195/UN 4.6.4.5.31 /PP46/2020). Researcher as one as an instrument, supported by interview guideline, an observation sheet, a camera, recording device,, and a writing instrument. The concept of data saturation was used in this research to guide the conclusion of data collection.

Informants are stakeholders who have the main tasks and functions of stunting control which were selected purposively. There are three kinds of informants namely key informant (head of the health office), supporting informant (nutrition officer primary health care/Puskesmas Sendana I which is a stunting locus in Majene district), and ordinary informants (head of the education office, head of the section of the diniyah education and Islamic boarding school, head of the women's empowerment and child protection office, the staff of development planning agency at sub-national level as a Task Forces to control stunting). The number of participants consisted of three persons from the health sector (head of the health office, and head of nutrition section, nutrition officer primary health care/Puskesmas Sendana I), one person from the education sector (head of the education office), two persons from the ministry of religion Majene District (head of the ministry of religion office, and head of the section of the diniyah education and Islamic boarding school), one person from women's empowerment and child protection sector (head of the women's empowerment and child protection office), one person from regional planning and development agency as a Task Forces to control stunting (n = 8).

Three data collection methods was employed in this study, including in-depth interviews, focus group discussions and observation. After the

ceremony of the research socialization by the principal investigator, the co-investigator met all stakeholders to request participation in this study. Individuals were contacted via telephone to agree to the interview schedule. In-depth interviews were conducted with each participant at a different time and location, and each in-depth interview was conducted between 40 and 60 min. Each in-depth interview was conducted once in person as face-to-face in comfortable conditions and location such as their office. The focus group discussion was held for 3 hours in the hall of the Majene district health office, centrally located venue and conveniently to sharing and discussion. Only one focus group discussion was held because the data were already saturated. In the process of the interview, the researcher supported note-takers, a telephone as a recording device, a camera for documentation collecting data, and an interview guide based on the purpose of this study consisted of key themes, which were the causes and impact of stunting, prevent dan overcoming stunting. Observation conducted to observe the children and measure height and compare with his/her age (Figure 1) as a triangulation form.

Qualitative data analysis by used taxonomy analysis and content analysis were then interpreted and presented in narrative form.

RESULTS AND DISCUSSIONS

a. Informants' characteristic

The in-depth interviews and focus group discussion provided insights into the perceptions of various stakeholders on the stunting. Of the 8 participants interviewed, half were men. The participants' ages ranged from 26 to 62 years. Postgraduate qualifications were held by all participants. Participants had work experience within their relevant field or sector for about 1-4 years.

b. Causes of Stunting

There were variations in stakeholder perceptions about the causes of stunting. From the perspective of the health sector, the causes of stunting are multi-factors, and the main factor is the economy, which implies the nutritional status of the community. Besides that, many pregnant women suffer chronic energy deficiency triggers the baby born with low birth weight. The other factors are the mothers not appropriate to giving early initiation of breastfeeding to the babies, triggering the failure of exclusive breastfeeding to babies. Other factors are the lack of knowledge on nutrition before marriage, bad diet and poor parenting, lack of exclusive breastfeeding, not appropriate supplementary feeding, mothers do not well-understood food processing for babies over six months and toddlers, so this implies an improper diet.

> *"… I think the first cause is the economic factor capacity compared to other places, right? Even though she knows about nutrition, but the purchasing power of the people, especially those who are stunted, is indeed far from expectations. The second is their knowledge, even though the team has given education but it does take time and habituation to change…"*
>
> *(Head of Health Office,)*
>
> *"Regarding the nutritional problem in Sendana, if it's from the food, one of them is the food, the local ingredients are already fulfilled, especially in the Sendana section. The work here is fishermen's stuff the ingredients are already fulfilled like vegetables. Farmers are also there but return to his son again e his people. There are already ingredients but they don't know how to manage it, there is still a lack of knowledge about food management, which for babies and toddlers is still lacking, so it's a lot of stunting… Pregnant women, right 1000 HPK, starting from pregnancy to 2 years of age, nowhere is still a high target for pregnant women in chronic energy deficiency, so it gives birth to a child who is less nutritious, resulting in stunting, yes LBW, then the early breastfeeding also becomes the success of breastfeeding is low. "*
>
> *(Nutrition Officer Primary Health Care/ Puskesmas Sendana I,)*

