Projective mapping of preferences on milk and dark chocolate bar fortified nanocapsules Arthrospira carotenoid

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Abstract. The characteristics in milk or dark chocolate Arthrospira products require testing before the product is released to the market. The purpose of this study was to use the Projective Mapping (PM) method to determine the characteristics and preferences of consumers toward milk or dark chocolate Arthrospira carotenoid products compared to commercial milk or dark chocolate products on the market, and to analyze the factors that can influence consumers' purchasing intention. The chocolate samples tested were Arthospira milk chocolate and ten commercial milk chocolate samples (SQ, DF, LD, DV, CB, MG, VH, BB, TB, and WD). The dark one compares to ten commercial dark chocolates (SQ, M5, M6, M7, DC, WD, TB, BB, LD, and DV). The factors that influence consumers' purchasing intentions are identified through an online survey and analyzed using chi-square. A total of 159 people (68 PM respondents and 91 non-PM respondents) took part in the milk chocolate poll, while 92 people (41 PM respondents and 51 non-PM respondents) took part in the dark chocolate poll. PM test shows consumers perceive milk chocolate and dark chocolate fortified with nanocapsules Arthospira carotenoid to be similar in taste, appearance, texture, and price to some commercial chocolate bar products, implying that both chocolate products fortified with nanocapsulesArthospira carotenoid can compete in the market. The results of the chi-square test for milk chocolate show that for PM respondents, socio-demographic factors, consumer habits of buying chocolate bars, knowledge of Arthrospira, and the benefits of consuming Arthrospira influence their buying interest, whereas for non-PM respondents, consumer habits of buying chocolate bars influence their buying intention. The results of the dark chocolate chi-square test show that respondents’ knowledge of the benefits of consuming chocolate bars and the emotion conducted to consume chocolate bars and influence their purchasing interest.

1. Introduction
Consumers are becoming more aware of the need for functional foods that are beneficial to their health. Arthrospira platensis nanocapsules are a type of functional food ingredient containing carotenoid antioxidants that are beneficial to human health, which the body can convert into vitamin A [1][2]. Arthospira platensis nanocapsules that can be used as functional food ingredients in food fortification. Food fortification is the addition of some bioactive compounds to food to increase nutritional content and provide health benefits [3]. A food vehicle that functions as a food ingredient that is given additional nutrients is one of the things that must be considered in food fortification. A chocolate bar is one of the alternative food vehicle products to fortify Arthrospira platensis nanocapsules, and the product of chocolate bar is prepared in a cocoa-based processed product that is...
popular among many people [4]. Chocolate bars are classified into three types: milk chocolate, dark chocolate, and white chocolate [5], are the most well-known of the three types of products in Indonesia.

Fortified *Arthrospira platensis* nanocapsules to milk chocolate bar products have been carried out such as the previous researchers [6][7] and the dark one [8][9]. Chocolate bars were made with fermented cocoa beans from cocoa farmers in Kalibawang, refined sugar, cocoa butter, vegetable lecithin, vanilla, baking soda, and *Arthospira platensis* nanocapsules. For milk chocolate bar the ratio of cocoa mass and cocoa fat is 11:10 with tempering temperature of 27°C meanwhile for dark chocolate bar the ratio of cocoa mass and cocoa fat is 40:30 with tempering temperature of 35°C. Both milk and dark chocolate bars added with *Arthospira platensis* carotenoid nanocapsules at a dose of 0.372%. The benefit of fortified *Arthospira platensis* nanocapsules to chocolate bar products increased the \( \beta \)-carotene content, and the fishy odor, pungent aroma and bitter taste were not detected by consumers. For the development of *Arthrospira* carotenoid chocolate bar products, it is necessary to test consumer preferences and perceptions of the products.

The projective mapping test is a tool for determining consumer perceptions and preferences for products. The parameters that will be used in the projective mapping test include taste, color, price and texture. The segmentation of the products tested can be determined using the projective mapping test [10]. The projective mapping test is simple to administer because it does not require trained panelists and can be used to determine the panelists' spontaneous responses [11]. Projective mapping tests have previously been used on food products such as chocolate [12], ewe milk cheese [13], and wines [14]. This study examined consumer perceptions and preferences, as well as the segmentation of *Arthrospira* carotenoid white chocolate bar and *Arthrospira* carotenoid dark chocolate bar products.

