The effect of β-Carotene (C\textsubscript{40}H\textsubscript{56}) in Carrots (\textit{Daucus Carrota}) as a natural additive substance for wet noodle durability

A Rohayat*, C Ardiana, R Nurkhotimah, D Hernawati and S Mulyaningsih

Prodi Pendidikan Biologi, Institut Pendidikan Indonesia, Jl. Pahlawan Sukagalih no 32, Garut 44151, Jawa Barat, Indonesia

*aseprohayat.biostkip@gmail.com

Abstract. Additives are chemical compounds added to maintain food including wet noodles. The durability of wet noodles is relatively lower compared to other staple foods. There are many ways to preserve wet noodles, one of which is natural additives. Natural additives are chosen because they are safer and do not pose a risk to human health. Substances Natural additives used are carrots (daucus carrota). Because carrots contain β-Carotene compounds that function as antioxidants. Where can reduce and deactivate free radical attacks and ROS (Reactive Oxygen Species) to foods caused by microorganisms. The study aims to influence the content of β-Carotene in carrots as a natural additive for the resistance of wet noodles. The research method used was an experiment with variations in the concentration of β-carotene in carrots 0%, 20%, 40%, 60%, and 80%. From the results of the study it was found that at the β-Carotene concentration of 60%, the durability of wet noodles reached a maximum of 4 days. This fact shows that the addition of β-Carotene with high concentration will affect the durability of wet noodles. So that shows that carrots (daucus carrota) can be used as natural additives in maintaining the durable power of wet noodles.

1. Introduction

Additives are organic compounds that are used as additives with the aim that the quality of samples given additional substances to be better. Additive substances are widely used for food preservation. The quality of the sample can be seen from taste, appearance, color, durability and others [1-5]. To maintain the quality of food samples to remain good, food additives are used. Food additives are natural and artificial. Many natural additives are found in plants and fruits while artificial additives are produced from certain chemical reactions, for example: borax and formalin.

β-carotene is an organic compound belonging to the group of terpenoids and is widely found in plants and fruits, such as carrots, sweet potatoes, and rice [3,6,7]. In plants, β-carotene is found in apricots, tomatoes, and carrots, whereas in fruits there are many in mango and papaya [8]. The properties of β-carotene compounds include: soluble in fat, easy to interact with the amino acid type casein, insoluble in water, and easily damaged because the compound is easily oxidized at high temperatures [8-10]. The famous carotene is an unsaturated hydrocarbon derivative of lycopene in the form of a long chain consisting of eight units of isoprene, arranged from head to tail so that a complete conjugated bond system is formed. This circuit is a lycopene ring at one end producing γ-carotene. Whereas if the ring occurs at both ends it will form tricyclic hydrocarbons, namely β-carotene. Isomers (e.g. α and γ-carotene) differ only in the location of their double bonds in cyclic end units. The structure of the β-carotene molecule can be seen in Figure 1 [11,12].
In this study carrots were chosen as natural additives. Because carrots are easily available and many contain β-carotene compounds which function as antioxidants. Antioxidants are compounds that can reduce and or deactivate free radical attacks and Reactive Oxygen Species (ROS) [13,14]. So that it can inhibit fermentation, acidification and other decomposition of food caused by microorganisms. As a result, food becomes more durable or has high durability.

For the food samples, wet noodles are used because wet noodles are a favorite food for the community. The popularity of these foods is not limited to taste, but can also be processed into various forms of cheap-priced dishes. Based on the water content (52%), wet noodles are most quickly damaged or decayed. This is because the water content is the most compared to other types of noodles. Based on these facts, a study was conducted to determine the effect of β-carotene content in carrots as a natural additive to the durability of wet noodles. In addition, the results of this study are expected to be used as alternative ingredients for natural additives in food preservation, especially in preserving wet noodles so that the community becomes more effective in its use.

