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SIMPATIK EDUCATION MODEL FOR KNOWLEDGE AND DIVERSITY OF FOOD INTAKE FOR STUNTING TODDLERS IN KERINCI REGENCY

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ABSTRACT

Background: The problem of under-five nutrition is still a significant concern in developing countries. One of the main factors is the level of nutritional knowledge, so feeding toddlers is not appropriate and varied. Nutrition education must be packaged in an informative, interactive and accessible way at any time. This study aims to analyze the influence of website nutrition education on the knowledge and diversity of toddler intake, especially in Kerinci.
Method: This type of research is development research to see the effectiveness of the SIMPATIK site using a pre-experimental design, pre-post test only design, with 40 mothers under five who met the inclusion criteria at the Integrated Healthcare Center in the working area of the Kemantan in 2023.
Result: Data collection through interviews and assistance from the SIMPATIK website. Statistical test using Wilcoxon test with SPSS IBM series 21 software. The result is an influence of the SIMPATIK website on maternal nutrition knowledge (p= 0.000) with a difference of 15.38, and the diversity of food intake of toddlers (p= 0.000) with a difference of 2.20.
Conclusion: In conclusion, the SIMPATIK education model improves the nutritional knowledge of mothers under five and the diversity of food intake of toddlers stunting.

Keywords: Nutrition education; SIMPATIK; Diversity of toddler intake; Stunting

INTRODUCTION

Indonesia is a developing country that supports the Sustainable Development Goals (SDGs) to end all forms of malnutrition. Undernutrition is a nutritional problem that must be resolved immediately to achieve specific SDG goals (Badan Perencanaan Pembangunan Nasional 2021). The main goal of the SDGs is to end hunger by 2030 and ensure access to nutritious, safe, and adequate food for poor and vulnerable people, such as babies, and to end all forms of hunger and malnutrition in children under the age of five (Kemenkes RI, 2021). Nutrition is a major investment in human resources for nation-building. Nutritional problems in toddlers from 2007 to 2021 did not show any significant changes.

The prevalence of malnourished children under five years of age experiencing fluctuations as follows: in 2007 (17,9%), 2010 (19,6%), 2013 (17,7%), 2018 (7,4%), and 2021 (7,1%), with a target of the Medium Term Development Plan (MTDP) of 6,8–7,3%. Attention should also be paid to addressing nutritional problems in Jambi City in 2021, with a prevalence of undernutrition of 8,85, which has not yet reached the target of the 2019–2024 MTDP (Kemenkes RI, 2021).

Diversity in quality consumption determines the optimal energy and nutrients that affect rapid growth and development into adulthood. Malnutrition during infancy is irreversible or nonrefundable (Beal et al., 2018). Several studies have shown that the causes of undernutrition in toddlers include low parental education, family income, low birth weight and birth length, breastfeeding for less than six months, the practice of giving

complementary foods, the incidence of infections, visits to irregular clinics, and lack of advice from health workers (Al Rahmad et al., 2020; Laksono et al., 2022; Yuniar et al., 2020).

One of the factors contributing to nutritional problems in developing countries is the level of education of parents and the knowledge of the mother or caregiver, who acts as a gatekeeper in determining or choosing food ingredients to be purchased and cooked (Paul et al., 2021). The results showed that the better the mother's habits in feeding toddlers, the better their nutritional status (Arini et al., 2017; Arini et al., 2022).

Providing nutrition education improves mothers' knowledge of the diversity of toddler consumption. Several studies have shown that nutrition education can increase mothers' knowledge, make toddlers' food more varied, and improve toddler nutrition (Gustina et al., 2018; Noor & Mangi, 2018; Rachmayanti, 2018).

Studies in Kenya that improve the competence of mothers who need social support are assisted by health workers in the practice of administering complementary foods to toddlers (Schneider et al., 2017). Other studies have shown that nutrition education using nutrition action cards for toddler mothers can increase the variety of toddlers' foods (Junita et al., 2020). Nutrition education carried out by visiting homes can improve the diversity of food consumption among toddlers (Janmohamed et al., 2020) Much research has been conducted on nutrition education to increase the nutritional knowledge of toddler mothers. However, there is no sustainable goal for nutritional knowledge in the community to be independent of the diversity of food consumption among toddlers. Providing nutrition education through media is one way to make it easier for toddlers to understand this material.In the era of digitization, access to nutrition education information can be easily obtained to quickly support an increase in health knowledge using websites. The use of a website can clarify the information conveyed, because the display is more attractive, interactive, and can be accessed at any time (Gustina et al., 2018; Yani, 2018).

The SIMPATIK website, which can be accessed via a smartphone, can be used to obtain information on the recording and reporting of consumption diversity and nutritional status. Dietary diversity was assessed using the webbased application, in Indonesian called "Sistem Edukasi MP-ASI Buah Hatiku (SIMPATIK)". This application can assist mothers in educating their toddlers on complementary feeding. Information that will later become the basis for the development of data and health information systems to support health programmes. An app that is packaged on a website that allows mothers to study independently, and it is hoped that there will be an increase in mothers' nutritional knowledge and diversity in toddler food consumption. The concept of learning through website media and mentoring is the novelty of this study. Based on this background, this study aimed to analyze the effect of nutrition education using the SIMPATIK website on mothers' knowledge and diversity of toddler consumption in Kerinci Regency.

METHODS

This type of research is quantitative and uses a quasi-experimental design, which aims to determine the impact of an education website sympathetic to knowledge and consumption diversity without a control group. Website development was carried out in 2014 through material and technology expert tests, which passed with improvements. Improvements to the application include adding educational videos and sounds in each section of the menu, assessing nutritional status, viewing passwords, and searching for food sources.

The research obtained ethical feasibility from the Health Research Ethics Commission of the Jambi Ministry of Health Polytechnics.

This research was conducted in the working area of the Kemantan Health Center in Kerinci Regency, from June to Agust 2023. Purposive sampling was used to determine the research location, with the condition that the urban village and public health center were willing, especially cadres, the Integrated Healthcare Center, and mothers of toddlers. The number of subjects involved was 40 people who met the following inclusion criteria: (1) mothers who had toddlers between the ages of 6 and 59 months; (2) living and staying for 6 months in the work area of the health center; and (3) toddlers who were not sick and did not receive medical therapy for >3 days, such as fever, cough, or runny nose during the study.

In the previous research stage, a website was developed through a prototyping model consisting of system requirements, website design, implementation, and evaluation. The SIMPATIK app, can be accessed from URL: https://litmas.poltekkesjambi.ac.id/simpatik, and instructions for use the App on the URL: https://link.kemkes.go.id/demosimpatik, or a demo account as follows: username: 081300000001, and password: 081300000001. SIMPATIK is a website that provides complementary feeding education to toddlers. In the first step, the mother creates an account, logs in, and enters the child's data, including name, date of birth, and gender of the toddler. On the website, there is a menu on my toddler's nutrition. In my toddler nutrition menu, there is a sub-menu on food ingredients consisting of staple foods, animals, vegetables, and fruit-side dishes with nutritional energy content, carbohydrates, protein, and fat per 100 g. The next menu is a history of toddler food to determine the diversity of toddler food consumption, which can be compared with toddler nutritional adequacy numbers.

Furthermore, mothers can also determine the nutritional status of toddlers according to weight categories based on age. The next menu contains nutritional information for my toddler, including nutritional education for toddler mothers regarding toddler feeding. The last menu concerned the question and answer columns for the toddlers with nutritionists. Maternal nutritional knowledge was collected through interviews using a questionnaire consisting of 20 questions. Each correct question was assigned a score of 20, with a maximum total score of 100. The questionnaire was valid and tested for reliability, with a Cronbach's alpha of 79,2%. The diversity of food consumption was assessed through interviews and food recalls 24 hours a day, completed by the mother every day on the SIMPATIK website, and then included in the Individual Dietary Diversity Score (IDDS) questionnaire consisting of nine food groups (starchy staple foods, green vegetables, fruits and vegetables rich in vitamin A, other fruits and vegetables, offal, meat and fish, eggs, legumes, whole grains, milk, and dairy products).

Assessment of consumption by giving a score: if toddlers consumed food in nine food groups on the food questionnaire, they were given a score of 1, and if they did not consume food, they were given a score of 0; then, the average consumption diversity was calculated. The IDDS questionnaire was tested for validity and reliability, with a Cronbach's alpha (69,2%).

On the first day (pretest), we asked the mothers of toddlers about their nutritional knowledge about complementary feeding and their habit of providing food for toddlers during the last 24 h (starting from waking up to going back to sleep). Enumerators fill in the diversity of food consumption every day. In weeks 1, 2, and 3, nutrition workers at the public health center received education on complementary feeding. On the 4th or 30th day, the mother's nutritional knowledge and diversity of toddler food consumption were

assessed.

The pre-requisite test results (Kolmogorov-Smirnov) for parametric analysis showed that the data were not normally distributed ($p < 0,05$) for the knowledge variable ($p = 0,000$) or the variation in consumption variable ($p = 0,000$). Therefore, inferential data analysis was performed using Wilcoxon test at a significance level of 95%.

RESULTS AND DISCUSSION

Subject characteristic data included the sex of the toddler, education, and the mother's occupation. The results of the study (Table 1) showed that 55,5% of children under five were female, the majority (67,5%) of mothers had a mandatory education, and 90,0% of mothers did not work or were housewives. Mothers' education affects their knowledge when choosing food for toddlers. High family income can provide quality food for toddlers, so that the food provided is varied, nutrients for toddlers are met, and toddlers do not develop nutritional problems (Khaliq et al., 2022).

Table 1. Characteristic distribution of the subjects

General Characteristics of subjects	n	%
Toodlers' Gender		
Male	18	45,0
Female	22	55,0
Pendidikan ibu		
Mandatory Education	27	67,5
Higher Education	13	32,5
Job		
Does Not Work	38	90,0
Work	2	10,0

As shown in Table 2, the average value of knowledge of the diversity of food consumption in toddlers before the intervention was 76,50 and after 91,88. after carrying out nutrition education using the SIMPATIK by as much as 15,38 points.

Likewise, regarding the diversity of food consumption, the average value of the diversity of food consumption in toddlers before the intervention was 3,03 and after increase 5,23. There was an increase in food consumption diversity with a difference of 2,20 points. The results showed that providing nutrition education using the SIMPATIK could increase mothers' knowledge and diversity of food consumption among toddlers in Jambi City. Nutrition education using a website with mentoring techniques is an innovation that can improve nutrition knowledge, motivation, and attitudes and behaviors in providing complementary foods to toddlers. Through SIMPATIK, mothers' knowledge and diversity of food consumption for toddlers increased. This study is in line with the study by Junita et al. (2020) showing that nutrition education, accompanied by a nutrition officer, can increase 4,19 points by providing a variety of toddler foods.

Table 2. Impact of SIMPATIK nutrition education on knowledge and diversity of children's food intake

Variables	Mean ± SD	Mean different	*p*
Nutrition Kwnowledge			
Before	76,50 ± 3,908	15,38	0,000
After	91,88 ± 4,908		
Diversity feeding intake			
Before	3,03 ± 0.620	2,20	0,000
After	5,23 ± 0,733		

Source: Primary Data (2023)

Nutrition officers play an important role in providing complementary food for breast milk (complementary food) by visiting toddlers' homes in the morning, afternoon, and evening to provide motivation and help and remind mothers regarding understanding in providing toddler food consumption, so that mothers make improvements to the provision of complementary food according to the age of the toddler (Faridi et al., 2020).

In line with two previous studies, research in Yogyakarta has shown that nutrition education with mentoring can increase mothers' knowledge of food provision for toddlers (Abdillah et al., 2020). According to a study in India, mothers who receive nutritional education can increase the

diversity of their toddlers' food consumption (Pavithra et al., 2019). It is important to provide parents or caregivers with appropriate education and social support so that they can emphasize clear and consistent references to information and avoid misinformation regarding infant feeding (Biks et al., 2018; Thow et al., 2017).

The SIMPATIK website is designed to make it easy for mothers of toddlers to obtain complete information about complementary food so that mothers do not have to look for information related to nutrition (the nutritional content of food and nutritional status), the diversity of toddler food consumption compared to the nutritional adequacy rate, etc. Nutrition education using websites can clarify information because they are more interesting, interactions occur quickly, and are flexible.

Nutrition education packaged on the website is technology-based education that can support the improvement of health knowledge. Research on nutritional education interventions can improve balanced nutritional behavior (Perdana et al., 2017). Smartphone- and gadget based nutrition education increases the nutritional knowledge of mothers under five years of age and the diversity of consumption and food intake of toddlers, improving nutritional status (Anjani et al., 2022; Rahmad et al., 2022; Setyawati & Herlambang, 2015).

Nutrition education assistance using the website is carried out with the concept of two- way communication using the following three steps:1) researchers, enumerators, and nutrition officers are mentors who play a role in gathering information from others of toddlers;2) the companion concludes the information obtained so that the problems of the mother under five are known; and 3) researchers and nutrition officers intervene by providing information on website usage, nutrition knowledge, and advice according to the problems of toddler mothers (Faridi et al., 2020).

CONCLUSION

SIMPATIK can increase mothers' nutritional knowledge and diversity of food consumption among toddlers.The implications of this research-can strengthen the theory of nutrition education and increase the knowledge and variety of toddler consumption.

The SIMPATIK website can be used as a medium for nutrition education in nutrition programs to monitor the diversity in toddler consumption.

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CONFLICT OF INTEREST

This research, there are no conflicts of interest regarding funding, including names in published articles, and the data collection process.

