

RESEARCH STUDY

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Vitamin A Content and Hedonic Test of Modified Modisco Slurp Pudding with Various Carrot Extract Additions

Kandungan Vitamin A dan Tingkat Kesukaan Puding Sedot Modisco Termodifikasi dengan Penambahan Sari Wortel

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ABSTRACT

Background: A Modisco is PMT-P as treatment for malnutrition and severe malnutrition. To increase acceptance and function of nutritional sources, Modisco is done by modifying shape and composition to become Modisco slurp pudding with the addition of carrot juice.

Objectives: The purpose of this study was to analyze the content of vitamin A and the results of the favorite test of the modisco suction pudding with the addition of carrot juice variations of 0%, 5%, 10%, and 15%.

Methods: The research design applied was true experimental with 12 experimental units. The vitamin A (beta carotene) content of the samples was determined using Atomic Absorption Spectrophotometry (AAS), and the acceptance test used the Hedonic Scale Test on 80 student aged 9-10 years. The Friedman and Wilcoxon Signed Ranks tests were used to examine the acceptance test results. Vitamin A content were determined using the One Way Anova and multiple comparisons Turkey HSD with a 5% (= 0.05) significant level. The proportion of extract carrot on Modisco slurp pudding was 0% (X0), 5%, 10% and 15% (X1, X2, and X3).

Results: The results of the study of vitamin A levels through statistical tests using one-way ANOVA showed that there was a significant difference in vitamin A content compared to variation in the addition of carrot extracts in modisco slurp pudding (p value = 0.0001 < 0.05). The results of the hedonic test showed a significant difference in aroma and taste, while color and texture did not differ significantly.

Conclusions: The addition of carrot juice to modisco slurp pudding increases vitamin A levels and is preferred in terms of aroma and taste. Based on the vitamin A content test, the addition of 5% (X1) of carrot extracts is more preferred and closest to the daily vitamin A needs of toddlers.

INTRODUCTION

Indonesia has shown no progress in handling malnutrition among under-fives²⁹. Riskesdas data (2018) states that the proportion of poor nutritional status and malnutrition in toddlers in 2018 nationally by 17.7%²³. Jember Regency Health Office in 2018 reported that the prevalence of malnutrition was 6.26 % and the prevalence of severe malnutrition was found to be 2.42%. Malnutrition case in Jember Regency was above 5% in 2018 and was considered as a health problem in Jember Regency⁷. Lack of nutrition or poor nutrition increases the risk of developing a deficiency of micronutrients, one of which is vitamins A. Vitamin A helps in the immune function. Vitamin A deficiency can affect the immune system that is not functioning optimally and worsen undernutrition and poor nutrition. One of the direct causes of malnutrition is the body condition including lack of nutrients and infectious disease⁴. In line with the result of a study by Oktavia *et al.* (2017) which stated that

there was a relationship between the history of infectious disease and nutritional status in Semarang Nutrition Center²⁷.

Children with malnutrition as well as severe malnutrition generally suffer from micronutrient deficiency due to inadequate food intake, one of which is Vitamin A deficiency. Muliah *et al.* (2017) reported that under-five children who receive blue Vitamin A capsules from the age of 6 months had a 37% chance to avoid severe malnutrition risks¹⁷. Based on a study by Huang *et al.*, Vitamin A plays a role in regulating both the innate immune system and adaptive immunity, enhancing the organism's immune function and providing enhanced defense against infectious diseases¹². Based on Riskesdas RI 2018 data, supplementation of Vitamin A capsules was not sufficient for the national target in Indonesia²³.

Malnutrition causes a cognitive and psychomotor decline in children, makes children vulnerable to disease and affects the quality of human resources of a

country^{12,19}. To address malnutrition and severe malnutrition problem, the Ministry of Health of the Republic of Indonesia made a short-term intervention program, that is Supplementary Feeding Program (SFP) or Pemberian Makanan Tambahan (PMT)⁶. One of the nutrient-dense SFPs is Modisco (Modified Dried Skimmed Milk and Coconut Oil). According to Lahdji *et al.* (2016) providing modisco daily for 3 months was associated with an increase in the nutritional status of under-five children in Purworejo Regency¹⁴.