"... indeed we did find in the field when we came down there were toddler biscuits that were distributed at every Posyandu in the working area of the Puskesmas, now we found that the patient's mother also ate biscuits, let alone the mother and father also ate so how good the child is when it comes to food. which should be consumed by their children but their parents also help with good reasons, this is what we all need to pay attention to… "

(Head of nutrition section of Health Office)

The perception of stakeholders who play a role in nutrition-sensitive interventions states that the cause of stunting is early marriage and lack of knowledge before marriage, which causes neglected children, lack of public awareness of the importance of good nutrition from an early age, which implies a lack of nutritional intake from the first 1000 days of life, and mothers do not give early initiation of breastfeeding to their children because yellow milk or colostrum is considered stale.

"... The main cause is the lack of nutritional intake, since the first 1000 days of life. began. This also happened due to their lack of provision in this knowledge before marriage ... "

(Head of Education Office of Majene Regency)

"... From the health side, in this case, nutrition, from the economic point of view, improper parenting style, it all affects parenting is like child neglect, mothers leave their children with their grandmothers because they are still young souls, this is influenced by marriage at the age of children

(Head of the Women's Empowerment and Child Protection Office)

"... The causes that we see in the field are certainly not free from mistakes or mistakes in parenting, because this is the way people don't only have low educational backgrounds, but some work so it cannot be denied that they are sometimes abandoned by their children, that's the term. roughly, for example, maybe entrusting the child to someone else or a family which then, of course, leads to malnutrition, because stunting is the main cause of lack of nutrition, I think so…"

(Task force stunting regional planning and development agency)

I think the cause is inseparable from the lack of awareness of our society about the importance of good nutrition from an early age since the mother's pregnancy because e will determine the nutritional status of her child after birth ..."

(Head of the Ministry of Religious Affairs)

""... The problem of EIB (early initiation breastfeeding) is sometimes people don't give EIB because they say it is yellow and it is said to be stale even though it exceeds the nutritional content of breast milk, especially career women pay attention to breastfeeding, and we suggest that every office/institution should prepare a room for employees to provide Breastfeeding for children and it is also a child care center but at the office, it is usually not possible to provide such a room… "

(Head of the diniyah education and Islamic boarding school section of the ministry of religion The Ministry of Religious Affairs Majene Regency)

Many factors cause stunting in toddlers and these factors are interrelated with one another. The previous research on stunting perceptions has been carried out by Liem S regarding social perceptions of stunting in Tangerang Regency shows that even though the term stunting is increasingly known, it has not been accompanied by adequate social perceptions especially malnutrition factor (Liem et al., 2019). Studies in the Philippines show stakeholder perceptions of health workers regarding the causes of stunting, namely nutritional

Table 1. World Cloud of Causes Stunting Perceived by Stakeholders

Statements Code
Economic and knowledge factors
Less nutritional intake since 1000 HPK Lack of knowledge before marriage
Poor knowledge about food management for babies Chronic energy deficiency in pregnant women
Poor parenting Neglect of children
Lack early initiation of breastfeeding implementation
Lack of knowledge about food and parenting Lack of exclusive breastfeeding The biscuit supplement program is less consumed by children
Lack of nutrition awareness from the society

and genetic deficiencies, followed by disease, hard work, and lack of sleep. And lack of sufficient nutrition during pregnancy. Studies in the Philippines show stakeholder perceptions of health workers regarding the causes of stunting, namely nutritional and genetic deficiencies, followed by disease, hard work, and lack of sleep. and lack of sufficient nutrition during pregnancy (Hossain et al., 2017). Nutritional status of pregnant women influences the health and development of the fetus. Impaired growth in the womb can cause low birth weight (Woldeamanuel et al., 2019).

c. The Impact of Stunting

The perception of stakeholders from the health sector about the consequence of stunting is a disorder in children's growth, psychomotor, and brain development, also vulnerability to disease. All of the impacts of stunting are considered a short-term consequence, based on the WHO conceptual framework about stunting. Meanwhile, the long-term effect of stunted children is to cause cognitive development disorder, low competitiveness, less creativity. It is difficult to find a good job that requires a qualified height such as police and soldiers so that the future is bleak.