2. Methods
To determine the effect of the content of β-carotene in carrots as a natural additive to the durability of wet noodles. Then several stages of research procedures are carried out, namely:

2.1. Preparation phase
The sample used is wet noodles. Wet noodles are first made using ingredients such as: flour, tapioca flour, salt, vegetable oil, eggs, and water until a mixture of wet noodles is formed. Next, 150 g of carrots are blended by adding 150 mL of aquadest to it to get a solution of carrot juice. The solution is assumed to contain β-carotene content (concentration) in a 100% carrot juice solution. Furthermore, the solution is diluted according to the concentration variations made, namely: 0%, 20%, 40%, 60%, and 80%. Dilution is calculated using the dilution formula: P1 x V1 = P2 x V2 [15].

2.2. Implementation phase
Wet noodle dough that has not been formed is then added a natural additive solution (carrot juice solution) in accordance with the concentration variations that have been made. After being added to the mixture, milling and the formation of wet noodles are then done.

2.3. Final stage
After the wet noodles are made, then the observation of wet noodles which starts from the first day to the fifth day. Observations were carried out with the aim to determine the durability (resistance) of wet noodles in accordance with variations in their respective concentrations. Next is the conclusion.

2.4. The determination of the optimum concentration of the power durability (resistance) of wet noodles
After observing variations in the concentration of carrot juice solution (Daucus Carrota) which was put into wet noodles, then the measurement of the durability test was carried out by looking at the durability (resistance) of wet noodles for each concentration. When the durability of wet noodles is high, the optimum value is at that concentration. This means that there is an influence of the content of β-carotene on carrots as a natural additive that is significant for the durability of wet noodles. The flow of research to the stage of determining the optimum concentration of the durability (resistance) of wet noodles is as follows:
3. Results and discussion

The solution used in this study is the solution produced from squeezing carrots by inserting carrot pieces into a blender. Water is added to it until all the carrot pieces are submerged and the volume is recorded. Then blended until a homogeneous solution is produced. Then filtered and the result is a mother liquor used as material added to wet noodles based on a predetermined variation of concentration, namely: 0%, 20%, 40%, 60%, and 80% for each treatment. Variations in the concentration of this solution are made and determined by the principle of dilution. After the process of mixing the solution with wet noodles, determination of the optimum concentration of each variation of the added concentration was carried.
out. The resulting data is in the form of long-lasting wet noodles to the variation of β-carotene concentration in carrots (Table 1):

**Table 1.** Data on the durability of wet noodles for each variation of the concentration of β-carotene in carrots.

| concentration | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---------------|-------|-------|-------|-------|-------|
| 0%            | all the noodles are fresh | - 2 packs are soft | - 3 packs are moldy | all the noodles are stickly | start to rot |
| 20%           | all the noodles are fresh | - 2 packs are fresh | - 3 packs are sticky | all the noodles are stickly | start to rot |
| 40%           | all the noodles are fresh | - 1 packs are sticky 1 | - 3 packs are moldy | all the noodles are moldy | start to rot |
| 60%           | all the noodles are fresh | all the noodles are fresh | 2 packs are stickly | all the noodles are moldy | start to rot |
| 80%           | all the noodles are fresh | all the noodles are fresh | - 3 packs are moldy | all the noodles are stickly | start to rot |

From table 1, it can be seen that at a concentration of 60% wet noodles still tend to stay fresh until day 3 compared to other variations in concentration. In fact, these results show that the concentration is very influential on the durability of wet noodles. Where when the content (concentration) β-carotene is added to the wet noodles is high then the durability becomes high. β-Carotene as an organic compound can inhibit or slow down the fermentation process. So that bacteria do not easily get into wet noodles both anaerobic and aerobic bacteria. Most microbes grow well at neutral pH (4.6 - 7.0) while Carrots have pH 5.5 - 6 [2]. With the addition of the concentration of β-carotene in carrots, it will provide a neutral pH in wet noodles so that it will result in noodles becoming more durable and long lasting.