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QUALITY ASSESSMENT OF *MORINGA OLEIFERA* LEAF JUICE AS AN IMMUNE BOOSTER AGAINST ENDEMIC DISEASES IN EAST NUSA TENGGARA

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ABSTRACT

Background: Moringa leaf juice is a natural beverage with high antioxidant properties, making it a potential candidate for traditional medicine and food additive applications. This study aimed to identify the classes of chemical compounds present in moringa leaf juice and evaluate its antioxidant activity, hedonic test and storage stability.
Method: Three different moringa juice formulations were prepared using variations of fresh leaf powder and evaluated for color, taste, aroma, phytochemical content (to confirm the presence of alkaloids flavonoids, saponins, and tannins), antioxidant activity, and storage stability. The optimal formulation was selected based on a panel of experts' sensory evaluation.
Result: The optimal moringa juice formulation consisted of 120 g of fresh moringa leaves, 50 mL of wild honey, 50 g of local guava, 800 mL of UHT milk, and 200 mL of purified water. Phytochemical testing revealed the presence of alkaloids, flavonoids, saponins, and tannins in the moringa leaf juice. The antioxidant activity was 14,339,974 ppm, indicating that moringa leaf juice is a potent antioxidant. The moringa juice remained stable at room temperature for 6 hours and in cold storage for 24 hours, maintaining the same taste and color as when initially prepared.
Conclusion: Moringa leaf juice is a natural beverage with high antioxidant activity and a rich phytochemical profile, including alkaloids, flavonoids, saponins, and tannins. The good storage stability of moringa leaf juice at room temperature and in cold storage suggests that it is a viable option as an antioxidant beverage.

Keywords: Antioxidants, Moringa juice, Moringa oleifera, Phytochemistry

INTRODUCTION

Immune system disorders can be managed with the administration of specific drugs such as antihistamines, anti-inflammatories, and corticosteroids. However, the long-term use of these medications can lead to undesirable side effects. Recently, combination therapy using immunostimulants has been explored, but synthetic drugs come with numerous side effects, are expensive, and have limited availability, making them less accessible to the general public (Arora et al., 2013). Immunostimulants derived from natural sources can be a preferable option due to their lower cost, minimal long-term side effects, and easy accessibility by the public (Aldi et al., 2015).

The moringa tree has numerous benefits, earning it the nickname "the miracle tree," and it is well-known by a significant portion of the global population (Mahmood et al., 2010). In East Nusa Tenggara, especially on the Timor mainland, this plant thrives abundantly, is easily obtainable, and boasts second-best quality globally just after Spain, making it highly sought after by international buyers(Stohs & Hartman, 2015). Chemical constituents of moringa leaves, serving as immunostimulants, have been identified including flavonoids, phenolic compounds, carotenoids, triterpenoids, vitamin A, and vitamin C (Biswas et al., 2012). Some pre-clinical trials on experimental animals have shown that moringa leaf extracts exhibit immunostimulant activity, and the discovery of new compounds such as ethyl 12,15-octadecatrienoate, 6-octadecenoic acid, cis-

vaccenic acid, and 2-octyl-cyclopropane-octanal in methanol extracts of moringa leaves strengthens the potential of moringa leaves as an immunostimulant (Biswas et al., 2012;Xiao et al., 2020).

Commonly, people process moringa leaves using conventional methods such as boiling or steaming (Gunathilake et al., 2018). Boiling, which involves heating, can reduce the active compound content in moringa leaves. The preparation of moringa leaf juice is one approach that can minimize the degradation of active compounds while offering practical advantages in utilization (Mahmood et al., 2010). Moringa, rich in benefits including its role as an immunostimulant, underscores the importance of immunostimulants in disease prevention. Coupled with the abundant availability of moringa leaves in the NTT region, these factors justify the significance of this research (Suhirman et al., 1985).

Previous studies have created moringa leaf juice as a dietary option, but data related to its immunostimulant effects remain unavailable (Netea et al., 2019). This study aims to create moringa leaf juice by adding UHT milk and guava, with the aim of enhancing its immunostimulant effects and imparting a unique flavor profile. The moringa juice preparation will then undergo qualitative and quantitative testing, as well as *in vitro* and *in vivo* immunostimulant evaluations.

METHODS

The samples used in this study were moringa (*Moringa oleifera L.*) leaves obtained from the East Nusa Tenggara region. The research commenced with the preparation of three different moringa juice formulations, incorporating variations of fresh leaf powder. The optimal moringa juice formulation, which was well-received by the panelists based on color, taste, and aroma (Acceptance test,Hedonic test). Subsequently, phytochemical testing was conducted to detect the presence of active compounds such as alkaloids, flavonoids, saponins, and tannins. The antioxidant activity of moringa leaf juice was evaluated to assess its overall antioxidant capacity. Shelf life testing is conducted to determine the duration during which a product can be stored without significant quality deterioration, including taste, color, texture, and nutritional content.

Qualitative phytochemical testing was conducted to detect the presence of active compounds.

Identification of Alkaloids

A total of 0.20 g moringa (*Moringga oleifera L.*) powder was mixed with 3 mL of distilled water and 3 mL of chloroform. The mixture was then boiled for 15 minutes until it formed two phases. These two phases were separated into different reaction tubes. An appropriate amount of the aqueous phase was pipetted into another reaction tube and then supplemented with a sufficient amount of Mg powder and 5 drops of HCl. A positive result was indicated by the formation of a red, yellow, or orange color (Aksara et al., 2013).

Identification of Flavonoid

A total of 0.20 g moringa (*Moringga oleifera L.*) powder was placed into a reaction tube, followed by the addition of a few drops of 2 N HCl and 9 mL of distilled water. The mixture was then heated on a water bath for 2 minutes, cooled, and filtered. The filtrate used for the flavonoid test was as follows: Three drops of the filtrate were added to 2 drops of Mayer's reagent, indicated by the formation of a white or slightly yellowish precipitate. Three drops of the filtrate were added to 2 drops of Bouchardat's reagent, indicated by a brown precipitate, ranging from reddish-brown to dark brown. Three drops of the filtrate were added to 2 drops of Wagner's reagent, indicated by the formation of a yellow precipitate (Nugraha et al., 2017).

Identification of Tannins

A total of 0.20 g Moringa (*Moringa oleifera L.*) powder was placed into a reaction

tube, and 1-2 drops of 1% ferric (III) chloride reagent were added. The presence of tannins was indicated by a change in the color of the filtrate to green or dark blue (Dwika et al., 2016).

Identification of Saponins

A total of 0.20 g Moringa (*Moringa oleifera L.*) powder was placed into a reaction tube, and then 5 mL of destilled hot water was added (Dwika et al., 2016).

Antioxidant Activity Test of Moringa Leaf Juice

The antioxidant activity of moringa leaf juice (*Moringa oleifera L.*) was evaluated to assess its overall antioxidant capacity. Based on qualitative testing, moringa leaf juice contains flavonoids, compounds known to enhance the body's antioxidant defense against free radicals. Moringa leaf juice is expected to be used as an immune booster against endemic diseases in East Nusa Tenggara. This research determined the antioxidant activity of moringa leaf juice, measured by the IC_{50} value using the DPPH (1,1-diphenyl-2-picrylhydrazyl) method. The principle of this method is the reduction in color intensity or absorbance of the DPPH solution, which is proportional to the increase in the concentration of antioxidant compounds. Moringa leaf juice was prepared using Formula I (fresh moringa leaves 90 g, local guava 50 g, wild honey 50 mL, UHT milk 800 mL, purified water 200 mL), Formula II (fresh moringa leaves 120 g, local guava 50 g, wild honey 50 mL, UHT milk 800 mL, purified water 200 mL) and Formula III (moringa leaves 150 g, local guava 50 g, wild honey 50 mL, UHT milk 800 mL, purified water 200 mL). The research was conducted by thoroughly washing each ingredient. Subsequently, fresh moringa leaves were blanched to remove bacteria, blended with guava and UHT milk, and the resulting juice mixture was filtered and then supplemented with honey. The prepared juice was used as the antioxidant test sample at concentrations of 10,000 ppm, 15,000 ppm, 20,000 ppm, 25,000 ppm, and 30,000 ppm.

Shelf Life Test of Moringa Leaf Juice

Moringa (*Moringa oleifera L.*) is a medicinal plant known for its antioxidant properties and is expected to be used as an immune booster against endemic diseases in East Nusa Tenggara. Erma Nur Faujan's research concluded that moringa leaf extract is effective in increasing hemoglobin levels in adolescent girls. Currently, fresh moringa leaves are being developed into juice, supplemented with local guava, UHT milk, and local honey from Semau Island. To ensure the quality of the juice, a storage test for moringa leaf juice is necessary. Asselerated Shelf Life Test (ASLT)is the Method.The shelf life test was carried out by placing the bottle of Moringa juice at closed room temperature (25-30^{0}C) for 8 hours, room temperature (30-34 ^{0}C) or 6 hours and also storing at a cold temperature of 2-8^{0}C for 24 hours.

Hedonic Test of Moringa Leaf Juice

Moringa (*Moringa oleifera L.*) is a plant with numerous benefits. Moringa grows easily in tropical regions like Indonesia and is commonly consumed as food. Nowadays, moringa leaves are processed into various forms, such as tea, face masks, juice and more. This research transforms fresh moringa leaves into juice, incorporating local guava, UHT milk, and local honey from Semau Island. To assess the quality and preference of 60 panelists in terms of color, texture, aroma, and taste regarding moringa leaf juice, a hedonic test was conducted. The hedonic scale is used to measure the level of liking for a product, ranging from "very much liked" score 5, "liked" score 4, "neutral" score 3, "disliked" score 2, "strongly disliked" score 1. This testing is employed to gauge consumer reactions to a product or evaluate consumer responses to tested samples. Hedonic test refers to several previous tests (Hastuti et al., 2016; Rustamaji & Ismawati, 2021; Winnarko & Mulyani, 2020).

RESULTS AND DISCUSSION

RESULTS

Data collection for the formulation, qualitative screening of flavonoids, and shelf life testing were conducted in the laboratory. The hedonic test was performed by distributing questionnaire forms to the respondents, while antioxidant activity testing was carried out using the DPPH method.

Preparation of Moringa Leaf Juice Formulas

Through several experiments, three Moringa leaf juice formulas that were deemed good by the researchers were obtained. The results of the formulations are shown in **Table 1** below.

Table 1. Moringa Leaf Juice Formulations

Composition	Formula I	Formula II	Formula III
Fresh moringa leaves	90 g	120 g	150 g
Semau honey	50 ml	50 ml	50 ml
Local guava	50 g	50 g	50 g
Uht milk	800 ml	800 ml	800 ml
Purified water	200 ml	200 ml	200 ml

In principle, we only made variations in the composition of fresh Moringa leaves, while the composition of the other ingredients remained unchanged, all the same in each formula.

Qualitative Testing of Moringa Leaf Juice

Qualitative screening of Moringa leaf juice was conducted for alkaloid, flavonoid, tannin, and saponin content. The test results are shown in **Table 2** below.

Table 2. Qualitative/Screening Results of Chemical Content in Moringa Leaves

Secondary Metabolite	Reagent	Result
Alkaloid	Mayer	(+)
	Wagner	(+)
	Bounchard	(+)
Flavonoid	Aquades+ Chloroform+ Mg Powder+ Concentrated HCl	(+)
Saponin	HCl	(+)
Tanin	$FeCl_3$	(+)

Based on the results of the qualitative testing, we found positive results for alkaloids, flavonoids, saponins, and tannins in Moringa leaves samples.

Quantitative Testing of Moringa Leaf Juice and Antioxidant Activity Test

Subsequently, an antioxidant activity test has conducted on Moringa leaf juice. We found that Moringa leaf juice Formula II exhibited antioxidant activity with an IC_{50} value of 14.339 ppm, while Moringa leaf juice Formula III exhibited antioxidant activity with an IC_{50} value of 17.049 ppm.

Shelf Life Test of Moringa Leaf Juice

The results showed that the shelf life of moringa leaf juice at room temperature lasted for 8 hours with the same taste and color as during the production process. The shelf life at outdoor temperature lasted for 6 hours with the same taste and color as during production. Remarkably, the shelf life of moringa leaf juice at cold temperatures (2-8°C) can extend for 24 hours with the taste and color remaining the same as during the production process.

Hedonic Test of Moringa Leaf Juice

Based on the results of the hedonic test of moringa leaf juice combined with guava and honey, considering aspects such as color, aroma and taste. it can be concluded that the juice most preferred by the panelists is Formula II juice, which consists of (Moringa leaves 120 g, guava 50 g, UHT milk 800 ml, honey 50 ml, and purified water 200 ml). The results of the hedonic test are shown in **Table 3** below.

Table 3. Average Results of Hedonic Quality Test for Moringa Leaf Juice

Specification	Formula I	Formula II	Formula III
Color	4.12	5.32	4.77
Aroma	4.5	5.75	4.75
Taste	4.63	5.58	4.75

Note:
Formula I: Addition of 50 g of moringa powder
Formula II: Addition of 90 g of moringa powder
Formula III: Addition of 120 g of moringa powder

DISCUSSION

Moringa (*Moringa oleifera* L.) is renowned for its high nutritional content. Its leaves contain vitamin A, which is equivalent to 10 times the amount in carrots, 17 times the amount of calcium in milk, 15 times the amount of calcium in bananas, 9 times the protein found in yogurt, and 25 times the iron content of spinach (Jonni, 2008). Research by Haryadi (2011) also reported that every 100 g of dried Moringa leaves contain 0.075%

water, 2.05% calories, 0.382% carbohydrates, 0.271% protein, 0.023% fat, 0.192% fiber, 20.03% iron, 8.7% sulfur, and 13.24% potassium(Biswas et al., 2012)(Stohs & Hartman, 2015).