".. What is worried about is of course the long term because it will affect the growth and development of the child, the height does not match his peers who are the same age, the disturbance of brain development, the catching power is slow so that the competitiveness is low, they could be guests in their own house anyway, meaning that there will be a lot of unemployment or something, low effectiveness ..."(Head of Nutrition Section Health Office)

"... Usually, stunting is a health impact, very susceptible to the most visible disease, but cognitive development, whatever, the psychomotor will be different from those who are not stunted who have good nutrition ..then the impact is also their competitiveness, how directly is the physical factor too. ""(Head Health Office)

"... The impact is, for example, when one of them is looking for work because most of them are seen from the height, so poor children who want to register the police or what. Then, brain development is also low from stunting, not only in terms of physicality but also like children's development too, creativity at school.." (Nutrition officer, PHC Sendana 1)

From the other sectors has responsibility for the nutrition sensitive intervention, their perception almost same with the health sector opinion. However, additional information was obtained that the linear growth disorder in children were seen after 2 years of old. Besides, the impact stunting can also cause delay of intelegence quotient will affect his performance in the future ..."

"The impact will be seen later, the first 1000 days of life is 2 years 3 years, on the height and development is linear, then the brain ..." (Head of Education Office)

"...delay in physical development and IQ due to people's lack of knowledge about health and nutrition. So, in my opinion, stunting is the obstruction of physical development and the inhibition of one's intellectual development which, according to what I know ... " (Head of the Ministry of Religion Affairs)

"... Talking about the impact of the body height is only physical, but actually what we are worried about is that in the long

term this is stunting, of course, this child will be slow in development, so maybe it is more cognitive because it will affect his performance in the future ..."(Task Force Stunting, Regional Planning and Development Agency)

Most of the informants in this study have the perception that the long-term impact on stunted children is identical to a short stature and has low competitiveness which is influenced by improper nutrition.

Accordance to the results of observations, it's found that the impact of stunting can be seen on after first 1000 days of life, which the height not age-appropriate or non-linear. Children who are stunted have slow growth from their age, namely weight 12 kg, height 80 cm, and age 25 months (Figure 1). This observation supporting the informant perception from the education sector.

The long-term impact of stunting is not only affecting growth but also slow brain development of children which in turn results in low competitiveness, and finally affects children's their lives in the future. Stunting before two years of old predicts poorer cognitive and educational outcomes in childhood and adolescence. This statement was proved in Ethiopia by (Woldehanna et al., 2017) that early childhood stunting is significantly negatively associated with the cognitive performance of children. Cognitive development includes aspects of thinking skills including learning skills, problem solving, rationality, and memory (Ekholuenetale et al., 2020). According to (Yadika et al., 2019) regarding the effect of stunting on cognitive development and learning achievement, it shows that nutritional deficiencies for a long time will cause permanent brain function disorders.

The results of a qualitative study in the Philippines that examined stakeholder perspectives regarding stunted children found that health workers mention that the impact of stunting causes lower cognitive abilities and problems during pregnancy for women. Policy makers who are less involved in handling stunting mention that children who suffer from stunting will receive intimidation and exclusion from high-requirement jobs, while policy makers with greater involvement in control stunting mention the consequences of stunting children such as slower cognitive development, worse performance in school, and lower work productivity (Sen et al., 2020).