2. Materials and Methods

The projective mapping (PM) test consisted of two types of chocolate bars: milk chocolate bars and dark chocolate bars fortified with *Arthospira* carotenoid nanocapsules. Fermented cocoa beans from Kalibawang farmers, powdered milk, refined sugar, vegetable lecithin, cocoa butter, vanilla, baking soda, and carotenoid nanocapsules developed at Fish Technology Laboratory, Department of Fisheries, Universitas Gadjah Mada [6][8]. The milk chocolate bar fortified with *Arthospira* carotenoid was based on the formula created by [6] while the dark one was by [8]. The research method used is PM to determine consumer perceptions and preferences as well as segmentation of *Arthospira* carotenoid milk chocolate bar and *Arthospira* carotenoid dark chocolate bar products.

2.1 Attribute determination

The attributes tested for PM were chosen based on research conducted by [9] [15] on the factors that influence consumer purchasing decisions for chocolate bar products. Taste, color, texture, and price are some of the factors that consumers consider when purchasing chocolate bars, according to the findings.

2.2 Commercial chocolate bar inventory

The goal of the chocolate bar inventory is to determine the products of chocolate bars in the Yogyakarta market. Yogyakarta was chosen as the research site because it is regarded as a miniature of Indonesia. Yogyakarta's population is drawn from all over Indonesia, making it a microcosm of the country. The inventory is completed by surveying Yogyakarta markets such as supermarkets, minimarkets, and chocolate production sites. The chocolate bars chosen and used for the study were commercial chocolate bars that were similar to the sample chocolate bars, namely milk chocolate and dark chocolate.

2.3 Projective mapping (PM) testing

PM testing was carried out with untrained panelists, the majority of whom were students. Panelists evaluated 11 samples, including *Arthrospira* carotenoid chocolate bars and ten commercial chocolate
Panelists were asked to taste the samples and then map them on 30 x 30 cm paper based on the similarities and differences in the samples’ characteristics. The sample was mapped by panelists based on their perceptions. The PM test evaluates the following characteristics: appearance, texture, taste, and price. In the price attribute, panelists were asked to write down the price based on their perceptions for each sample weighing 80 grams. Panelists were asked to test all of the parameters at the same time on four different test papers. Products with similar characteristics are grouped together, while products with dissimilar characteristics are grouped together. Panelists were also asked to write a description of each sample’s characteristics on each attribute. To create a projective map, the horizontal and vertical distances from the sample mapping points are translated into x and y coordinates. The obtained coordinates were then analyzed using MFA (Multiple Factor Analysis) software from IBM Statistics SPSS 20. The PM test flow chart is presented in Figure 1.

![Projective Mapping Test Flowchart](image)

**Figure 1.** Projective Mapping Test Flowchart.

### 2.4 Online Survey

An online survey was carried out to determine what factors influence consumer purchasing interest in chocolate products. Respondents were chosen from among those who owned or frequently consumed chocolate bars. Respondents were divided into two groups: those who took the PM test first and then completed the survey, and those who only completed the survey. The online survey includes questions about socio-demographic data, chocolate bar knowledge, chocolate bar consumption habits, chocolate bar purchasing habits, and Spirulina knowledge. The online survey was conducted between the 15th of February and the 30th of April, 2020, using Google Forms. The data from the online survey were analyzed using chi-square and Ms. software. Excel and IBM Statistics SPSS 20 are both available. Tables and diagrams are used to present the data for each tested attribute.

### 3. Results and Discussion

#### 3.1. Inventory of Commercial Chocolate Bars

An inventory of commercial chocolate bars was conducted in order to select commercial chocolate bars for comparison in projective mapping tests in order to make the process of production, distribution, knowing consumer preferences, and knowing buying interest in milk and dark chocolate products fortified with Arthospira easier in the future. Commercial chocolate bars are made from the same chocolate as the Arthospira carotenoid chocolate bar, namely milk and dark chocolate. Data on commercial milk chocolate bars are presented in Table 1 and data for commercial dark chocolate bars are presented in Table 2.
Table 1. Commercial Milk Chocolate Bar for Projective Mapping.