Based on the results of these studies, the addition of β-carotene in carrots as natural additives can increase the durability of wet noodles.
4. Conclusion

From the results of the study, it was found that 60% of the β-carotene concentration added to wet noodles had a significant effect on the durability in which wet noodles experienced a storage power of 4 days.

Acknowledgements

The author would like to thank Rektor IPI Garut, who has helped and facilitated the authors in conducting research and publications. Than the Faculty of FITS along with Program Studi Pendidikan Biologi of the Institut Pendidikan Indonesia which has given permission and facilities for the implementation of this research.

References

[1] Astawan and made 1999 *Membuat Mie dan Bihun, First Edition* (Penebar Swadaya. Jakarta) pp 6-9
[2] Ayustaningworo and Fitriyono 2014 *Teknologi Pangan Teori Praktis dan Aplikasi* (Artikel Ilmiah) p 2
[3] Idris N 2011 *Analisis Kandungan β-Karoten dan Penentuan Aktivitas Antioksidan dari Buah Melon (Cucumis melo Linn.) Secara Spektrofotometer UV-Vis* (Universitas Islam Negeri Alauddin Makassar) pp 1-2
[4] Kusbandari A, Susanti H 2017 Beta Carotene Content and Free Radical Scavenging Activity of Cantaloupe (Cucumis melo var. Cantalupensis L.) Extract Against DPPH (1,1-diphenyl-2-picrylhydrazyl) using UV-Visible Spectrophotometry Method *Jurnal Farmasi Sains dan Komunitas* 14(1) pp 37-42
[5] Soares S, Mateus N, and de Freitas V 2018 Polyphenol Interactions and Food Organoleptic Properties *Reference Module in Food Science* pp 650-655
[6] De Medeiros P M, Santos Pinto B L, and do Nascimento V T 2015 Can organoleptic properties explain the differential use of medicinal plants? Evidence from Northeastern Brazil *Journal of Ethnopharmacology* 159 pp 43–48
[7] Lu L, Wu J, Wei L, and Wu F 2016 Temperature dependence of aggregated structure of β-carotene by absorption spectral experiment and simulation *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 169 pp 116–121
[8] Bollinedi H, Dhakane-Lad J, Gopala Krishnan S, Bhowmick P, Prabhu K, Singh N, and Singh A 2018 Kinetics of β-carotene degradation under different storage conditions in transgenic *Golden Rice®* lines *Food Chemistry* 278 pp 773-779
[9] Allahdad Z, Varidi M, Zadmard R, and Saboury A A 2018 Spectroscopic and docking studies on the interaction between caseins and β-carotene *Food Chemistry* 255 pp 187–196
[10] Salvia-Trujillo L, Verkemipneck S, Rijal S K, Van Loey A, Grauwet T, and Hendrickx M 2018 Lipid nanoparticles with fats or oils containing β-carotene: storage stability and in vitro digestibility kinetics *Food Chemistry* 278 pp 396-405
[11] Anna P 2005 Dasar – Dasar Biokimia. First Edition (Universitas Indonesia (UI-Press). Jakarta) pp 56-60
[12] Kang L, Ji C Y., Kim S H, Ke Q, Park S -C, Kim H S, Kwak S -S 2017 Suppression of the β-carotene hydroxylase gene increases β-carotene content and tolerance to abiotic stress in transgenic sweetpotato plants *Plant Physiology and Biochemistry* 117 pp 24–33
[13] Amin F and Bano B 2018 Damage of cystatin due to ROS-generation and radical-scavenging activity of antioxidants and associated compounds *International Journal of Biological Macromolecules* 119 pp 369–379
[14] Casadey R, Challier C, Senz A, and Criado S 2019 Antioxidant ability of Tyrosol and derivative-compounds in the presence of O2(1Δg)-species. Studies of synergistic antioxidant effect with commercial antioxidants *Food Chemistry* 285 pp 275-281
[15] Mulyono H M 2006 *Membuat Reagen Kimia di Laboratorium. First Edition.* (Bumi Aksara. Jakarta) p 45