The impact of stunting can be categorized into short-term and long-term impacts. The short-term impact of stunting can cause growth failure, inhibition of cognitive and motor development, and not optimal physical body size and metabolic disorders. Long-term impact causes decreased intellectual capacity. If there are obstacles to cognitive and motor development, it can have an impact on the decrease in the ability to absorb lessons at school age which will affect their productivity as an adult (Primasari & Keliat, 2020).

Table 2. Word cloud of Stunting Consequence Perceived by Stakeholders

Statements Code
Body Height and brain development
Low competitiveness, Unemployment
Delay or inhibit IQ development
Vulnerable to disease, Disturbance psychomotor development Poor cognitive
Performance in the future ..."

d. Prevention and Control of Stunting

Regarding the problem of preventing and overcoming stunting, stakeholders from the health sector have the perception that they have carried out a number of activities in the form of a nutrition improvement program in the first 1000 days of life by creating a program to care for pregnant women, training cadres as counselors for feeding children in every village, discussing with mothers who have stunting children regarding their diet and parenting patterns so that stunting can be controlled. In addition, programs outside the target of the first 1000 days of life were carried out, namely youth groups by forming posyandu and CERIA cadres (preventing adolescents from anemia). However, there were several obstacles so that the program did not run continuously, such as because of a change of cadres due to changing village heads, however, they were still notified to the puskesmas so that the newly elected cadres would still be

trained in implementing child feeding counseling using BOK funds (health operational assistance), and encouraging the use of funds. villages for child feeding counseling activities in each village. Another perception from the health sector is that there is indeed a need for cross-sectoral cooperation that is strengthened by regulations in the use of natural resources, especially fish which are abundant in the Majene district, as well as making a number of innovations and education to the public.

".. We have formed cheerful cadres, we have trained child feeding (PMBA) counseling in all villages since 2016, we have trained at least 1 village 2 people to become counselors. "... We are still training PMBA cadres until this year, but it seems that next year there will be no more, in the last 2020 funds from the central government if funds from the regions have been erased, especially yesterday since Covid was all gone. So our activity is an intervention for the locus village, so we try to encourage the locus village so that the funds in the village can be used for how to handle stunting. These innovations are maximized to keep the pathway for handling stunting. Then care for pregnant women it's 2018 so that's what we have done, there was once in 2019 there was a cheerful Posyandu. So we are not only going to 1000 HPK, we are trying to get closer to teenagers, the plan is that this year the road is just like the situation, but we still encourage the Puskesmas, there is a youth Posyandu so we try how to keep going ..(Head of Nutrition Scction, Health Office)

"... The handling of stunting must indeed be cross-sectoral with our natural resources, especially in particular, there are a lot of fish resources. Japan, when compared to last years in World War II, can rise from the education sector, so we have to work. hard. Compared to other districts there is no other livelihood besides fish, so from the factor of education and public education it is the influential factor, then it is assisted by regulations and rules on how to make innovations so how availability. For example, the family planning factor is not limiting but controlling the pregnancy ..(Head of Health Office)

"...Handling stunting, the problem of stunting is not only a health issue because the cause of stunting is due to food intake, there was an activity from the province yesterday, namely nutrition service activities in the village of stunting locus, so we are looking for how to care for and eat and the results are still some parents who think that there are certain foodstuffs that cannot be eaten, for example, if a child eats fish, they will experience worms with a certain age, the food cannot be swallowed so there are many perceptions in the community that they still need an educational approach. We also carry out training activities for PMBA (Infant and Child Feeding) cadres, the problem is that at the time of selecting a new village, sometimes some of the cadres are replaced so that the trained cadres stop doing counseling because they are not in the decree, but they still encourage nutrition officers to keep making SK cadres that change and continue to do counseling with BOK funds at the Puskesmas…(Head of Nutrition Scction, Health Office)

The same thing was conveyed by the stunting prevention task force from the regional planning and development agency, that stunting prevention programs are not only focused on the first 1000 days of life by involving the health sector, but also by preventing early marriage as a trigger for stunting. as well as conducting pre-marital counseling/education and ensuring the proper nutritional status of the bride and groom. The program was set out in a memorandum of understanding between the regional planning and development agency, the health office and the ministry of religious affairs. This is confirmed by a statement from the Ministry of Religion as a commitment to prevent child marriage.