| Market            | Silver queen (SQ) | Delphi (DF) | Lindt (LD) | Dove (DV) | Cadbury (CB) | Monggo (MG) | Van Houten (VH) | Ndalem (BB) | Toblerone (TB) | Wondis (WD) |
|-------------------|-------------------|-------------|------------|-----------|--------------|-------------|-----------------|-------------|----------------|-------------|
| Superindo         | v                 | v           | v          | v         | v            | v           | v               | -           | -              | -           |
| Mirotakampus      | v                 | v           | -          | v         | v            | v           | v               | v           | -              | -           |
| Gardena           | v                 | v           | -          | v         | v            | -           | v               | -           | -              | -           |
| Lottemart         | v                 | v           | -          | -         | v            | -           | -               | -           | -              | -           |
| Ndalem Chocolate  | -                 | -           | -          | -         | -            | -           | -               | v           | -              | -           |
| Monggo Chocolate  | -                 | -           | -          | -         | -            | -           | -               | -           | -              | -           |
| Wondis Chocolate  | -                 | -           | -          | -         | -            | -           | -               | v           | -              | -           |
| Frequency         | 4                 | 4           | 1          | 3         | 4            | 2           | 3               | 1           | 1              | 1           |

Table 2. Commercial Dark Chocolate Bars for Projective Mapping.

| Market           | Silver queen (SQ) | Monggo 58% (M5) | Monggo 69% (M6) | Monggo 77% (M7) | Toblerone (TB) | Dove (DV) | Lindt (LD) | Delicacao (DC) | Ndalem (BB) | Wondis (WD) |
|------------------|-------------------|-----------------|-----------------|-----------------|----------------|-----------|------------|----------------|-------------|-------------|
| Mirotakampus     | v                 | v               | v               | v               | v              | v         | v          | -              | -           | -           |
| Superindo        | v                 | v               | v               | v               | v              | v         | v          | v              | -           | -           |
| Gardena          | v                 | -               | -               | -               | v              | v         | v          | -              | -           | -           |
| Indomart         | v                 | -               | -               | -               | v              | -         | -          | -              | -           | -           |
| Alfamart         | v                 | -               | -               | -               | -              | -         | -          | -              | -           | -           |
| Monggo Chocolate | -                 | v               | v               | v               | v              | -         | -          | -              | -           | -           |
| Ndalem Chocolate | -                 | -               | -               | -               | -              | -         | -          | v              | -           | -           |
| Wondis Chocolate | -                 | -               | -               | -               | -              | -         | -          | v              | -           | -           |
| Frequency        | 5                 | 3               | 3               | 3               | 3              | 4         | 2          | 1              | 1           | 1           |
There were 10 brands of commercial milk chocolate bars selected and used in the PM test. Silverqueen, Delfi, and Cadbury brand chocolates are the most commonly found chocolates on the market with a frequency of 4 times. Ten different brands of commercial dark chocolate bars were chosen and used in the PM test. With a frequency of 5 times, Silverqueen brand chocolate is the most commonly found chocolate on the market.

The frequency of many different brands of milk and dark chocolate bars is quite fascinating. This commercial product, which can be found in several supermarkets and minimarkets, aims to determine how many marketing areas the brand has, with the expectation that there will be more milk and dark chocolate brands. The chocolate bar, which is marketed in several locations, shows that the brand is well-known by consumers, which can increase consumer purchasing interest in milk and dark chocolate brands. So Arthrospira is a brand that can be used as a comparison in marketing milk and dark chocolate products.

3.2. Arthrospira carotenoid milk chocolate bar

3.2.1. Appearance Attribute

Figure 2 depicts the results of the PM test for the taste attributes of Arthrospira carotenoid milk chocolate bar. Arthrospira carotenoid milk chocolate bar (MS) is comparable to Ndalem (BB) and Monggo (MG) chocolate samples. The three chocolates are all dark brown in color. According to [16], the more Arthospira platensis added to the chocolate bar, the darker the chocolate color becomes from the original color.