Modisco has a liquid form (enteral feeding) in this way children do not like it. Modification on the shape and texture of the modisco is needed to improve its quality and be more acceptable for children^{14,17}. One of the modifications of modisco is to change its texture to a slurp pudding and add carrot extract to increase the level of Vitamin A in the product. Aderinola *et al.* (2019) mentioned that the content of Vitamin A (beta carotene) in every 100 mL of carrots is 5.28±0.15 mg. The content of vitamin A in carrots is greater when compared with the content of beta carotene in 100 g of fresh carrots, which is 3.784 mg². Beta-carotene in fresh carrots is higher

compared to other plant-based food sources of provitamin A such as yellow carrot (1.569 mg), mango (0.316 mg), chickpeas leaves (3.266 mg), and sage (2.042 mg)². This study used Modisco ½ which is recommended in the stabilization phase in the initial administration of the Protein Energy Malnutrition (PEM)/severe malnutrition treatment.

METHODS

This was an experimental study with Posttest Only Control Group Design as the study design. There were four levels of research treatment: the first level is X0 (Modisco slurp pudding without adding carrot extract/control), the second level is X2 (Modisco slurp pudding adding 5% carrot extract), third level is X3 (Modisco slurp pudding adding 10% carrot extract), and the rest is X3 (Modisco slurp pudding adding 15% carrot extract) with replication (repetition) 3 times, so that the total sample was 12 experimental units. The vitamin A content of the samples was determined using Atomic Absorption Spectrophotometry (AAS). The test was carried out at the Biosan Laboratory Politeknik Jember.

Table 1. The proportion of carrot extract in the Modisco Slurp Pudding composition at 4 treatment levels

Treatment	Milk Skim (g)	Sugar (g)	Coconut Oil (g)	Jelly Powder (g)	Water (ml)	Carrot Extract (ml)
X0	100	50	25	5	820	0
X1	100	50	25	5	820	50
X2	100	50	25	5	820	100
X3	100	50	25	5	820	150

X0 = Control; X1 = Adding 5% carrot extract; X2 = Adding 10% carrot extract; X3 = Adding 15% carrot extract; g (gram); ml (millilitre)

The acceptance test used the Hedonic Scale Test based on the liking scale (5 = really liked, 4 = liked, 3 = ordinary, 2 = disliked, 1 = very disliked). The acceptance test was conducted at Primary School Jelbuk 1 Jember on 80 students aged 9-10 years (untrained panelists) that had met the minimal requirement for untrained panelists for a hedonic test². The inclusion criteria were willingness to be a sample, being in the place when the research was conducted, and had entered the menstrual period. Meanwhile, the exclusion criteria were having taboo or restrictions or allergies to food ingredients, being in a state of illness that could cause limited food to be consumed, including the product to be tested, and the product being tested was the panelist's favorite food or disliked food.

The independent variable in this study is the addition of carrot extract, while the dependent variable is vitamin A content and acceptability. Sources of data used in this study are primary data (observational data and laboratory data). The Friedman and Wilcoxon Signed Ranks tests were used to examine the acceptance test results. Vitamin A content were determined using the One Way Anova and multiple comparisons Turkey HSD with a 5% (= 0.05) significant level. This Research has passed an ethical test by Komite Etik Penelitian

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RESULTS AND DISCUSSION

Vitamin A Content in Pure Carrot Extract and the Addition of Carrot Extract by 0%, 5%, 10%, 15% in the Modisco Slurp Pudding

According to the findings of laboratory vitamin A analysis (Figure 1), Modisco slurp pudding added at X0, X1, X2, and X3 has enhanced Vitamin A levels. It can be seen from the figure, the Vitamin A value of each treatment for adding carrot extract is 6.67 m/100 g (X0); 379 mg/100 g (X1); 752 mg/100 g (X2) and the highest was 1121.3 mg/100 g (X3). The result of a statistical test using One-Way ANOVA showed the significant value=0.0001 (<0.05). This result reflected that there was a significant difference between the concentration of Vitamin A in the modisco slurp pudding and the various additions of the carrot extract. As the statistical test result showed a significant difference, a Tukey HSD multiple comparison test was carried out. The results showed that the pair groups (X0 with X1, X0 with X2, X0 with X3, X1 with X2, X1 with X3, and X2 with X3) had a significant value of <0.05 (Table 2). This result indicated that these groups had significantly different levels of Vitamin A (beta carotene).