"... Actually what we are targeting is 1000 HPK and this involves the health office, if from other precautions that have been carried out, the MOU with the Ministry of Religion for child marriage, that's why this is the only activity with the word conference ..."

"... Efforts in handling stunting, that is, we involve the ministry of religious affairs (KUA) regarding pre-marriage about how the bride and groom are nutritionally and how to provide future bride and groom (catin) education ..."

(Task Force Stunting, Regional Planning and Development Agency)

"...The services that exist in the ministry of religion so far have a lot to do with the existence of this Stunting, one of which is, for example, early marriage, so we and the local government, especially with the health and civil registration services, already have an MOU regarding how to hold back the pace. This stunting is according to the portion we have, now I happen to be in the Ministry of Religion handling marriages and it is realized that in the upper Majene early marriages are one of the sources of this high stunting ..."(Head of the Ministry of Religion Affairs)

Efforts to prevent and control stunting according to stakeholders from the women's empowerment and protection agency by implementing a number of programs such as training for breastfeeding counselors, socializing the use of Moringa leaves as a nutrient-rich food to prevent stunting children, and holistic early childhood education (PAUD) programs with providing three nutrition workers as breastfeeding counselors, as well as a child-friendly school program. In addition, the family welfare empowerment team from the women empowerment and child protection office has conducted counseling on "Majene mapaccing: as a movement to live clean and healthy, and keep the environment in a clean condition, so it is not easy for diseases to occur, especially infectious diseases which are one of the triggers for the occurrence. stunting child.

"... We conduct breastfeeding counselor training by providing an understanding of breastfeeding to the target and how to do breastfeeding properly. Then the socialization of the use of Moringa leaves has been held and the benefits can be applied later in the villages in handling stunting, counseling on "Majene Mapaccing": in each sub-district has been carried out by the PKK and also held holistic PAUD followed by education about the condition of children in Holistic PAUD and there 3 nutrition workers if anyone needs counseling on breastfeeding, then the child-friendly school program .."(Head of the Women's Empowerment and Child Protection Office)

The education sector as another stakeholder states that efforts to prevent stunting through making reproductive health a curriculum in local content subjects to provide understanding to school-age children, especially junior high school children in preparing for the transition period for marriage preparation with the aim of minimizing the incidence of stunting. The education sector is involved in sensitive intervention, by implementing programs from the ministry of education related to the education of trainer candidates for early childhood education teachers, involving 20 teachers and each trained teacher to train 2 villages. In addition, a memorandum of understanding has been signed between the education office and the office of women's empowerment and child protection for the implementation of holistic and integrated early childhood education, and, and there was also the signing of a memorandum of understanding between the education office and the health office regarding the provision of iron tablets to junior high school children

"... We provide an understanding of local content to further hinder this with a curriculum that includes reproductive health and minimizes stunting in terms of understanding the age of junior high school students because they want to

enter the transition to the next level which is marriage preparation, and there was also the signing of a memorandum of understanding between the education office and the health office regarding the provision of iron tablets to junior high school children ..."

(Head of the Education Office)

"... The handling of stunting is a sensitive intervention in the education office. It has attempted to produce a program from the center of the ministry of education called PCP (training for trainees) that has been carried out at the ministry and the participants are PAUD teachers because early childhood education is a sensitive age that needs to be addressed, already there are 20 PAUD (early childhood) teachers who are PCP and these have been integrated. PCP has been running in 2019 and has trained the target, namely PAUD teachers so 1 PCP trains 2 villages.." (Head of the Education Office)

There was some variations in the perceptions of informants about stunting (causes, impact, prevention and controlling) was based on different levels of education, knowledge and occupation or job duties. All stakeholders' perceptions regarding the prevention and control of stunting are based on the main tasks of the work in their respective institutions related to specific and sensitive-nutrition interventions. Types of specific interventions carried out were delivered by stakeholders from the health sector, while sensitive nutrition interventions were delivered by stakeholders outside the health sector. Efforts to prevent and control stunting in an integrated manner are only at the level of commitment manifestation marked by a memorandum of understanding between the health and non-health sectors driven by the regional development planning agency, but this cooperation has not been realized in the field during this research.