![Figure 2. PM results attribute the appearance of milk chocolate.](image)

3.2.2. Texture Attribute

As shown in Figure 3, the Arthrospira carotenoid milk chocolate bar (MS) is close to the Monggo brand chocolate sample (MG). MS and MG chocolate have a sandy texture. Chocolate with Arthospira has a sandy texture [16]. The texture of the Arthrospira carotenoid milk chocolate bar is already comparable to that of commercial chocolate.
3.2.3. Taste Attributes
Figure 4 shows an Arthrospira carotenoid milk chocolate bar (MS) next to a Dove brand (DV) chocolate sample. Sweet and bitter chocolate flavors were detected in the two chocolate samples. People who are health conscious do not like too sweet chocolate, so the desired chocolate flavor has more chocolate composition than chocolate that tastes sweet with sugar. According to the results of the PM test on the taste attributes of milk chocolate, the Arthrospira carotenoid milk chocolate bar already tastes similar to commercial chocolate on the market.

3.2.4. Price Attribute
The price attribute PM test was carried out to ascertain the panelists' opinions on the price that is considered appropriate for Arthrospira carotenoid milk chocolate bar. The price attribute PM test can
also be used to determine whether the price of Arthrospira carotenoid milk chocolate bars is competitive with commercial milk chocolate bars. Figure 5. depicts the PM test results for the milk chocolate price attribute. Arthrospira carotenoid milk chocolate bar (MS) is near the Ndalem (BB) chocolate sample. The majority of the panelists stated that MS and BB chocolates cost between IDR 20,000 and 30,000. Appropriate and affordable prices are factors that consumers consider when making purchasing decisions. Pricing is done in accordance with the quality of the product produced and is of interest to consumers, which means that if the price is right, consumers will be influenced to buy the product. Because the majority of the panelists in the PM test are students, the majority of whom do not have income, the prices written are the prices that are suitable for students.

![Figure 5. PM test results for milk chocolate price attributes.](image)

3.3. Arthrospira carotenoid dark chocolate bar

3.3.1. Appearance Attribute

Figure 6. shows the PM test results for dark chocolate bar taste attributes. The Arthrospira carotenoid dark chocolate bar (DS) is located next to the Toblerone (TB) chocolate sample. The two chocolates are the same color, which is a shiny dark brown with a hint of reddish. According to [16], dark chocolate bars have a reddish brown appearance. Arthospira carotenoid dark chocolate bar's appearance is already similar to commercial chocolate on the market.
3.3.2. Texture Attribute
Samples of *Arthospira* carotenoid dark chocolate bar (DS) were near the Monggo 77% (M7), Ndalem (BB), and Wondis (WD) chocolate samples as shown in Figure 7. The textures of the four chocolates have similarities, which is hard and soft when melted and a little gritty. In *Arthospira* carotenoid dark chocolate bar, sandy texture appears due to the addition of *Arthospira* into the product [16]. *Arthospira* carotenoid dark chocolate bar already has a similar texture to commercial dark chocolate bars on the market.

3.3.3. Taste Attributes
Taste is an important factor for consumers when selecting *Arthospira* carotenoid dark chocolate bar [9]. The PM test can determine whether *Arthospira* carotenoid dark chocolate bars taste similar to
commercial chocolate bars. Figure 8. depicts the PM test results for dark chocolate bar taste attributes. *Arthrospira* carotenoid dark chocolate bar (DS) located near a chocolate sample of brand Delicacao (DC). The flavors of DS and DC chocolate are similar: bitter and slightly sweet. The incorporation of carotenoid nanocapsules *Arthrospira platensis* into a dark chocolate bar has no effect on the product's taste [8].

![Figure 8. PM test results for dark chocolate taste attributes.](image)

**3.3.4. Price Attribute**

Figure 9 shows the PM test results for dark chocolate price attributes. *Arthrospira* carotenoid dark chocolate bar (DS) was found near samples of Lindt (LD) and Monggo 77 percent chocolate (M7). The majority of the panelists wrote that DS, LD, and M7 chocolates cost between IDR 20,000 and 30,000. Consumers will purchase products that are in line with their income [17]. The majority of the PM test panelists are students, the majority of whom do not have income, so the prices listed are student-appropriate prices.

![Figure 9. PM test results from dark chocolate price attribute.](image)
3.4. Factors of Consumer Interest in Buying Arthrospira Milk chocolate

Table 3. displays the results of the milk chocolate chi-square test. The results obtained are that the interest factors of PM respondents and non-PM respondents in buying Arthrospira carotenoid milk chocolate bars are different. PM respondents' factors in buying Arthrospira carotenoid milk chocolate bars are influenced by socio-demographic, consumer habits of buying chocolate bars, knowledge of Arthrospira and the benefits of consuming Arthrospira.