Color is a critical category because it significantly influences the appearance of a food product and affects panelists preference. Based on the results of the hedonic quality test, Formula I, Formula II, and Formula III received an average score of 4.12; 5.32; and 4.77 respectively for color. This difference is attributed to the varying amounts of Moringa leaf powder added, resulting in different colors. The highest average score for color among the three formulas was achieved by Formula 2. This finding is supported by the research of Widyawatiningrum et al. (2018), which stated that the more Moringa leaves added to chicken nugget dough, the greener the product becomes. This green color is due to the high chlorophyll content in Moringa leaves reaching 6890 mg/kg, which is four times more than wheatgrass(Winnarko & Mulyani, 2020).

Aroma plays a crucial role in how panelists perceive food products. It can indicate whether a product is pleasant or not. Based on the hedonic quality test results, Formula I received an average score of 4.5, Formula II received a score of 5.75, and Formula III received a score of 4.75. These differences are attributed to the varying amounts of Moringa leaf powder added, resulting in different aromas. The highest average score for aroma among the three formulas was achieved by Formula 2. This is in line with Widyaningrum's statement that factors influencing the taste of food ingredients include smell, oral stimulation, and taste(Widyawatiningrum et al., 2018).

The taste results from the combination of food ingredients and is perceived by the sense of taste. It is the most crucial factor in determining the final decision regarding the acceptance of a food product. Based on the hedonic quality test results, Formula I received an average score of 4.63 for taste, Formula II received a score of 5.58, and Formula III received a score of 4.75. Panelists perceived a stronger taste of Moringa leaves in Formula III due to the higher quantity of Moringa leaves added, however the highest average score for taste among the three formulas was achieved by Formula II. As more Moringa leaves are added, the taste of Moringa becomes more pronounced.

The study also conducted shelf-life tests on the Moringa leaf juice produced. The results showed that the juice can maintain its quality at room temperature for 6 hours and also at refrigerator temperatures (2-4°C) for 24 hours. Several previous studies have reported that Moringa can resist microbial spoilage due to its tannin and saponin content. The qualitative test results in our study indicated the presence of tannin and saponin in Moringa juice(Akmi et al., 2022; Kusumawardani et al., 2018).

Furthermore, we found that Moringa leaf juice exhibits high antioxidant activity. The antioxidant activity of Moringa has been extensively reported in previous studies. Nurulita *et al.* found that Moringa leaf extract inhibits the β-carotene bleaching process (BCB inhibitor) and collagenase enzyme inhibition by 47%. Moringa leaf body butter has potential anti-aging effects through antioxidant mechanisms and collagenase inhibition(Nurulita et al., 2019). Fitriana *et al.* reported that the ethyl acetate phase exhibited antioxidant activity of 85.4% in the DPPH assay and 92.12% in the ABTS assay. The antioxidant activity of the ethyl acetate phase is influenced by the phenolic compound content in Moringa leaves, such as quercetin, flavonoids, and kaempferol(Fitriana et al., 2015).

The studies conducted by Yuliani *et al.*, as well as Meigaria *et al.*provide valuable insights into the antioxidant activity of Moringa leaf extracts compared to vitamin C. Yuliani et al. concluded that the antioxidant

activity of Moringa leaf infusion is lower than vitamin C, with an IC_{50} value of 2.151 ppm for Moringa leaf infusion and 3.454 ppm for vitamin C. This suggests that Moringa leaf infusion has a weaker antioxidant activity compared to vitamin C(Yuliani & Dienina, 2008). In line with those study, Meigaria *et al*. reported that the IC_{50} value of Moringa leaf acetone extract is 427.49 µg/mL, while the IC_{50} value of vitamin C is 35.52 µg/mL. This significant difference in IC_{50} values indicates that Moringa leaf acetone extract has relatively weaker antioxidant activity compared to vitamin C(Komang Mirah Meigaria, I Wayan Mudianta, 2016). Furthermore, the results of the antioxidant activity test for the ethanol extract of Moringa leaves in this study showed an IC_{50} value of 89.305 ppm, while vitamin C, used as a comparative compound, had an IC_{50} value of 8.374 ppm(Hasanah et al., 2017).

CONCLUSION

In conclusion, the best formulation of Moringa leaf juice, which was well-received by the panelists in terms of color, taste, and aroma, consists of 120g of fresh Moringa leaves, 50 mL of Semau honey, 50g of local guava, 800 mL of UHT milk, and 200 mL of distilled water. The antioxidant activity of Moringa leaf juice was determined to have a value of 14.339 ppm.

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DESCRIPTION OF THE EOSINOPHIL LYMPHOCITE RATIO (ELR) WITH PULMONARY TUBERCULOSIS AT SEVERAL HEALTH CENTER IN JAMBI CITY

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ABSTRACT

Background: Pulmonary Tuberculosis is an infectious disease caused by the bacteria Mycobacterium Tuberculosis. To reduce the number of pulmonary tuberculosis cases, treatment is carried out using OAT or what is commonly called anti-tuberculosis drugs. The length of treatment can affect the hematological system, including eosinophil cells and lymphocyte cells. An increase or decrease in the ratio of these two cells can describe the healing process of Pulmonary Tuberculosis disease.
Method: This study was conducted to determine the description of the eosinophil lymphocyte ratio (ELR) in pulmonary tuberculosis patients based on the duration of treatment. The research method was descriptive with a cross sectional approach. The research was conducted in February-June 2023 with a total sample of 40 respondents with Pulmonary Tuberculosis in several Puskesmas in Jambi City. The research was conducted in the hematology laboratory of the Technology Laboratory Medicine, Poltekkes Kemenkes Jambi.
Result: From the research conducted, it was found that the average ELR in patients with pulmonary tuberculosis undergoing treatment for <2 months was 0.08; the average ELR at the treatment stage >2 months was 0.12;
Conclusion: the conclusion of the ELR independent T test based on the length of treatment with a sig value of 0.230 (p>0, 05).

Keywords: Pulmonary Tuberculosis; Duration of Treatment; Eosinophil Lymphocyte Ratio (ELR)

INTRODUCTION

Pulmonary Tuberculosis is an infectious disease caused by Mycobacterium tuberculosi bacteria that has become a global concern due to the high morbidity and mortality rates in a fairly short time. Based on data from the Global Tuberculosis Report, in 2020 there are an estimated 10.1 million cases of pulmonary TB in the world, while in 2021 there will be an increase to 10.6 million cases of pulmonary TB in the world (WHO, 2021). Indonesia ranks third as the country with the most cases of Pulmonary TB in the world after India and China, with around 824,000 cases (Kemenkes RI., 2021). Jambi Province is one of the provinces in Indonesia with a high prevalence of Pulmonary TB. Based on data from the Jambi Provincial Statistics Agency, in 2020 there were 4,838 cases of Pulmonary TB in Jambi Province, with the Jambi City area contributing the most cases (BPS, 2020). In 2021 there were 828 people with Lung TB with the most cases at Kenali Besar Community Health Center (Jambi Provincial Health Office, 2021).

To reduce the number of cases due to pulmonary TB, the government implemented the Directly Observed Treatment Shortcourse (DOTS) strategy recommended by WHO to break the chain of transmission of pulmonary TB. The Pulmonary TB treatment process is provided in 2 phases, namely the intensive phase and the continuation phase. The drugs used are Anti Tuberculosis Drugs (OAT) in the form of a combination of several types of drugs with sufficient

quantities and the right dosage (Kemenkes RI, 2019). OAT is the most important component in the treatment of Lung TB, but OAT has side effects, especially on the hematological system such as eosinophilia caused by Rifampicin and Isoniazid drugs. This is in line with research conducted by Sanida (2017) showing that the number of eosinophils in the intensive phase was 5.4% above normal, while in the advanced phase there were 10% of eosinophils above normal.

The length of Pulmonary TB treatment with OAT can also affect the number of lymphocytes. Active Pulmonary TB infection causes lymphocytes to decrease, after treatment lymphocytes will return to normal. Based on research conducted by Subagyo, J. (2019), stated that the number of lymphocytes based on the length of treatment in the intensive phase obtained 17% of patients with lymphocytopenia, 66% of normal patients and 17% of patients with lymphocytosis. In the advanced phase, 4% of patients experienced lymphocytopenia and 96% of patients with normal lymphocyte counts, none experienced lymphocytosis.

The increase or decrease in the number of lymphocytes and eosinophils in patients with pulmonary TB will affect the Eosinophil to Lymphocyte Ratio (ELR), this is in line with research conducted by Cristopel et al., (2018) which states that the eosinophil-lymphocyte ratio is calculated by comparing the number of eosinophils and lymphocytes from diff count examination. REL research on TB patients specifically does not yet exist, but REL research has been found in endometrial cancer patients to see the prognosis of the disease before treatment, high REL is strongly associated with a worse risk of death and survival (Holub & Biete, 2018). In addition, in patients with Covid-19 REL evaluates the clinical course and treatment success (Georgakopoulou et al., 2021). The success of Pulmonary TB treatment is expected to be seen from REL examinations such as Covid -19, where REL can predict the course of a disease.

Based on the above background, the formulation of the problem is how the Eosinophil Lymphocyte Ratio (REL) in Pulmonary TB patients based on the length of treatment. With the hypothesis that there is a significant difference in ELR in pulmonary TB patients based on the length of treatment. The purpose of the study was to determine the description of ELR in pulmonary TB patients based on the length of treatment.

METHODS

The research method used is descriptive with a cross sectional approach with variable length of treatment. This research was conducted in February-June 2023 with a total sample of 40 respondents with Pulmonary TB at Puskesmas Simpang IV Sipin, Puskesmas Simpang Kawat, Puskesmas Rawasari, Puskesmas Putri Ayu and Puskesmas Pakuan Baru.This research was conducted in the hematology laboratory of the Medical Laboratory Technology department of the Jambi Ministry of Health Polytechnic.

RESULTS AND DISCUSSION

RESULTS

The data obtained from this study were recorded and presented in tabular form and analyzed using the independent T test whose results can be seen as follows:

Table 1. Description of eosinophil cell count based on length of treatment

Variable	n	Mean	Median	Min	Max
≤ 2 months	12	1,83	1,45	1	3,70
>2 months	28	3,53	2,55	1	18

Table 1 shows that the average number of eosinophil cells at the ≤ 2 months treatment stage is in the normal range (1-3%). whereas at the treatment stage> 2 months has an average number of eosinophils outside the normal range. While the average lymphocyte

cell count at both stages of treatment was in the normal range (20-40%), it can be seen in the following tab :

Table 2. Description of lymphocyte cell count based on length of treatment

Variable	n	Mean	Median	Min	Max
≤ 2 months	12	23,23	24,35	6,80	42
>2 months	28	27,87	28,00	12,40	42,80

Based on table 2, the average number of lymphocyte cells is higher at the treatment stage > 2 months, which is 27.87, while at the ≤ 2 months stage it is 23,23.

Table 3. Description of ELR based on length of treatment

Variable	n	Mean	Std. Deviation	Std. Eror Mean	P.Value
≤ 2 months	12	0,08	0,04	0,01	0,230
>2 months	28	0,12	0,10	0,02	

The average ELR in pulmonary tuberculosis patients at both stages of treatment is in the range of normal values of 0.25-0.15 with P-value > 0.05 which can be seen in table 3.

DISCUSSION

This study was conducted on the description of ELR in patients with pulmonary tuberculosis in several health centers in Jambi city with a total sample of 40 patients with pulmonary tuberculosis. the results of ELR research based on the length of treatment showed that ELR increased at the treatment stage> 2 months. ELR is calculated by comparing eosinophil cells and lymphocyte cells so that the increase in ELR is influenced by these two cells. At the treatment stage > 2 months, the average number of eosinophil cells increased, this is the same as research conducted by Sanida (2017) found that the number of eosinophil cells increased by 10% at the treatment stage > 2 months.

The average number of lymphocyte cells is in the normal value range, this is in line with the research of Subagyo, J. (2019) which states that after treatment the number of normal lymphocyte cells is 83.7%. Eosinophil cells play a role in phagocytosing various types of foreign organisms such as parasites and bacteria, this makes eosinophil cells increase at the beginning of pulmonary TB infection. Along with treatment eosinophils and lymphocytes will return to normal, but some OAT has side effects that can disrupt the hematological system, one of which is eosinophilia caused by Rimfapisin and Isoniazid. An increase in the number of eosinophils in patients with pulmonary TB can also occur due to allergies, this is reinforced by data from the questionnaire, namely at the treatment stage> 2 months, 28% of patients with Pulmonary Tuberculosis experienced itching.

The results of research conducted on REL in patients with Pulmonary TB showed the average value of REL at the ≤ 2 treatment stage of 0.08 and the > 2 month stage of 0.012. The average value of REL at both stages of treatment is in the range of normal values (0.025-0.15) which shows the condition of patients with Lung TB when compared to the percentage value of eosinophils to lymphocytes, where as many as 33 out of 40 patients with Lung TB have normal REL values. Based on the independent T test conducted, there was no difference in the average REL based on the length of treatment (P-value>0.05).