Thus, the effort will be an important entry point to accelerate the reduction in the prevalence of stunting in the Majene Regency. There is evidence from several countries that have succeeded in reducing the prevalence of stunting fantastic every year, such as in Asia (Bangladesh and Vietnam) and Latin America (Brazil) with an average annual decline in both countries in Asia of 4.5% and Brazil 8.4 %. It s due to a strong political commitment and multi-sectoral collaboration between government, non-government, national, and international organizations and programs delivered through community service delivery platforms with active community engagement (Hossain et al., 2017).

Table 3. Word cloud of Prevention and Control of Stunting Perceived by Stakeholders

Statements Code
Care for pregnant women, Cadre training on infant and child feeding Infant and child feeding counseling by cadre Youth Posyandu and Cheerful cadres Cross-sector collaboration, Innovations and education. Encourage use of village funds
Breastfeeding counselors, Socialization of the use of Moringa leaves Counseling on "Majene Mapaccing"
Prevention in the first 1000 days of life Suppress child/early marriage Pre-marital counseling Ensuring the nutritional status of the bride and groom
Reproductive health curriculum Training of trainer for early childhood teacher

CONCLUSION

Stakeholder perceptions of the causes, impacts, prevention, and control of stunting differ based on knowledge and experience as well as their respective perspectives, and all their given perception is positive, This study suggests examining the implementation, monitoring, and evaluation of the convergence program agreed upon in the memorandum of understanding, by involving the active participation of the community.

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Example of tables:

Table 1. Characteristics of Patients in Malnutrition and Non-Malnutrition Groups

Karakteristik	Malnutrition (n=70)		Non-Malnutrition (n=233)		Total (n=303)	X^2	p value
	n	%	n	%			
Sex							
Male	38	54,3	117	52,5	155	0,070	0,790
Female	32	45,7	106	47,5	138		
Age							
<55 years old	48	68,6	151	67,7	199	0,890	0,180
≥55 years old	22	31,4	72	32,3	94		
Education							
Low	24	34,3	51	22,9	75	10,153	0,063
Middle	33	47,1	151	67,7	184		
High	13	18,6	21	9,4	33		

Table 2. Average of Nutrition Intake in Malnutrition and Non-Malnutrition Groups

Nutrition Intake	Malnutrition (Mean ± SD)	Non-Malnutrition (Mean ± SD)	t	*p value*
Calories	1328,1± 215,3	1482,9± 327,4	2,04	0,032
Protein	43,2±13,1	48,7±17,3	2,47	0,010

Example of a figure:

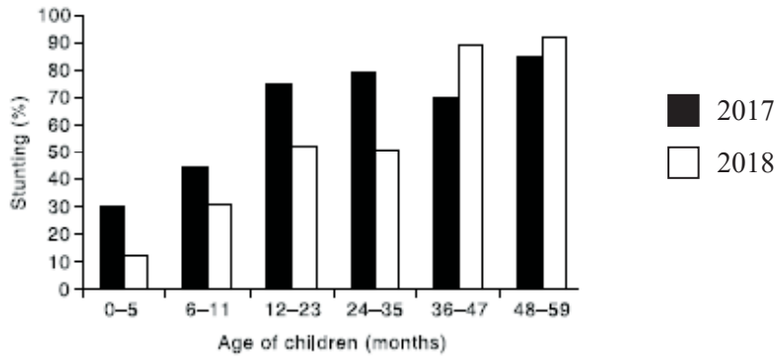

Figure 1. Changes in Stunting Prevalence (%) in Toddlers in Kalimantan

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