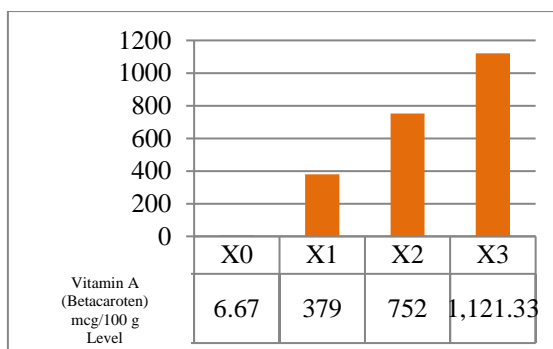


Figure 1. Vitamin A (Beta Carotene) Level of Each Sample

Table 2. Multiple Comparison Turkey HSD test on beta-carotene levels Modisco Slurp pudding with variation of carrots extract

Treatment	X0	X1	X2	X3
X0		0.0001*	0.0001*	0.0001*
X1			0.0001*	0.0001*
X2				0.0001*
X3				

X0 = Control; X1 = Adding 5% carrot extract; X2 = Adding 10% carrot extract; X3 = Adding 15% carrot extract;

*) Sig <0.05 with multiple comparison Turkey HSD test

The pure carrots in this study were carrots made in a 2:1 ratio. (water : carrot peeled). All ingredients are smoothed with a blender for 5 minutes. After that, the material that has been smoothed is filtered using a fabric filter. The result of pure carrot sauce obtained has not undergone the process of sensation at all. Based on the results of laboratory tests in 50 ml of pure carrots, the average vitamin A content of 7.457 mcg of beta carotene was obtained.

Based on the laboratory analysis results, It can be concluded that The level of vitamin A (beta-carotene) increases with the increase in carrot extract. The highest vitamin A content in modisco slurp pudding is the addition of carrot extract as much as 15% (X3), and the lowest vitamin A content is in the modisco slurp pudding without adding with carrot extract (X0). This is support by research Febrihantana *et al.* (2014) on product fortification yogurt with the addition of carrots to the total carotene, indicating that the more carrots are added to the yogurt, the more Total amount of carotene obtained⁸. The ratio of vitamin A in pure carrot with Vitamin A in modisco slurp pudding value is higher in pure carrots is 7457 mcg compared to 1121.3 mcg in the Modisco slurp pudding with 15% carrot extract (X3). This difference occurs because pure carrots do not go through the heating process, unlike carrots extract cooked along with other ingredients into modisco slurp pudding. The occurrence of a decrease in the level of betacarotene during the process of boiled in accordance with research Rahayu and Pribadi (2012) on the levels of vitamins and minerals in fresh fruits and damp sweetness Karika Dieng that the vitamin A level in Karika sweetness that previously passed through the rescue process occurred a decreased level of vitamin A is quite large compared to the Vitamin A level on the fresh Karika dieng fruit, in which the decreases occurred ranging 70-80%. This is because vitamin A (betacarotene) can be damaged by heating²².

Other studies on the influence of temperature and heating time on the content of Vitamin A and Vitamin C in the process of making tomato pasta stated that the higher the temperature of heating, the greater the decrease in vitamin A levels, the 80° C heating temperature can reduce more than 50% of the vitamin A level¹¹. Furthermore, research on changes in the level of beta-carotene in the three ways of using singkong leaves as a source of Vitamin A, i.e. dissolving with salt water, dissolvment with saltwater continued with dissolutions with santan, and dissolved with saltwater continued by dissolves with fried oil obtained the result that the lowest level of betacarotene at dissolvers with salted water continued with the dissolve of santan. Twice the redemption resulted in a decrease in betacarotene¹⁵.

There are several ways to keep the vitamin A/beta-carotene level not wasted, including using water. Oil or other residual oil so that the dissolved vitamin A/betacarotene can be consumed optimally¹. Other research suggests that one of the ways to maintain the level of vitamin A/beta-carotene is choosing saute compared to boil. When the process boiled should be treated with a dilution method, it is better to use as little water as possible It is possible and not to discard the remaining water so that the soluble beta-carotene content can be useful. Temperature monitoring during the process and use variation of time so that you can know the length of time used precisely²⁵.