CONCLUSION

Based on the results of research on the description of the eosinophil lymphocyte ratio (ELR) in patients with pulmonary tuberculosis in several Jambi City health centers that have been carried out, it can be concluded that there is no significant difference in ELR in patients with pulmonary tuberculosis based on the length of treatment. For future researchers, it is hoped that this research can be a reference and research can be carried out by adding other disease variables such as HIV and Hepatitis in order to get varied data.

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CONFLICT OF INTEREST

All authors involved declare no conflict of interest in the writing of this study.

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SEDENTARY BEHAVIOR, MACRONUTRIENT CONSUMPTION LEVELS AND CHILDREN'S NUTRITIONAL STATUS POST COVID-19 PANDEMIC AT SMP NEGERI 5 MENGWI

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ABSTRACT

Background: Nutritional status is influenced by food consumption and physical activity of a person. Sedentary activity is the behavior of a person sitting or lying down in daily life excluding sleeping. School-age children tend to prefer sedentary activities such as playing on computers and smartphones. The purpose of this study was to determine the relationship between sedentary activity and the level of consumption of macronutrients with the nutritional status of students in the Post-COVID-19 Pandemic at Junior High School 5 Mengwi.
Method: The type of research used is Observational analytic with a Cross-Sectional design and using the Simple Random Sampling technique with a total of 90 people. The data was collected by interview and measurement methods. Data is presented with frequency tables and cross tables.
Result: The results of the Spearman rank analysis test showed that there was a significant relationship between nutritional status and sedentary activity (p=0.000, r=0.63). Furthermore, with the same test, the result that there was a relationship between the level of energy consumption and nutritional status (p=0.000, r=0.659), there was a relationship between the level of carbohydrate consumption and nutritional status (p= 0.000, r =0.427). Furthermore, that there was no relationship between the level of protein consumption and nutritional status (p =0.0619, r =0.053) and then, that there was a relationship between the level of fat consumption and nutritional status (p= 0.001, r =0.338).
Conclusion: Sedentary activity and the level of consumption of energy, carbohydrates and fats are strong variables that affect the nutritional status of school children.

Keywords: Sedentary activity, Consumption rate, Macro nutrients, Nutritional status

INTRODUCTION

In 2020, the world was shocked by the emergence of a new virus called SARS-CoV-2 and which causes Coronavirus Disease 2019 (COVID-19) (Yuliana, 2020). All aspects of human life are disrupted, including education. The long-term consequences of the COVID-19 crisis include a drastic increase in the prevalence of stunting, overweight and obesity. This is caused by a lack of physical activity and a continuous increase in consumption of processed foods containing high levels of sugar, salt and fat (Unicef, 2020). School age children are a very valuable investment for the nation. Students at school are in a phase of very rapid growth and very active physical activity, so health levels need to be improved, through improving nutritional status (Ulfa, Et al, 2018).

Based on the results of the 2018 Basic Health Research for adolescent students aged 13-15 years, the percentage of overweight based on Body Mass Index/Age was 11.2%. Meanwhile, the percentage of obesity is 4.8% (Kemenkes, 2018). School-aged children tend to choose less active activities such as playing games, using smartphones and watching television, especially when the pandemic forces them to learn online (Rahma, 2020). In Bali, the district with the highest prevalence of obese nutritional status in adolescents 13-15 years old based on BMI/U is Tabanan District with a prevalence of 21.47% and the highest obesity is Badung District with a prevalence of 15.27% (Riskesdas, 2018).

Bali Province shows a lack of physical activity with an average of 25.98% and Badung Regency is a district that has a figure of less activity that is higher than the average value of 34.35% (Kemenkes, 2018). Sedentary activities have a reversible relationship with the risk of obesity, meaning that people who frequently engage in sedentary activities have a higher risk of obesity, as well as people who are obese will be reluctant to carry out activities (Kemenkes, 2019).

Objective

In general, this research aims to determine the relationship between sedentary activities and levels of macronutrient consumption and the nutritional status of school children in the post-COVID-19 pandemic at SMP Negeri 5 Mengwi. Meanwhile, the specific aim of this research is to identify sedentary activities, levels of consumption of macronutrients (energy, carbohydrates, protein and fat), nutritional status, and analyze the relationship between sedentary activities and levels of consumption of macronutrients with the nutritional status of school children in the post-COVID-19 pandemic at SMP Negeri 5 Mengwi.

METHODS

This type of research is observational with a cross-sectional design. The research was conducted at SMP Negeri 5 Mengwi in December 2022. The population was all students in grades VII and VIII, both male and female. The sample consisted of 90 people with the sampling technique: proportional simple random sampling. Sedentary activity data was collected by filling in the ASAQ questionnaire and consumption level data by interviews using an instrument in the form of a 2x24 hour Recall form. Meanwhile, anthropometric data uses digital scales and microtoise. Calculation of nutritional status is using the z-score formula with categorization based on BMI/U. Meanwhile, the results of the sedentary activity data are categorized as low (<2 hours/day), medium (2-5 hours/day), and high (>5 hours/day). Data on macronutrient consumption levels is processed using the Nutrisurvey application and compared with daily nutritional requirements of Indonesia. Hypothesis testing was carried out using the chi-squared test.

RESULTS AND DISCUSSION

SMP Negeri 5 Mengwi is a state junior high school located on Jalan Lurah Office no.1, Banjar Negara Kaja, Sading Village, Mengwi District, Badung Regency. The number of students recorded in the 2022/2023 academic year is 1.075 with the number of study groups being 33. Students at SMP Negeri 5 attend school from Monday to Saturday. In one day, students take part in learning activities at school from 07.30 AM to 12.00 AM.

1. Sample Characteristics

The characteristics of the sample in this study are as shown in Table 1.

Table 1. **Generalized Characteristic Subject**

Variable / Category		F	%
Gender	Man	33	36.7
	Woman	57	63.3
Age (years)	13	79	87.8
	14	10	11.1
	15	1	1.1
Class	VII	44	48.9
	VIII	46	51.1
N		90	100.0

Based on Table 1, it can be seen that the largest gender group is women with 57 people (63.3%), the largest sample age is 13 years with 79 people (87.8%), and the largest class is class VIII with 46 (51.1%).

2. Sedentary Activities

The lowest sedentary activity in the sample was 28.4 minutes and the highest was 399.08 minutes, with an average of 143.3633 minutes in the moderate level sedentary activity category. The sample sedentary activities are described in Table 2, as follows:

Table 2. Characteristic subject sedentary activities

Sedentary Activities	f	%
Low (< 2 hours a day)	38	42.2
Medium (2-5 hours a day)	36	40.0
High (> 5 hours a day)	16	17.8
Total	90	100.0

Based on Table 2, it can be seen that the majority of the sample (42.2%) had low sedentary activity. Meanwhile, there were 40.0% samples whose sedentary activity was classified as moderate and 17.8% samples which were classified as high.

3. Macronutrient Consumption Levels

The lowest energy recall result in the sample was 231.95 kcal and the highest was 3,216.7 kcal, with an average of 2,096.985 kcal. Most of the sample energy consumption levels are in the excess category (47,8%), while there are 8,9% in the deficit category.

Base on the data of this research, the lowest carbohydrate recall result in the sample was 55.2 grams and the highest was 566.68 grams, with an average of 278.244 grams. Most of the carbohydrate consumption levels of the samples were in the adequate category (55.6%) and 8.9% samples of excessive consumption levels.

The lowest fat recall result in the sample was 31.16 grams and the highest was 125.2 grams, with an average of 70.29 grams. Most of the sample fat consumption levels were in the excess category, namely 66 samples and the deficit consumption level was 3.3%.

The sample macronutrients consumption levels are described in Table 3, as follows:

Table 3 Charactheristic subject on Macronutrients Consumption Level

Variable/Category		f	%
Energy	Deficit	8	8.9
	Adequate	39	43.3
	Excess	43	47.8
Carbohydrate	Deficit	32	35.5
	Adequate	50	55.6
	Excess	8	8.9
Fat	Deficit	1	1,1
	Adequate	23	25,6
	Excess	66	73,3
	Total	90	100.0

4. Nutritional status

After calculating the nutritional status of the samples based on BMI/U, the results showed that there were no samples with poor nutritional status. The complete nutritional status of the sample is described in Table 4, as follows:

Table 4. Characteristic Subject on Nutritional Status

Nutritional Status (BMI/A)	f	%
Undernutrition	3	3.3
Normal	36	40. 0
Overweigth	28	31.1
Obesity	23	25.6
Total	90	100.0

Most of the samples had good nutritional status (40.0%), and there were 31.1% overweight and 25.6% had obesity.

5. Relationship between Sedentary Activities and Nutritional Status of School Children

The results showed that of the 23 samples with obese nutritional status, there was 1 sample with low sedentary activity, 16 samples with moderate sedentary activity, and 6 samples with high sedentary activity. Of the 28 samples with over nutritional status, there were 3 samples with low sedentary activity, 17 samples with moderate sedentary activity, and 8 samples with high sedentary activity. Details regarding the relationship between sedentary activity and nutritional status can be seen in Table 5, as follows:

Table 5. Bivariate analysis based on Sedentary Activity and Nutritional Status

Sedentary Activities	Nutritional Status								*p*	*r*
	Obesity		Overweight		Normal		Under nutrition			
	f	%	f	%	f	%	f	%		
Low	1	1.1	3	3.3	31	34.5	3	3,3	0,000	0,677
Medium	16	17.8	17	18.9	3	3.3	0	0		
High	6	6,7	8	8.9	2	2.2	0	0		
Total	23	25.6	28	31,1	36	40.0	3	3,3		

The results of the Spearman correlation test show a p value of 0.0000. This means that there is a significant relationship between sedentary activity and students' nutritional status. The strength of the relationship is shown by the r value or correlation coefficient, which is 0.677, which means the level of correlation is strong.

6. Relationship between Macronutrient Consumption Levels and Nutritional Status

The research results showed that of the 23 samples with obese nutritional status, there was 1 sample whose energy consumption level was classified as deficit, 2 samples were classified as adequate, and 20 samples were classified as excessive. Of the 28 samples with excess nutritional status, there was 1 sample whose energy consumption level was classified as deficit, 7 samples were classified as adequate, and 20 samples were classified as excessive. Details regarding the relationship between energy consumption levels and nutritional status can be seen in Table 6, as follows:

Table 6 Bivariate analysis on Energy Consumption Level and Nutritional Status

Consumption Levels	Obesity		Overweight		Normal		Under nutrition		*p*	*r*
	f	%	f	%	f	%	f	%		
Energy										
Deficit	1	1,1	1	1,1	5	5,6	1	1,1		
Adequate	2	2,2	7	7,8	28	31,1	2	2,2	<0,001	0,659
Excess	20	22,3	20	22,2	3	3,3	0	0		
Carbohydrate										
Deficit	2	2,2	8	8,9	19	21,1	3	3,3		
Adequate	17	18,9	18	20,0	15	16,7	0	0	<0,001	0,427
Excess	4	4,5	2	2,2	2	2,2	0	0		
Protein										
Deficit	4	4,5	3	3,3	9	10,0	1	1,1		
Adequate	16	17,8	21	23,3	20	22,2	2	2,2	0,619	0,053
Excess	3	3,3	4	4,5	7	7,8	0	0		
Fat										
Deficit	0	0	0	0	1	1,1	0	0		
Adequate	3	3,3	3	3,3	16	17,8	1	1,1	0,001	0,338
Excess	20	22,2	25	27,8	19	21,1	2	2,2		
Total	23	25,6	28	31,1	36	40,0	3	3,3		

The results of the Spearman correlation test show that there is a significant relationship between the level of energy consumption and the nutritional status of students ($p < 0.05$), with a correlation coefficient of 0.659, which means a strong correlation level.

Based on the results of data analysis, the level of carbohydrate consumption and nutritional status of the research shows that of the 23 samples with obesity nutritional status, there are 2 samples whose level of carbohydrate consumption is classified as deficit, 17 samples are classified as adequate, and 4 samples are classified as excessive. Of the 28 samples with excess nutritional status, there were 8 samples whose carbohydrate consumption levels were classified as deficit, 18 samples were classified as adequate, and 2 samples were classified as excessive. There is a significant relationship between the level of carbohydrate consumption and the nutritional status of students ($p<0.05$). The strength of the relationship is shown by the value $r = 0.427$, which means the correlation level is quite strong.

The research results showed that of the 23 samples with obese nutritional status, there were 4 samples whose protein consumption levels were classified as deficit, 16 samples were classified as adequate, and 3 samples were classified as excessive. Of the 28 samples with overweight, there were 3 samples whose protein consumption levels were classified as deficit, 21 samples were classified as adequate, and 4 samples were classified as excess. After carrying out the Spearman correlation test, it was concluded that there was no significant relationship between the level of protein consumption and the students' nutritional status ($p>0.05$).

Of the 23 samples with obese nutritional status, there were 3 samples whose level of fat consumption was classified as adequate, and 20 samples were classified as excessive. Of the 28 samples with excess nutritional status, there were 3 samples whose level of fat consumption was classified as adequate, and 25 samples were classified as excessive. There is a significant relationship between the level of fat consumption and the nutritional status of students ($p<0.05$) with a correlation coefficient of 0.338, which means the correlation level is quite strong.

Based on the results of research on the sedentary activity of students at SMP Negeri 5 Mengwi in 6 days (Monday-Saturday), it was found that the majority of samples had sedentary activity which was classified as low, as many as 38 samples. Meanwhile, there were 36 samples classified as moderate sedentary activity and only 16 samples for high activity. Sedentary activities are activities related to all types of activity that occur outside sleep time and are characterized by a very low-calorie output, namely less than 1.5 METs (Putra, 2017). This is different from

the research conducted (Mozo, 2017) with the title "The Relationship between Dietary Patterns, Physical Activity and Sedentary Activity with Overweight in SMA Negeri 5 Surabaya" which obtained the results that most of the samples had high sedentary activity. This is because the majority of the sample often engages in sedentary activities such as playing with gadgets and there is an increase in sedentary activities on Saturday-Sunday.