Table 3. Milk Chocolate Chi-square Test Results.

| Factors                                      | PM     | Non PM |
|----------------------------------------------|--------|--------|
| Socio-demographic of respondents             |        |        |
| - Age                                        | 0*     | 0.805  |
| - Gender                                     | 0.019* | 0.441  |
| - Profession                                 | 0*     | 0.495  |
| - Origin                                     | 0.838  | 0.278  |
| Respondent's knowledge about chocolate bars  |        |        |
| - Likes to consume chocolate bars            | 0.36   | 0.179  |
| - How to consume chocolate bars              | 0.979  | 0.696  |
| - Knowledge of the benefits of consuming chocolate bars | 0.47 | 0.473 |
| - The perception of chocolate bars on the market | 0.12 | 0.351 |
| Respondents' habit of buying chocolate bars  |        |        |
| - Attributes that attract consumers          | 0.05*  | 0.831  |
| - Frequency of consuming chocolate bars      | 0.508  | 0.315  |
| - Types of chocolate bars                    | 0.296  | 0.276  |
| - Chocolate bar size                         | 0.695  | 0.399  |
| Respondents' habit of consuming chocolate bars|        |        |
| - Activity while consuming chocolate bars    | 0.28   | 0.84   |
| - Where to buy chocolate bars                | 0.796  | 0.242  |
| - Conditions when consuming chocolate bars   | 0.883  | 0.05*  |
| Respondent's knowledge about Arthrospira     |        |        |
| - Respondents know or not about Arthrospira  | 0*     | 0.674  |
| - Experience consuming Arthrospira           | 0.825  | 0.712  |
| Benefits of consuming Arthrospira            |        |        |
| - Arthrospira chocolate price increase       | 0.813  | 0.08   |
| - Arthrospira belief is good for health      | 0.003* | 0.061  |

Description: PM = respondents who took the PM test  
Non PM = respondents who did not take PM test  
* significant results, the p-value is smaller than alpha 0.05

Age, gender, and profession are socio-demographic factors that influence interest in purchasing Arthrospira carotenoid milk chocolate bars. The p-values for age, gender, and profession factors in PM respondents were 0, 0.019, and 0. Because the p-values of these three factors were less than the alpha value of 0.05, these three factors influenced respondents' purchasing interest in Arthrospira carotenoid
milk chocolate bar. This result demonstrates that men and women have different levels of preference for chocolate bars: men prefer savory foods such as meat, fish, and eggs, whereas women prefer sweet foods such as chocolate, cakes, and ice cream [18]. Students, both PM and non-PM respondents, are the most professional factors. Despite their various occupations, almost all respondents, according to the survey results, are interested in purchasing milk chocolate bar carotenoids Arthrospira.

Carotenoids Arthrospira is the attribute that attracts consumers (taste, color, price, and texture) to buy chocolate bars. The results of the chi-square test of attributes that attract consumers for PM respondents obtained a p-value of 0.05, indicating that these attributes that attract consumers affect respondents' buying interest in Arthrospira carotenoid milk chocolate bar. The habit of buying chocolate bars because of the attributes (taste, color, price, and texture) also works for knowing the extent of consumer preference for chocolate bars.

In PM respondents, the p-value for knowing or not knowing about Arthrospira is 0. These findings suggest that respondents' level of knowledge about Arthrospira influences their purchasing interest in Arthrospira carotenoid milk chocolate bar. The Arthrospira knowledge factor refers to knowing or understanding Arthrospira. Respondents who have heard of Arthrospira usually describe it as a type of green microalgae that is beneficial to one's health.

In PM respondents, the p-value of the Arthrospira confidence factor is good for health, which is less than the alpha value of 0.05, which is 0.003. According to these findings, respondents' trust in Arthrospira's health benefits influences their interest in purchasing the Arthrospira carotenoid milk chocolate bar. The advantage of consuming Arthrospira is that it promotes health. Arthrospira contains antioxidant and anti-inflammatory phycocyanin pigments, polysaccharides with antitumor and antiviral properties, and -linoleic acid (GLA) from Arthrospira, which can function in lowering cholesterol and rapidly reducing the effect of immunoglobulin (IgE) [19].