Hedonic Test of the Modisco Slurp Pudding with the Addition of Carrot Extract by 0%, 5%, 10%, 15%

Taste

According to the Hedonic Scale Test findings, the panelists found that the taste of Modisco slurp pudding with variation carrot extract is satisfactory (Table 3). The treatment with the highest value is the treatment with the addition of 0 % carrot extract (X0) with a value of 4.10 (like). In comparison, the lowest value is the treatment

with the addition of 15% carrot extract (X3) with a value of 3.70 (normal-like). According to the analysis results using the Friedman test, the acceptance of the taste of Modisco slurp pudding with variation carrot extract has a significance level of 0.0001, so the conclusion is that H0 is rejected (there is a significant difference from the addition of carrot extract to the taste acceptance of Modisco slurp pudding). The Wilcoxon Signed Ranks Test analysis in Table 4 shows that the acceptability of the taste of Modisco slurp pudding with variation carrot extract showed p-value < (0.05) with significantly different treatments. There were three pair groups with the significant value of ≤ 0.05, which indicated there was a significant difference. These three pair groups were X0 with X1, X0 with X2, and X0 with X3. It can be seen from the result that X0 had a more likable taste compared to X1, X2, and X3. Taste is the response of the taste buds to nerve stimuli, such as sweet, bitter, and sour.

Isocoumarin content in carrots causes a languid aroma and bitter taste in carrots¹⁸. According to Ozcan and Chalchat (2007) carrots have a bitter taste, the bitter taste can be increased due to exposure to temperature, mechanical disturbances, low oxygen atmosphere, and length of processing or storage²⁰.

Carrot extract addition made the modisco slurp pudding have an unpleasant taste (*langu*), hence the experimental groups (X1, X2, and X3) had a lower taste Hedonic Test score compared to the control group (X0). Taste organoleptic test of yogurt with carrot extract addition showed that yogurt with 0% carrot extract was preferable for carrot extract addition creating an unpleasant (*langu*) aftertaste²⁴. Another study reported that as the carrot extract concentration in the candy increased, the candy was less preferred by the panelists, as the addition of carrot extract added an unpleasant (*langu*) taste in the carrot jelly candy²⁸.

Table 3. The p value of Friedman Test for Acceptability of Modisco Slurp Pudding with variation of carrots extract

Treatment	The average of acceptance treatment			
	Taste	Color	Aroma	Texture
X0	4.1	3.77	3.90	3.70
X1	3.90	3.62	3.60	3.81
X2	3.72	3.55	3.50	3.72
X3	3.70	3.50	3.50	3.62
p value	0.0001*	0.052	0.011*	0.857

X0 = Control; X1 = Adding 5% carrot extract; X2 = Adding 10% carrot extract; X3 = Adding 15% carrot extract;

*) the mean is significantly difference (p value <0.05) with Friedman test

Table 4. Wilcoxon signed rank test on hedonic taste levels Modisco Slurp pudding with variation of carrots extract

Treatment	X0	X1	X2	X3
X0		0.032*	0.001*	0.002*
X1			0.075	0.204
X2				0.949
X3				

X0 = Control; X1 = Adding 5% carrot extract; X2 = Adding 10% carrot extract; X3 = Adding 15% carrot extract;

*) Sig p value < 0.05 with Wilcoxon signed rank test

Color

The result of the color Hedonic Test showed that the score for all of the four samples was above 3.00 which indicated that the panelists liked the product. The average Hedonic Test score for X0, X1, X2, and X3 were 3.77, 3.62, 3.55, and 3.50, respectively, everything is in normal – like range (showed table 3). A non-parametric statistical test using Friedman Test showed the significant value=0.052 (>0.05). As seen from the color indicator, it can be concluded that there was not significantly difference in the level of preference for the modisco slurp pudding with various additions of carrot extract. This is in line with research conducted by Amdala and Basar (2017), that the addition of carrot puree does not effect on the color of waffle products³. According to Cahyono (2012) *cit* Yunita et al. (2020), the color is influenced by the high content of beta carotene in in the skin and flesh of carrots which reddish yellow or orange yellowish, so that it can give reddish yellow or yellow orange color, The increasing amount of carrot on the sweet bread then the color orange produced becomes brighter³⁰.

Aroma

According to the aroma Hedonic Test findings, that the average score was above 3.00 which indicated that the panelists liked the product. The average Hedonic Test score for X0, X1, X2, and X3 were 3.90, 3.70, 3.53, and 3.50, respectively. Meanwhile, it was known from the result of a non-parametric statistical test using the Friedman Test that the significant value=0.011 (<0.05) (Table 3). This result reflected that in terms of aroma, there was at least one out of the four samples had different levels of preference for the slurp pudding with various additions of carrot extract. As the previous result showed a significant difference, another non-parametric statistical test was carried out using the Wilcoxon Signed Rank Test. The result of the Wilcoxon Signed Rank Test showed that two pair groups had significant differences where the significant value was ≤ 0.05. Both pair groups were X0 with X2 and X0 with X3 (Table 5). The result indicated that in terms of aroma, the panelists prefer modisco slurp pudding with 0% carrot extract addition (X0) to X2 and X3. This means X0 was most preferred by the panelists over the other pair groups as X0 had a strong sweet milky aroma, according to Faridah and Kasmita (2006) *cit* Nadila and Sofyan (2022), carrot tubers