Based on the results of calculating students' energy consumption levels, the results showed that the majority of samples had consumption levels that were classified as excessive, namely 43 samples. Energy sources are dietary fat sources such as fats and oils, nuts and seeds (Putra, 2017). This is in accordance with what was stated in research (Revi, et al, 2015) entitled "The Relationship between Energy Intake and Nutritional Status of Female Students at SMA Negeri 4 Manado". The results of this study state that excess energy intake can be caused by excess fat intake, malnutrition as a process of deficiency due to one or more nutrients not being met, this is supported by the theory that 1 gram of fat is equal to 9 calories, so excess fat intake also affects energy intake (Primashanti dan Sidhiarta, 2018).

Meanwhile, regarding students' carbohydrate consumption levels, the results of this study show that the majority have adequate consumption levels, namely 50 samples. Carbohydrates function as a sweet taste, save protein, regulate fat metabolism, and help excrete feces (Adriani dan Wiratmadji, 2016). In research conducted (Rosida dan Adhi, 2017) entitled "The Relationship between Breakfast Habits, Adequate Levels of Energy, Carbohydrates, Protein and Fat, with Nutritional Status of Students at the Al-Fattah Buduran Islamic Boarding School, Sidoarjo" it was found that the majority of respondents had sufficient levels of carbohydrate consumption. have normal nutritional status. Apart from that, research entitled "Breakfast Habit and Nutritional Status of Undergraduates in Ekiti State, Nigeria" (Adeshola, et al, 2014) stated that teenagers who skipped breakfast showed differences in the average carbohydrate intake between teenagers who skipped breakfast.

The level of protein consumption of students shows that the majority of samples have adequate levels of protein consumption, namely 59 samples. Protein functions for growth and maintenance of tissue, as a material for forming enzymes, as a means of transportation and storage, as a movement regulator, and as a mediator for the transmission of nerve impulses (Proverawati dan Wati, 2014). In research conducted (Paputungan, 2016) entitled "The Relationship between Iron and Protein Intake and the Incidence of Anemia in Class VIII and IX Students at SMPN 8 Manado" showed the results that there was a relationship between protein intake and the incidence of anemia in female students at SMP Negeri 8 Manado. This is in line with the theory which states that protein functions as a transporter, namely in transporting iron in the body.

The results of research on students' fat consumption levels were that the majority of samples had excessive levels of fat consumption, namely 66 samples. Fat is rich in energy, so fat is important for maintaining energy balance and body weight (Desthi, et al, 2019). The results of research on levels of fat consumption are the same as research conducted (Dewi dan Kartini, 2017) entitled "The Relationship between Nutritional Knowledge, Physical Activity, Energy Intake and Fat Intake with the Incidence of Obesity in Junior High School Adolescents", which shows that the level of excess fat intake is quite high, namely as much as 66.7%.

Based on the results of calculating nutritional status according to BMI/U for students, the results showed that the majority of samples had good nutritional status, namely 36 samples. Apart from that, there were 2 samples that had less nutritional

status, 28 samples had more nutritional status, and 23 samples had obesity status. The primary factor that influences nutritional status is food composition.

CONCLUSIONS

There is a significant relationship between sedentary activity and nutritional status. In addition, there is a significant relationship between the level of energy, carbohydrate and fat consumption and nutritional status. There is no relationship between the level of protein consumption and the nutritional status of students.

The advice we can convey is: school institutions are expected to provide education regarding the prevention of overweight and obesity, as well as the importance of physical activity in improving the health of school children. Students are expected to increase their physical activity. Meanwhile, future researchers are expected to carry out further research on the relationship between protein intake and nutritional status to identify the factors causing there to be no relationship between protein intake and nutritional status.

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CONFLICT OF INTEREST

We all authors declare that there is no conflict of interest from this research activity.

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FORMULATION AND PHYSICAL QUALITY TESTING OF CANDLES COMBINING ESSENTIAL OILS OF RED ROSES (*Rose hybrid*) AND WHITE ROSES (*Rose alba*) AS AROMATHERAPY

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ABSTRACT

Background: There are many aromatherapy options on the market, one of which is in the form of aromatherapy candles. Aromatherapy candles are made using several ingredients and use essential oils that have an aromatherapy scent, a combination of red rose and white rose essential oils. These essential oils are used not only for the treatment and prevention of disease, but also for their effects on mood, emotions, and a sense of well-being.
Method: In this experimental study, a comparative test was carried out between 5 concentration variations of red rose and white rose essential oils with F1 = 1%:5% ; F2= 2%:4% ; F3= 3%:3% ; F4= 4%:2% ; and F5= 5%:1%, using the same basis. Then an evaluation was carried out by testing the physical quality of the candle aromatherapy preparations which included organoleptic tests, melting point tests, burn time tests, and hedonic tests.
Result: The organoleptic test on formulas 1 and 5 produced an even color, no cracks and a characteristic odor, but in formulas 2,3 and 4 the color was uneven and there were depressions. In the melting point test, all formulas are within the standard candle time range, namely 540C, the average burn time test is not more than 2 hours and the preference test is on formula 5.
Conclusion: The final result is a formula that meets all testing standards, namely 5%:1% formula 5, in which the ratio of essential oils of red roses and white roses is and the ratio of paraffin and stearic acid is 54%:40%.

Keywords: Formulation, Wax, Essential oil, Aromatherapy

INTRODUCTION

Indonesia is an agricultural country and is one of the essential oil exporting countries. Essential oils are a large group of vegetable oils that are in the form of thick liquids, evaporate easily at room temperature, giving them a distinctive aroma (Dasar & Kimia, 2021).

Essential oils are natural oils taken from immunostimulant plants. A famous medical expert in India called Ayurveda, has also tried using various kinds of essential oils in his medical practice. A similar opinion was also expressed by Theophrastus, that the aromatic substances contained in plants apparently have a good response to the state of mind, feelings and bodily health (Rislianti et al., 2021).

Aromatherapy is an alternative treatment method derived from volatile plant materials, first known in the form of essential oils. Aromatherapy believes that essential oils can be used not only for the treatment and prevention of disease, but also for their effects on mood, emotions and a sense of health (Herawaty, 2021).

There are many aromatherapy options available on the market, one of which is available in the form of aromatherapy candles. Scented candles are not only used because of their fragrance, but also because they can change a person's mood for the better and have benefits including creating a comfortable atmosphere, increasing energy, increasing concentration, reducing stress, and controlling pain. So in the last few months production has increased by using natural ingredients as an

alternative complementary medicine whose popularity is increasing in the world of health (Herawaty, 2021).

Roses are one of the oldest ingredients in the world of perfume. Since ancient times, roses have been known for their fragrant smell. Of the 200 species, potential types as raw materials for essential oils include the red rose Rosa damascene. Other species are the rose Rosa alba and the pink rose Rosa centifolia. The first one has white flowers. Unfortunately, the oil content is lower than red roses (Dasar & Kimia, 2021).

Previously research on combination essential oil candles had been made by (Herawaty, 2021). The results obtained in this research were that the combined concentration of basil leaf essential oil (Ocimum sanctum L) and lemongrass essential oil (Cymbopogon citratus) had an effect on the physical properties of aromatherapy candles. Another research conducted by (Rusli & Rerung, 2018) stated that patchouli leaf essential oil combined with lime fruit essential oil could be formulated in aromatherapy candles as an anti-mosquito. And according to research (Kurniawati, 2019) the essential oil contained in rose flower extract can be used as a fragrance in cosmetic products, namely perfume. Based on the description of the problem above, the author is interested in conducting research on " Formulation And Physical Quality Testing Of Candles Combining Essential Oils Of Red Roses (*Rose hybrid*) And White Roses (*Rose alba*) As Aromatherapy".

METHODS

1. Types of research

This research uses an experimental research method, namely formulation. In this experimental research, a comparative test will be carried out between the concentrations of essential oils of red roses and white roses with a ratio of 1%, 2%, 3%, 4% and 5%%. Then an evaluation will be carried out by testing the physical quality of the aromatherapy candle preparation which includes organoleptic testing, melting point testing, burning time testing and hedonic testing.

2. Time and Place of Research

The research was carried out in February – June 2023. It was carried out in the pharmacognosy and chemistry laboratory of the Jambi Ministry of Health Polytechnic.

3. Tools and materials

The tools used in this research were analytical scales, metal spatula, beaker, stir bar, measuring pipette, horn spoon, porcelain cup, hot plate, watch glass, thermometer, candle wick, candle glass, tube clamp, dropper pipette, and lighter. fire.

The materials used in this research were Red and White Rose Essential Oils, Stearic Acid, and Paraffin Wax.

4. Ways of working

Making Essential Oils

Weigh 100 grams of sample then extract with 400 ml of ethanol solvent until the sample is submerged, leave for 3x24 hours, stirring periodically. Strain the soak to separate the filtrate and residue. Maceration of red roses and white roses is done separately and is done in the same way. The filtrate obtained is then distilled to separate the oil from the solvent (ethanol). The distillation process is carried out using a temperature of 78^{o}C so that the oil does not evaporate along with the ethanol. This process lasts for ±3 hours. After that, the resulting oil is evaporated again using an oven to remove any remaining solvent remaining in the oil at a temperature of 78^{o}C. The aim of using this temperature is so that the solvent evaporates because the boiling point of ethanol is 78.4^{o}C (Handayani & Nurcahyanti, 2015). Distillation of red roses and white roses is done separately and in the same way.

Making Aromatherapy Candle Bases

Make aromatherapy candle preparations from stearic acid and paraffin wax formulations with a ratio of 60%:40% because

research results (Rislianti et al., 2021) are the best basic results. And adding a combination of red rose essential oil and white rose essential oil in a ratio of 1%:5% (F1), 2%:4% (F2), 3%:3% (F3), 4%:2% (F4), 5%:1% (F5). According to (Rislianti et al., 2021) The way to make the base is to weigh 40 grams of paraffin wax and 54 grams of stearic acid. Put Paraffin wax and stearic acid into a porcelain cup according to the concentration that has been determined, then melt it completely on a hot plate at a temperature range of 65-84ºC. After that, stir and homogenize using a stir stick, wait until the temperature drops to around 55ºC, which is the temperature where the Stearic Acid starts to solidify again. then dripped in a combination of red rose oil and white rose oil according to the specified concentration, stirred and homogenized using a stirring rod. Put the liquid wax into a mold that has a candle wick installed in the center and wait until the wax solidifies into a candle.

Physical Properties Test

a. Organoleptic Test (Herawaty, 2021)

Take an aromatherapy candle preparation and observe the shape, color and smell of the preparation.

b. Melting Point Test (Herawaty, 2021)

Put the melted wax into the capillary tube and store it in the refrigerator at 4-10°C for 16 hours, then tie the capillary tube to a thermometer and put it in a 500 ml beaker filled with half water, heat the beaker glass and record the temperature when the wax first drips. from the capillary tube.

c. Burn Time Test (Herawaty, 2021)

Take the aromatherapy candle preparation then burn the candle wick and observe the burning time of the aromatherapy candle until the candle wick burns out. Candle burning time is the time interval that shows how long the candle can burn until it runs out. The burning time is obtained from the difference between the initial burning time and the time when the candle wick burns out (the flame goes out).

d. Hedonic Test (liking) (Herawaty, 2021)

Look for 10 respondents then burn the candle wick to observe the smell of the wax produced. Testing was carried out in a room with each room containing 1 formula that the respondent did not know. Respondents filled out a questionnaire asking questions regarding their preference for the preparation of essential oil candles from a combination of red roses (Rose hybrid) and white roses (Rose alba) as aromatherapy.

RESULTS AND DISCUSSION

Extraction of red roses and white roses is done by cold method (maceration). The extraction process using the maceration technique is carried out by shaking or stirring several times at room temperature for 3x24 hours. The advantage of this method is that it is easy and does not require heating so there is little chance of the material being damaged or decomposed (Susanty & Bachmid, 2016). The use of 96% ethanol as a solvent is because 96% ethanol can act as a solvent and preservative so that the desired substance can be extracted and is long-lasting. and it is not easy for fungi to grow (Wullur et al., 2012).

After extraction, continue with extracting the essential oil using the distillation method for approximately 3 hours. Because the material is easily damaged by the heating process, in this study the suitable method for extracting rose essential oil was distillation. According to (Damayanti & Fitriana, 2012) this method is very suitable for flower materials, because the nature of the material is not resistant to high temperatures and also damages the oil if it is overheated.

After that, the resulting oil was evaporated again using an oven for 15 minutes to remove any remaining solvent remaining in the oil at a temperature of 78^0C. The aim of using this temperature is so that the solvent evaporates because the boiling point of ethanol is 78.4^0C.

Based on research carried out in the pharmacognosy laboratory and chemistry

laboratory at the Jambi Ministry of Health Polytechnic, Department of Pharmacy regarding "Formulation and Physical Quality Testing of Candles Combination of Red Rose (Rose hybrid) and White Rose (Rose alba) Essential Oils as Aromatherapy" the following observation results were obtained:

Table 1. Formulation of Aromatherapy Candle Preparations

Active ingredients	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5
Red rose essential oil	1%	2%	3%	4%	5%
White rose essential oil	5%	4%	3%	2%	1%
Stearic acid	54%	54%	54%	54%	54%
Paraffin wax	40%	40%	40%	40%	40%

Physical Quality Test

1. *Organoleptic Test*

This test is carried out with the aspect being tested in the form of the physical condition of the wax, which is the same color, not cracked, not deformed and not broken according to SNI 0386-1989-A/II 0348-1980 (Rislianti et al., 2021).

The observation results show that formula 1 and formula 5 comply with the parameters, shown by having a good wax appearance and even color, no defects, cracks and depressions in the wax. If a slight depression forms in the candle, this is normal when making candles. The depression can be overcome with special manufacturing techniques so that depressions do not form during the candle making process. By using the best base according to research (Rislianti et al., 2021) which states that the best base results have been obtained which is F4 where there is 40% paraffin wax and 60% stearic acid.

And for the uneven color of the wax due to the inhomogeneity of the wax base and rose oil, this is because the rose oil used still has residual solvent left behind, due to the limitations of the tools used during the solvent separation process. To homogenize the base and rose oil, an emulsifier can be added. Emulgator is a material that allows all ingredients to be mixed evenly. (Handayani & Nurcahyanti, 2015).

Table 2. Results of Organoleptic Observations on Candles

Formula	Properties of Wax	Parameter
1	The wax color is even, does not crack and has a distinctive smell	The color is evenly distributed, no cracks, no defects and no breaks
2	The color of the wax is uneven, there are no cracks, there are depressions and it has a distinctive smell	
3	The color of the wax is uneven, there are no cracks, there are slight depressions and it has a distinctive smell	
4	The wax color is uneven, does not crack and has a distinctive smell	
5	The wax color is even, does not crack and has a distinctive smell	

2. *Melting Point Test*

This test was carried out with the aspect being tested in the form of determining the melting point of aromatherapy wax in accordance with SNI 0386-1989-A/SII 0348-1980 regarding the melting point of wax ranging from 50 to 58°C (Rislianti et al., 2021).

The results obtained from research show a melting of 54oC. This melting point is still within the range of wax melting points based on SNI.

The main raw material for making candles is paraffin. When making candles, using a lot of staric acid can increase the amount of oleic acid. The greater the amount of oleic acid, the wax formed will have a lower melting point. Adding stearic acid to paraffin wax will lower the melting point of the wax. Continuing with the burning time test, it was carried out by calculating the length of time the candle burned when burned, and the result was that the more stearic acid you eat, the longer the candle will burn. This can also be influenced by the quality of the candle wick, whether it is straight or not straight. However, these observations are in accordance with the theory that stearic acid is used to increase the durability and consistency of the candle flame. The melting point is influenced by the melting point of the wax base used, where the melting point of stearic acid according to Pharmacopoeia III edition is 54oC, while the

melting point of paraffin according to Bennet (1963) is around 42-60oC. (Al Fatina et al., 2021).

Table 3. Melting Point Test Results on Wax

Formula	Results	Information	Parameter
1	54ºC	Meet the requirements	Est the melting point of the wax Well said if, SNI 06-0386 -1989 range between 50-58ºC
2	54ºC	Meet the requirements	
3	54ºC	Meet the requirements	
4	54ºC	Meet the requirements	
5	54ºC	Meet the requirements	

3. *Burn Time Test*

This test is carried out with the aspect being tested in the form of The longer the burning time, it shows that the longer it takes for the candle to burn out, the longer the burning time required, the better the quality of the candle (Fatimah, 2016) (Herawaty et al., 2021).

Research results showed that the burning time ranged from 1 hour 55 minutes to 2 hours. The candle with the longest burn time is the candle with formula 3, and the candle with the fastest burn time is the candle with formula 2. However, the difference in burn time between formulas is not that big.

In this study, formula 1 shows a time of around 1 hour 57 minutes, formula 2 shows a time of around 1 hour 55 minutes, formula 3 shows a time of around 2 hours, formula 4 shows a time of around 1 hour 59 minutes and formula 5 shows a time of around 1 hour 57 minutes.

Table 4. Burn Time Test Results on Candles

Formula	Results	Parameter
1	1 hour 57 minutes	Burn time is obtained from the difference between the start time burnt and time when wicking The candle burns out (fire goes out)
2	1 hour 55 minutes	
3	2 hours	
4	1 hour 59 minutes	
5	1 hour 57 minutes	

4. *Test Likeability*

This test was carried out with the aspect being tested in the form of the panelists' level of preference for the aroma of the candle when it was burned. (Rislianti et al., 2021).

In hedonic testing (likes), a questionnaire was created where the test criteria in the questionnaire contained 4 points, namely; don't like, don't like, like and really like. After testing preferences and continuing with filling in the questionnaire, we obtained a recapitulation of the results most frequently chosen by respondents, so that was the final result.

The research results showed that the formula that was very liked was formula 5, the formula that was liked was formula 3 and 4, the formula that was less liked was formula 2 and the formula that was not liked was formula 1.

Table 4. Hedonic Test Results (liking)

Formula	Test Criteria	Favorite			Results
	Really like	Like	Do not like it much	Do not like	
1	3	2	1	4	Do not like
2	2	2	4	2	Do not like it much
3	2	5	3	1	Like
4	2	6	2	0	Like
5	5	3	2	0	Really like

CONCLUSION

There were 4 physical quality tests carried out on aromatherapy candles, namely organoleptic tests on formulas 1 and 5, the candles produced an even color, no cracks and a distinctive smell, but on formulas 2, 3 and 4 the color was less even and there were depressions. In the melting point test all formulas were within the standard candle time range, namely 54^0C, the average burn time test was no more than 2 hours and the preference test was for formula 5.

The formula that was very liked was formula 5, whose organoleptic test was in accordance with the standard, the melting point test was still within the standard range, the burn time test was 1 hour 57 minutes and the preference test was very popular with respondents.

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CONFLICT OF INTEREST

There is no conflict of interest.

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FIBER INTAKE, PHYSICAL ACTIVITY, AND BLOOD SUGAR LEVELS IN TYPE 2 DM PATIENTS AT PUSKESMAS I DENPASAR TIMUR

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ABSTRACT

Background: Diabetes Mellitus (DM) is a chronic disease that occurs when the pancreas is unable to produce insulin or when the body cannot use properly produced insulin. Normal blood sugar levels are below 200 mg/dl. The purpose of this study is to find out the correlation of fiber intake and physical activity with blood sugar levels in patients with type 2 diabetes mellitus at Public Health Center (Puskesmas) of Denpasar Timur I.
Method: This type of study is observational using *cross sectional* design. This study was conducted in December 2022. The number of samples in this study was 50 people. Fiber intake data are collected using the SQ-FFQ form, physical activity data are collected using the GPAQ (Global Physical Activity Questionnaire), blood sugar levels by blood strip using a glucometer.
Result: The data was processed with statistical analysis of Spearman Rank correlations. The results showed that 58% had sufficient fiber intake, 16% had high-category physical activity, and 42% had blood sugar levels <200 mg/dl. The results showed there was a relationship between fiber intake and blood sugar levels ($p<0.05$) and also a significant relationship of physical activity with blood sugar levels ($p<0.05$).
Conclusion: The final result is there was a relationship between fiber intake and blood sugar levels and also a significant relationship of physical activity with blood sugar levels.

Keywords: Fiber intake, Physical activity, Blood sugar levels

INTRODUCTION

1. Background

Diabetes mellitus is a metabolic disorder characterized by hyperglycaemia due to abnormalities in insulin action, insulin secretion or both. According to the World Health Organization (WHO), diabetes mellitus is one of the diseases that causes the most deaths in the world. The International Diabetes Federation (IDF) confirms diabetes as one of the fastest growing global health crises of the 21st century. Based on 2019 International Diabetes Federation (IDF) data, Indonesia ranks 7th out of 10 countries in the world with the highest number of diabetes sufferers, namely 10.7 million (Kemenkes, 2020).

Basic Health Research Data Riskesdas, 2018, the prevalence of diabetes mellitus in Indonesia was 2%. According to the results of Basic Health Research (Riskesdas, 2018), the prevalence of diabetes mellitus in Bali Province was 1.74%. Based on the 2020 Bali Province Health Profile, Denpasar City ranks first with the highest number of diabetes mellitus sufferers at 14,353 people (Dinkes Prop Bali, 2021). Puskesmas (Public Health Centre) Denpasar Timur I is one of the public health centres with the highest number of DM sufferers in Denpasar City with a total of 1,376 sufferers (Dinkes Kota Denpasar, 2020). Data results from Puskesmas Denpasar Timur I in 2021 recorded the number of people suffering from type 2 DM as 1,546 people.

Type 2 DM is influenced by several factors, namely age, physical activity, lifestyle, heredity, diet, gender, social and economic aspects, level of education, and

sugar levels in the body (Delfina, et al, 2021). DM management is known for its four main pillars, namely, education, food planning, physical activity, and medicine (Mujisari, 2021). The most important part in diabetes management is nutritional therapy which is carried out by regulating diet, such as consuming foods sourced from complex carbohydrates or foods with a low glycemic index and consuming high fiber foods. Blood sugar levels in DM sufferers can be controlled if the fiber intake consumed is sufficient. The results of research by Adhi, et al (2020) show that people in Denpasar City tend to have a high fat and low fiber consumption pattern with a fiber consumption percentage of 65.0%. Changes in people's lifestyles with fast-food diets containing high calories, fat and low fiber from traditional diets are one of the causes of this consumption (Adhi, et al, 2020).

Physical activity in diabetes mellitus sufferers plays an important role in controlling blood sugar. During physical activity, there is an increase in glucose use by working muscles which directly causes a decrease in blood sugar (Amrulah, 2020). Insulin will increase during activity so that blood glucose will decrease (Mayawati dan Isnaeni, 2017). The results of research from Kresniari, et al (2022) showed that the physical activity of the elderly in Denpasar City was mostly included in the sufficient category with a percentage of 53.2%. This is supported by data that some elderly people only often do light physical activity. In fact, there are still many elderly people who have low physical activity.

2. Objective

In general, this study aims to determine the relationship between fiber intake and physical activity with blood sugar levels in Type 2 DM sufferers at Puskesmas Denpasar Timur I. Meanwhile, the specific aim of this research is to assess fiber intake, physical activity, measure blood sugar levels and analyze the relationship between fiber intake and physical activity with blood sugar levels in Type 2 DM patent at Puskesmas Denpasar Timur I.

METHODS

This research was conducted at Puskesmas Denpasar Timur I on December 7-24th 2022. This type of research was observational with a cross-sectional design. The population in this study were all Type 2 DM patients who visited Puskesmas Denpasar Timur I, both men and women. The sample in this study was 50 people with a sampling technique in the form of Non Probability Random Sampling with the Purposive Sampling method. Fiber intake data was collected by interview using an instrument in the form of the SQ-FFQ form and physical activity data by interview using the Global Physical Activity Questionnaire (GPAQ) instrument. Meanwhile, blood sugar level data is measured using a glucometer.

Fiber intake data is processed using the Nutrisurvey application and then given low (< 25 grams/day) and sufficient (≥ 25 grams/day) categories. Meanwhile, physical activity data results are given categories of low (< 600 METs per week), medium (3000 > MET ≥ 600 METs per week), and high (METs ≥ 3000 METs minutes per week). Data on blood sugar levels are categorized as controlled (< 200 mg/dl) and uncontrolled (≥ 200 mg/dl). Hypothesis testing was carried out using the Spearman Rank correlation test.

RESULTS AND DISCUSSION

UPTD Puskesmas Denpasar Timur I is located on Jl. Pucuk No.1, Sumerta, East Denpasar District began operations on October 10th 1957 with a working area of 7,509 km2. UPTD Puskesmas Timur I is one of two community health centers in the East Denpasar District area. The number of DM sufferers recorded at Puskesmas Denpasar I in 2021 was 1,546 people.

1. Samples Characteristics

The identity data for this research sample includes gender, age, highest level of education, occupation and nutritional status as described in Table 1, as follows:

Table 1 Sample Characteristics

Sample Characteristic	n	%
Gender		
a. Male	28	56.0
b. Female	22	44.0
Age (year)		
a. 36-45	4	8.0
b. 46-55	11	22.0
c. 56-65	21	42.0
d. 66-75	14	28.0
Education level		
a. Low	12	24.0
b. Midle	22	44.0
c. High	16	32.0
Job status		
a. Housewife	19	38.0
b. Private sector employee	14	28.0
c. Retired	10	20.0
d. Civil servants	3	6.0
e. Trader	2	4.0
f. Laborer	1	2.0
g. Jobless	1	2.0
Nutritional Status		
a. Thin	3	6.0
b. Normal	24	48.0
c. Obese	23	46.0
Total	**50**	**100**

The results of data analysis on 50 samples were 28 people (56.0%) male. A total of 21 people (42.0%) were in the age range 56-65 years. Age can increase the incidence of type 2 DM because aging triggers physiological decline which affects the decline in organ function which ultimately reduces insulin sensitivity which can affect blood sugar levels. Most of them had a secondary education level, namely 22 people (44.0%). The level of education influences the occurrence of DM. People who are highly educated usually have a lot of knowledge about health. Looking at other characteristics, namely work, the majority work as housewives, namely 19 people (48.0%). Judging from nutritional status, 23 people (46%) had a nutritional status in the obese category. This is in accordance with the theory that DM tends to be caused by obesity which is related to insulin resistance, which causes an increase in blood sugar levels due to the accumulation of body fat which can inhibit insulin action.