has a savory and slightly sweet taste¹⁸. X2 and X3 considered to have a languorous aroma, carrots have a flavorful aroma (languorous) so these vegetables are rarely consumed directly¹⁰. This result was similar to research on tuna fish balls where the control sample or the tuna fish ball without carrot extract addition (Y0) had a higher score than Y1 (15% addition of carrot extract), Y2 (20% addition of carrot extract), and Y3 (25% addition of carrot extract)⁹. Organoleptic test of yogurt with carrot extract addition showed that yogurt with 0% carrot extract was preferable for carrot extract addition creating an unpleasant (*langu*) aftertaste²⁴. Another study reported that as the carrot extract concentration in the candy increased, the candy was less preferred by the panelists, as the addition of carrot extract added an

unpleasant (*langu*) taste in the carrot jelly candy²⁸. Isocoumarin content in carrots causes a languid aroma and bitter taste in carrots¹⁸. In addition, according to Rubatzky and Yamaguchi (1997) *cit Mufidah et al.* (2017), the oil pockets in the intercellular space of the pericicles in carrot tubers contain essential oils that cause the characteristic odor and aroma of carrots¹⁶. However, temperature or temperature will cause the odor or languish in carrots to disappear²⁶. In this research, the aroma of the liquid produced by the blended technique is lower than the aroma of the liquid produced by the shredded technique. The increasing temperature produced by the heating machine makes the languorous aroma decrease.

Table 5. Wilcoxon signed rank test on hedonic aroma levels Modisco Slurp pudding with variation of carrots extract

Treatment	X0	X1	X2	X3
X0		0.088	0.002*	0.001*
X1			0.0143	0.145
X2				0.798
X3				

X0 = Control; X1 = Adding 5% carrot extract; X2 = Adding 10% carrot extract; X3 = Adding 15% carrot extract;

*) Sig p value < 0.05 with Wilcoxon signed rank test

Texture

The average score of texture Hedonic Test for X0, X1, X2, and X3 were 3.85, 3.81, 3.73, and 3.63, respectively. All four samples had scores above 3.00 which indicated that the panelists liked the product. X0 had the highest score (3.85) than X1 (3.81), X2 (3.73), and X3 (3.63). Carrot contains pectin. It is thickened, so influencing the textures. Pectin content in carrots 7.4 percent¹⁶. A non-parametric statistical test using Friedman Test showed the significant level=0.857 (>0.05). Thus, it can be concluded that texture, there was not significantly difference in the level of preference for the modisco slurp pudding with various additions of carrot extract.

Recommended Product Handling Based on the Test Result of Vitamin A Level and Hedonic Test

The best treatment was selected based on high vitamin A content and also has good acceptance values in terms of taste, color, aroma and texture, namely X1, modisco slurp pudding with the addition of 5% carrot extract. X1 contains 379 mcg/100 g and has an average value of acceptability of 3.90 (taste), 3.62 (color), 3.60 (aroma) and 3.81 (texture) which means (normal-like).

Accordingly, the product recommendation as menu options for the Supplementary Recovery Feeding Program (SRFP) is modisco slurp pudding with 5% addition of carrot extract (X1). To address malnutrition and severe malnutrition problem accompanied by Vitamin A deficiency among under-five children, Supplementary food can be served during snack time. Snacks are 10% of the Recommended Dietary Allowance (RDA) total value. Vitamin A levels in X1 per serving (100 g = 379 mcg) are able to meet the vitamin A requirement as a snack (10% RDA) of 240 mcg in children aged 24-47 months and 270 mcg in children aged 48-59 months²¹.

CONCLUSIONS

Vitamin A content in Modisco slurp pudding with the addition of extract carrot with variations of 0%, 5%, 10%, and 15% amounted to 6.67 mcg, 379 mcg, 752 mcg, 1121.3 mcg. Modisco slurp pudding with the addition of 5% extract carrot is the most preferred, and meets the vitamin A needs of children aged 24-59 months on snacking (10% RDA).

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Conflict of Interest and Funding Disclosure

This study has no conflict of interest and no funding for this reaseach.

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