2. Fiber Intake

Fiber intake is the average amount of fiber intake per day that comes from food consumed in the last month by the sample. The recommended fiber consumption for DM sufferers is 25 grams/day. From the 50 samples taken, the lowest fiber intake in the sample was 14.5 grams and the highest fiber intake in the sample was 26.2 grams with the average fiber intake obtained by the samples being 19 .8. The sample fiber intake is described in Table 2, namely as follows:

Table 2 Sample distribution based on fiber intake

Fiber intake	f	%
Low (< 25 gram/day)	29	42.2
Enough (≥ 25 gram/day)	21	40.0
Total	50	100.0

Based on Table 2, it can be seen that 21 samples (42.0%) had fiber intake in the sufficient category, while 29 samples (58.0%) had fiber intake in the low category.

3. Physical Activity

Physical activity is any body movement produced by skeletal muscles that requires energy. Physical activity data was obtained from the results of physical activity interviews conducted by the sample in the last week with the help of the GPAQ (Global Physical Activity Questionnaire) questionnaire. Of the 50 samples taken, the lowest MET value in the sample was 240 and the highest MET value was 3140 with the average MET value obtained in the sample being 1052.39. Physical activity in the sample is described in Figure 1, as follows:

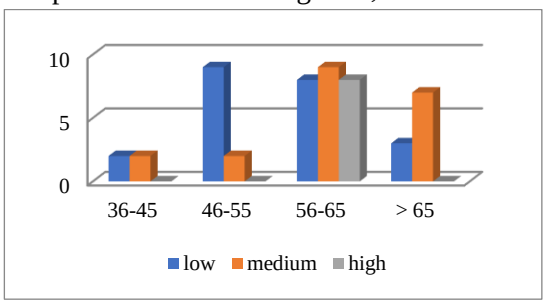

Figure 1. Distribution of samples according to physical activity

A total of 22 samples (44.0%) had low physical activity while 8 people (16.0%) had

high physical activity.

4. Blood Sugar Levels

Current blood sugar levels are categorized into two, namely controlled if < 200 mg/dl and uncontrolled if ≥ 200 mg/dl. The lowest blood sugar level in the sample was 102 mg/dl and the highest blood sugar level in the sample was 363 mg/dl with the average blood sugar level obtained in the sample being 190.86. Blood sugar levels during the sample are described in Table 3, as follows:

Table 3 Distribution of samples based on temporary blood sugar levels

Temporary Blood Sugar Levels	f	%
Under control	24	48,0
Uncontrollable	26	52,0
Total	50	100

Based on Table 3, it can be seen that 26 samples (52.0%) had blood sugar levels in the uncontrolled category and 24 people (48.0%) had blood sugar levels that were controlled or normal.

5. Relationship between fiber intake and blood sugar levels

The results showed that 26 samples (100%) had insufficient fiber intake with blood sugar levels ≥ 200 mg/dl. Of the 24 samples with controlled blood sugar levels, there were 3 samples (12.5%) with low fiber intake, 21 samples (87.5%) with sufficient fiber intake. Details regarding the relationship between fiber intake and blood sugar levels can be seen in Table 4, as follows:

Table 4. Bivariate analysis of blood sugar levels based on fiber intake

Fiber intake	Blood sugar level				Total		*p*	*r*
	< 200		≥ 200					
	n	%	n	%	n	%		
Low	3	12.5	26	100.0	29	58.0	0,000	-0,658
Medium	21	87.5	0	0	21	42.0		
Total	24	100	26	100	50	100		

After carrying out the Spearman correlation test, a significant value of 0.0000 was obtained ($p < 0.05$), so it can be said that there is a significant relationship between fiber intake and blood sugar levels. The strength of the relationship is shown by the r value or correlation coefficient, which is -0.658, which means the level of correlation is strong. The relationship between these two variables is unidirectional so it can be interpreted as the more adequate fiber intake, the lower the blood sugar level or the lower the fiber intake, the higher the blood sugar level.

6. Relationship between physical activity and blood sugar levels

The results showed that of the 26 samples with uncontrolled blood sugar levels, there were 18 samples (69.8%) whose physical activity was classified as low and 8 samples (30.2%) whose physical activity was classified as moderate. Of the 24 samples with controlled blood sugar levels, there were 4 samples (16.7%) whose physical activity was classified as low, 12 samples (50.0%) were classified as moderate, and 8 samples (33.3%) were classified as high. Details regarding the relationship between physical activity and blood sugar levels can be seen in Table 5, as follows:

Table 5. Bivariate Analysis of blood sugar levels and physical activity

Physical Activity	Blood sugar level				Total		*p*	*r*
	< 200		≥ 200					
	n	%	n	%	n	%		
Low	4	16.7	18	69.8	22	44.0	0,000	-0,609
Medium	12	50.0	8	30.2	20	40.0		
High	8	33.3	0	0	8	16.0		
Total	24	100	26	100	50	100		

Based on the results of the Spearman correlation test, it can be concluded that there is a significant relationship between physical activity and blood sugar levels ($p<0.05$). The strength of the relationship is shown by the r value or correlation coefficient, which is -0.609, which means the level of correlation is strong. The relationship between these two variables is unidirectional so it can be interpreted as the higher the physical activity, the lower the blood sugar level of the sample.

7. Discussion

Dietary fiber is the main component of plant cell walls such as fruits, vegetables, cereals and various tubers. Dietary fiber influences the GI value of food due to its role as a physical inhibitor in the digestive process. Dietary fiber has a hypoglycemic effect because it can slow gastric emptying, glucose diffusion, and glucose absorption which can reduce blood sugar (9). A total of 3 samples

(12.5%) out of 24 samples had fiber intake < 25 grams (low) and 21 samples (87.5%) had fiber intake ≥ 25 grams (sufficient) with blood sugar levels under control. Meanwhile, 26 samples with uncontrolled blood sugar levels had fiber intake < 25 grams (low).

The results of this study are in line with research conducted (Rosa, 2015) which states that low fiber intake has a significant relationship to blood glucose levels in type 2 DM patients, where patients who have low fiber intake have high blood glucose levels. In the digestive tract, fiber forms a layer that can inhibit digestion and absorption. Fiber has the effect of lowering blood sugar, by slowing the absorption of sugar. The longer time it takes for fiber to be digested by the body can reduce the workload of the pancreas to produce insulin, reduce insulin use, and slow blood sugar spikes.

One form of non-available carbohydrate is fiber found in vegetables and fruit. The body cannot digest non-available forms of carbohydrates which is why it has a low GI (Afandi, et al, 2019). The Glycemic Index (GI) is a number that shows the potential of carbohydrates in food to increase blood sugar or can be said to be a level or assessment of food according to its effect on blood sugar. There is an increase in blood sugar after consuming carbohydrate source foods. There are 3 categories for classification of the glycemic index of food ingredients, namely food ingredients with a low glycemic index (IG < 55), food ingredients with a medium glycemic index (55 ≤ IG ≤ 70), and food ingredients with a high glycemic index (IG > 70). Eating foods with a low glycemic index causes blood sugar levels to be more controlled. This is due to the slow digestive process so that the rate of gastric emptying becomes slow. As a result, suspended food components move more slowly to the small intestine, thereby slowing glucose absorption.

Physical activity is one of the basic principles of clinical management of type 2 DM patients. Absorption of glucose in body tissues at rest requires insulin, while insulin levels in active muscles do not increase even though glucose requirements increase. This is because when a person does physical activity the sensitivity of insulin receptors in active muscles increases. Insulin resistance, which causes glucose not to enter the cells, is the main problem that occurs in type 2 DM. Muscles have insulin-like properties where when muscles contract, membrane permeability to glucose increases. Therefore, exercise reduces insulin resistance (Efendi, et al, 2022).

Based on physical activity data, it shows that the majority of the sample, namely 22 people (44%) have low activity with a METs value of <600 minutes per week. The physical activities most frequently carried out by the sample were daily household activities such as sweeping, cooking and washing. The low physical activity in the sample could be because most of them were elderly. This has to do with the activities carried out interspersed with rest and not being too strenuous. This is in accordance with the theory that there is no significant effect on blood sugar levels if physical activity is followed by a long period of rest. Excessive rest or too little exercise can worsen the decline in insulin sensitivity because physical activity functions to stimulate cell insulin sensitivity again and reduce the amount of central fat and changes in muscle tissue (Azhita, et al, 2018). Physical activity according to the CRIPE principle (continuous, rhythmical, interval, progressive, endurance training) and carried out for approximately 30 minutes regularly (3-4 times a week) and trying to reach 75-85% of the maximum heart rate is recommended for people with type 2 DM (Anggraeni and Alfarisi, 2018).

CONCLUSION

Most Diabetes Mellitus sufferers have low fiber intake and relatively low physical activity with uncontrolled blood sugar levels. It is recommended that education be provided regarding DM management and the recommended diet for patients. The educational activities in question are counselling and education to DM patients, especially regarding fiber consumption, such

as recommendations for good fiber for DM patients and food ingredients that have high fiber content. Apart from that, the posyandu for the elderly should be more active in providing health services and regularly carry out healthy exercise activities so that the elderly can actively participate in the posyandu's activities and it is hoped that this will increase the awareness of the elderly about the importance of health.

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CONFLICT OF INTEREST

There is no conflict of interest in this research.

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EFFECTIVITY OF SUKAMOND PUDDING AS A HEALTHY SNACK FOR HYPERCHOLESTEROLEMIA PATIENTS

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ABSTRACT

Background: Hypercholesterolemia is a disorder of cholesterol metabolism caused by cholesterol levels in the blood exceeding normal limits. Sukamond Pudding is a pudding made from milk flour, rice bran, and almonds, which contain high fiber, vitamin C, and Vitamin E. This study aims to analyze the effectiveness of giving Sukamond pudding as a healthy snack in hypercholesterolemia sufferers.
Method: This type of research is quantitative with a quasi-experimental research design. This research was conducted from December 2022 to January 2023 at the OKU Sekarjaya Health Center. The research sample was selected by systematic random sampling with a total sample of 60 respondents.
Result: There was an effect of giving Sukamond as a healthy snack to patients with hypercholesterolemia (p=0.000).
Conclusion: The results of statistical tests showed that there was an effect of giving Sukamond as a healthy snack to people with hypercholesterolemia.

Keywords: Total Cholesterol Level, Hypercholesterolemia, Sukamond Pudding

INTRODUCTION

Hypercholesterolemia is a cholesterol metabolism disorder caused by cholesterol levels in the blood exceeding normal limits (Ministry of Health RI, 2022). Cardiovascular disease is usually a complication of hypercholesterolemia. Cholesterol can irritate and break down blood vessels (Sanlia et al., 2020). The formation of plaque on the arterial wall causes an inflammatory process caused by metabolic disorders, increased LDL and lipoprotein levels, and decreased HDL levels (Nurhidajah et al., 2019).

Hypercholesterolemia is a major cardiovascular risk factor that increases the incidence of atherosclerotic disease in adults (Félix-Redondo et al., 2013)). Factors causing atherosclerosis and atherosclerotic cardiovascular disease due to increased serum triglyceride levels (Ohmura, 2022). Each individual has a variation of risk of coronary heart disease. Part of this variation can be explained by risk factors (Simonetto et al., 2022). Cholesterol includes steroid molecules such as bile salts, steroid hormones, and vitamins. Bile salts are synthesised in the liver before becoming a very effective molecule in dissolving fat (Benito-Vicente et al., 2018). Based on research conducted by (Daum Aner et al, 2019), familial hypercholesterolemia causes an increase in LDL-C levels and a decrease in HDL-C.

Based on data from the World Health Organization (WHO) in 2018, it was recorded that more than 160 million people worldwide have hypercholesterolemia with total cholesterol levels > 200 mg/dl, which is

included in the rather high category. In the next 5 years, developing countries such as Indonesia will experience an increase of 137%, while in developed countries, it will only increase by 48%. According to the 2018 Riskesdas, the prevalence of heart disease in Indonesia is 1.5%. The prevalence of heart disease in South Sumatra is 1.2%. The prevalence of heart disease in Ogan Komering Ulu Regency is 1.1%. The Sekarjaya Health Center is one of the health centres in OKU Regency, and in 2021, the prevalence of hypercholesterolemia is 2.8%.

In addition to using pharmacological therapy prescribed by doctors, non-pharmacological treatment of hypercholesterolemia that is appropriate to the patient's disease conditions must be carried out (Cabral & Klein, 2017). Non-pharmacological treatment reduces total cholesterol levels in the blood by consuming foods that contain fibre, vitamin C and E nutrients. These can lower cholesterol levels. Food that can be given to hypercholesterolemia sufferers to reduce total cholesterol levels is Sukamond pudding. The aim of this research is to determine the effect of giving Sukamond pudding (flour milk, rice bran and almonds) as a snack for hypercholesterolemia patients.

METHODS

Methods This study uses a quantitative method with a quasi-experimental research design.

This study included two groups: the treatment group and the control group (as Control). The treatment group was the group that was given Sukamond pudding and received cholesterol-lowering drugs, while the control group was the group that only received cholesterol-lowering drugs. The research was conducted at the Sekarjaya Health Center, Ogan Komering Ulu District, South Sumatra Province. The research was carried out in December 2022 - January 202 3. After being determined using the formula, the number of samples used was 60 respondents, with the division of each treatment group consisting of 30 respondents and a control group of 30 respondents. Sampling used a systematic random sampling method.

The sample in this study had inclusion criteria, namely aged ≥ 30 years, total cholesterol levels above ≥ 200 mg/dl, hypercholesterolemic outpatients with mild complications such as hypertension, taking cholesterol-lowering drugs prescribed by doctors, and willing to be respondents. The exclusion criteria were patients with hypercholesterolemia hospitalised with complications from diabetes mellitus, kidney, and liver. As well as residing outside the working area of the Sekarjaya OKU Health Center. In this study, the treatment group was given Sukamond Pudding for 7 consecutive days twice a day, namely a morning snack at 10.00 and an afternoon snack at 16.00. Each serving of 225 g of Sukamond Pudding can contribute 10-20% of daily nutritional needs. The nutritional value of 1 portion of Sukamond Pudding is energy 251 kcal, protein 9.27 g, fat 8.7 g, carbohydrates 33.7 g, dietary fibre 5.83 g, vitamin C 18.18 mg, vitamin E 6.7 mg.

Sukamond Pudding is a pudding made from prosteo plus milk flour, rice bran, and almonds, which contain the right nutrients that may reduce total cholesterol levels. (Soliman, 2019), giving rice bran can significantly reduce LDL cholesterol in patients with hypercholesterolemia because it contains good nutrition and high fibre, potentially reducing total cholesterol levels (Irma et al, 2018). One hundred grams of bran contains 423.19 kcal of energy, 16.61 g of protein, 33.24 g of KH, 24.15 g of total fibre, and 438 mg of calcium (Aparecida et al., 2012). The milk used is Prosteo Plus powdered milk. Prosteo Plus is a low-fat and high-protein cholesterol-free milk powder

useful for building and repairing body tissues. It is high in dietary fibre, which can help lower blood cholesterol levels if accompanied by a diet low in saturated fat and cholesterol. In research (Kalita et al., 2018), almonds can reduce LDL-C, a risk factor for coronary heart disease. Studies have also looked at the effect of almonds on HDL-C, and it has been found that consumption of almonds has helped maintain and even increase HDL-C levels.

Sukamond Pudding is a pudding made from prosteo, milk flour, rice bran, and almonds. Prosteo plus milk is low-fat, cholesterol-free, high in dietary fibre and vitamin C, making it very suitable for helping reduce cholesterol in the blood. Rice bran is a food ingredient high in dietary fibre, and almonds contain unsaturated fats and are high in vitamin E. Apart from these three ingredients, agar-agar flour, water, and sugar are added, then cooked until boiling and placed in a mould.

This study used univariate, bivariate, and multivariate analysis. Research Ethics Number: 596 / KEPK / Adm2 /VIII/ 2022.

RESULTS AND DISCUSSION

Results

1. Univariate Analysis

Table 1. Characteristics of Respondents

Characteristics of Respondents	Treatment		Control	
	n	%	n	%
Gender				
Man	16	53,3	17	56,7
Woman	14	46,7	13	43,3
Total	**30**	**100**	**30**	**100**
Age				
30- 39	2	6, 7	7	23,3
40-49	6	20.0	9	30
50 - 59	10	33,3	7	23,3
60-69	12	40	7	23,3
Total	**30**	**100**	**30**	**100**
Nutritional status				
Thin	0	0	0	0
Normal	10	33,3	4	13,3
Overweight	14	46,7	10	33,3
Obesity	6	20	16	53,3
Total	**30**	**100**	**30**	**100**

Table 2. Average Total Cholesterol Before Intervention

Group	Number of Samples	Highest Cholesterol	Lowest Cholesterol	Average	Std. Deviation
Treatment	30	329	242	275, 67	23,176
Control	30	337	243	251, 27	21,826

Table 3. Average Total Cholesterol After Intervention

Group	Number of Samples	Highest Cholesterol	Lowest Cholesterol	Average	Std. Deviation
Treatment	30	280	173	223, 27	24,100
Control	30	315	183	254, 43	28,922

Table 4. Nutritional Intake

Nutrients	Treatment		Control	
	n	%	n	%
Energy				
More	5	16,7	12	40
Good	25	83.3	18	60
TOTAL	**30**	**100**	**30**	**100**
Protein				
More	6	20.0	11	36,7
Good	24	80.0	19	63,3
TOTAL	**30**	**100**	**30**	**100**
Fat				
More	9	30.0	11	36,7
Good	21	70.0	19	63,3
TOTAL	**30**	**100**	**30**	**100**
Carbohydrate				
More	10	33,3	16	53,3
Good	20	66,7	14	46,7
TOTAL	**30**	**100**	**30**	**100**
Fiber				
More	0	0	0	0
Good	24	80.0	17	56,7
Not enough	6	20,0	13	43,3
TOTAL	**30**	**100**	**30**	**100**
Vitamin C				
More	0	0	0	0
Good	26	86.7	19	63,3
Not enough	4	13,3	11	36,7
TOTAL	**30**	**100**	**30**	**100**
Nutritional status				
More	0	0	0	0
Good	25	83.3	17	56,7
Not enough	5	16,7	13	43,3
TOTAL	**30**	**100**	**30**	**100**

2. Bivariate Analysis

Tabel 5. Differences in Average Total Cholesterol Before and After Intervention

Group	Initial means	Final means	p-values
Treatment	275, 67	223,26	0.0 02
Control	277,10	254, 43	0.018

Tabel 6. The Effect of Giving Sukamond Pudding on Reducing Total Cholesterol

Group	Average Difference	t	p-value
Treatment	5 2.41	4, 676	0.000
Control	22.67		

3. Multivariate Analysis

Tabel 7. Candidate Selection Results based on sequence

Subvariable	Betas	Sig
Vitamin C	2.900	0.004

Fiber	4 ,211	0.066

The results of the analysis above can be concluded that from all the independent variables (fiber, vitamin C, and vitamin E) turned out to be vitamins C has a significant value, namely p-value < 0.005, which means Vitamin C has the greatest influence on reducing levels total cholesterol. The beta value of Vitamin C has a positive relationship pattern meaning the more vitamin C consumed, the more decreased total cholesterol levels.

Discussion

1. Age

Based on the results of this study, it was conducted on 60 respondents who were the research sample. The majority of hypercholesterolemic sufferers in the treatment and control groups were aged 60-69 years, namely 19 people (31.67%) in the treatment and control groups. Total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, and triglyceride (TG) levels must be checked regularly so that you know if you have coronary artery disease (Caselli et al., 2021). Low values of lipoprotein cholesterol, apolipoprotein A-I and monocytes/high-density lipoprotein can interpret the severity of coronary heart disease (Li et al., 2020). The results of this study are in line with research by (Félix-Redondo et al., 2013). Hypercholesterolemia is a risk factor that increases the incidence of atherosclerotic disease in adults and the elderly.

2. Gender

In this study was found that in both the treatment group and the control group, the majority of respondents were male, namely 16 people (54.3%) in the treatment group and 17 people (60%) in the control group. This is in line with research (Nikolaos Mavritsakis et al., 2019); 54 males and 118 females were diagnosed with obesity. 45 out of 54 males had very low HDL. In contrast to females, only 35 out of 118 women had very low HDL.

3. Nutritional Status

Based on the results of this study, the majority of respondents had overweight nutritional status, namely as many as 14 people (46.7 %). In the control group, most of them had obese nutritional status, i.e 16 people (53,3%). This is in line with research (Rhee et al., 2019). Individuals who are obese or overweight find that total cholesterol, LDL-C, and triglyceride concentrations decrease with weight loss. Therefore, energy intake must be consumed to create an ideal body weight. Research conducted by (Satoh et al., 2021) showed that Individuals with high total cholesterol levels cause an increase in the LTR of CHD mortality in hypertensive individuals.

4. Nutrition Intake

a. Energy

Most of the respondents in this study had good energy intake, as many as 25 people (83.3%) in the treatment group and good energy intake in the control group of 18 people (6 0%). (Sugini, 2019) the data analysis results were that there was a relationship between energy intake and total cholesterol levels (p=0.016, r=0.434). High energy intake also results in fat accumulation, especially triglycerides. It can also increase VLDL and IDL in the blood, which will have an impact on increasing total cholesterol.

b. Proteins

Some of the respondents in the study, both the treatment group and the control group, had sufficient protein intake according to their needs. Research results (Fernandez & Murillo, 2022) show that the increase in LDL in adults following intake of 640 mg/day of cholesterol (3 eggs) resulted in higher LDL concentrations compared to 0 mg of additional cholesterol in adults. However, this is different from the results of a study (Pasiakos et al., 2015), which showed that the cardiometabolic benefits of a high-protein diet in free-living adults were limited

to an increase in HDL cholesterol.

c. Fat

Most respondents in this study had a greater fat intake than needed. However, still, some people still consume excess fat. Individuals with hypercholesterolemia are recommended to consume dietary cholesterol up to < 200 mg/day to reduce LDL cholesterol and non-high-density lipoprotein cholesterol concentrations (Carson et al., 2020). This is in line with research (Lordan et al., 2018). Another study fed 40 g/day of butter or cooked cheddar cheese to 19 participants with hypercholesterolemia for four weeks in a randomised cross-sectional trial. They observed that total cholesterol and LDL cholesterol increased significantly in the butter group (p-value < 0.05).

d. Carbohydrate

Most of the respondents in this study had adequate carbohydrate intake for their needs. Consuming daily food should not be excessive, especially carbohydrates. Excessive carbohydrate intake, especially simple sugar intake, can increase blood triglyceride levels. It is recommended that consumption of total carbohydrates be limited to 65% of daily energy intake (Rhee et al., 2019). The results of (Utami et al., 2017) showed that carbohydrate intake is related to total cholesterol levels in coronary heart disease patients at Dr Kariadi General Hospital, Semarang. The biggest risk factor for CAD is abnormal blood lipid metabolism. The risk is also greater with high total cholesterol concentration (Liang et al., 2022).

e. Fiber

Most respondents in this study had enough fibre intake than needed. Regular consumption of soluble fibre, such as beta-glucans from wheat or barley, has been shown to lower blood levels of LDL cholesterol, a risk factor for cardiovascular disease. Insoluble fibre that does not dissolve in water – inert to digestive enzymes in the upper digestive tract. Most diets combine soluble and insoluble fibre, with 75 per cent coming from insoluble fibre and 25 per cent from soluble fibre (Chibuzo et al., 2021). This study is in accordance with research (Soliman, 2019) showing that there was a significant decrease in LDL cholesterol in the intervention group that consumed 50 mg of rice bran extract compared to the placebo group (from 163 ± 25.3 mg/dL to 135.9 ± 26.8 mg /dL).

f. Vitamin E

Most of the respondents in this study had sufficient intake of vitamin E. Hal ini sejalan dengan studi intervensi dari (Liao et al., 2022) bahwa setelah enam minggu 30 orang dewasa menerima dosis farmakologis vitamin E (73,5 mg/hari), Aktivitas enzim antioksidan glutathione peroksidase (GPx) dalam plasma meningkat, dan konsentrasi kolesterol total menurun pada waktu yang sama pada kedua kelompok. In research (Garg & Lee, 2022), Vitamin E is a very important antioxidant because it can inhibit oxidation so that LDL is not able to penetrate the artery walls. Vitamin E can neutralise peroxidase intermediates (free radicals) and prevent damage to vital molecules by converting radicals into hydroperoxide.

5. The Effect of Giving Sukamond Pudding on Changes in Total Cholesterol Levels

An independent t-statistic test that has been carried out shows that there is a significant effect of giving Sukamond pudding on reducing total cholesterol levels. Bran is a by-product of the rice milling process, which can be used as an additional ingredient in cake making because it has good nutritional content and high fibre, so it has the potential to reduce total cholesterol levels (Aparecida et al., 2012). Vitamin C in Prosteo plus milk can also lower cholesterol levels. Vitamin C (ascorbic acid) as an antioxidant affects the lipid profile. Almonds, which are also one of the ingredients for making pudding, also have vitamin E, which has a positive effect on total cholesterol levels.

This is also in line with the results of (Muzakar et al., 2010), the results of the chi-square statistical test for vitamins B3, vitamin C, vitamin E, and fibre obtained p <0.05, which means that there is an effect of vitamin C on reducing cholesterol levels. Multivariate analysis was tested on the treatment group using total cholesterol data after intervention. Multivariate analysis showed that the nutrient that had the most effect on reducing total cholesterol levels was vitamin C, where the statistical result was p-value = 0.0 04. Nevertheless, for the nutrients vitamin C, fibre, and vitamin E are equally significant, using Sukamond pudding to lower total cholesterol levels still needs to be controlled.

CONCLUSION

Most of the respondents are in the age category 40-49 and 60-69 years. The sex of the respondents is mostly male. Nutritional status of respondents Most of the respondents in the treatment and control groups had nutritional status of overweight. The average total cholesterol after treatment decreased significantly.

Dependent T-test shows total cholesterol levels before and after had differences in the treatment group. Independent T-test showed that there was an effect of giving sukamond pudding on total cholesterol levels in hypercholesterolemic patients. The multivariate analysis showed that the most influential nutrient for reducing total cholesterol levels was contained in the pudding (vitamin C).

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

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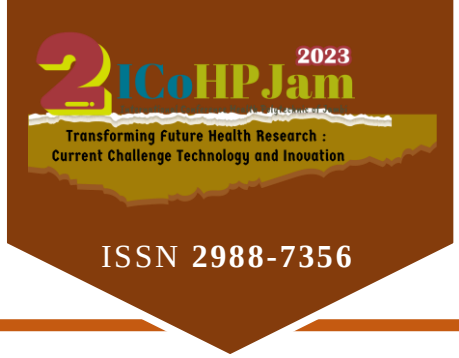

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