Consumption of chocolate bars is a factor that influences non-PM respondents' interest in purchasing milk chocolate bar carotenoids Arthrospira. on the health benefits of eating chocolate bars. The chi-square test of the condition factor when eating chocolate bars yielded a p-value of 0.05. According to these findings, the conditions under which respondents consume chocolate bars can influence their purchasing interest in Arthrospira carotenoid milk chocolate bars. Chocolate's sweet taste is thought to be able to please people who consume it in order to reduce stress. Theobromine and phenylethylamine are important in regulating a person's feelings of pleasure. It increases the Serotonin in our brain, also known as the happiness hormone, and causes feelings of pleasure.

3.5 Factors of Consumer Interest in Buying Arthrospira Dark chocolate

Table 4. shows the results of the chi-square test for the carotenoid Arthrospira's dark chocolate product. In PM respondents, the p-value of the knowledge factor on the benefits of consuming chocolate bars and the conditions when consuming chocolate bars is less than the alpha value of 0.05, both of which are 0. These findings indicate that knowledge of the benefits of consuming chocolate bars, as well as the conditions under which chocolate bars are consumed, influenced PM respondents' purchasing interest in Arthrospira carotenoid dark chocolate bar. In non-PM respondents, the p-value obtained from all factors is greater than the alpha value of 0.05, indicating that no factors influence the respondent's lack of purchasing interest. These findings indicate that the respondent's purchase of an interesting Arthrospira carotenoid dark chocolate bar is not influenced by any factors.
Table 4. Dark Chocolate Chi-square Test Results.

| Factors                                           | p-value               |
|--------------------------------------------------|-----------------------|
|                                                  | PM       | Non PM  |
| Socio-demographic of respondents                 |          |         |
| Age                                              | 0.992    | 0.317   |
| Gender                                           | 0.418    | 0.073   |
| Profession                                       | 0.960    | 0.311   |
| Origin                                           | 0.731    | 0.138   |
| Respondent's knowledge about chocolate bars      |          |         |
| Likes to consume chocolate bars                  | -        | 0.677   |
| How to consume chocolate bars                    | 0.418    | 0.638   |
| Knowledge of the benefits of consuming chocolate bars | 0*        | 0.734   |
| The perception of chocolate bars on the market   | 0.829    | 0.446   |
| Respondents' habit of buying chocolate bars      |          |         |
| Attributes that attract consumers                | 0.898    | 0.729   |
| Frequency of consuming chocolate bars            | 0.807    | 0.585   |
| Types of chocolate bars                          | 0.160    | 0.417   |
| Chocolate bar size                               | 0.866    | 0.299   |
| Respondents' habit of consuming chocolate bars   |          |         |
| Activity while consuming chocolate bars          | 0.529    | 0.688   |
| Where to buy chocolate bars                      | 0.777    | 0.988   |
| Conditions when consuming chocolate bars         | 0*       | 0.852   |
| Respondent's knowledge about Arthrospira         |          |         |
| Respondents know or not about Arthrospira        | 0.083    | 0.597   |
| Experience consuming Arthrospira                 | 0.347    | 0.142   |
| Benefits of consuming Arthrospira                |          |         |
| Arthrospira chocolate price increase             | 0.976    | 0.193   |
| Arthrospira belief is good for health            | 0.162    | 0.122   |

Description: PM= respondents who took the PM test  
Non PM = respondents who did not take PM test  
* significant results, p-value is smaller than alpha 0.05

Based on the buying interest test results, it was discovered that there were still many respondents who were unaware of Arthrospira, so the results of the PM respondents' buying interest test provided a good picture for developing a marketing strategy for Arthrospira carotenoid dark chocolate bar.

There must be a marketing strategy in place to develop Arthrospira carotenoid dark chocolate bar products, such as labeling the products with Arthrospira 's health benefits. The label provided is expected to educate consumers on the benefits of eating chocolate and Arthrospira. Another marketing strategy is to provide samples of Arthrospira carotenoid dark chocolate bar products at sales locations so that consumers can taste the product and decide whether or not to purchase it.

4. Conclusion

According to the PM test results, consumers perceive milk chocolate and dark chocolate fortified with nanocapsules Arthrospira carotenoid to be similar in taste, appearance, texture, and price to some
commercial chocolate bar products, implying that both chocolate products fortified with nanocapsules Arthrospira carotenoid can compete in the market. The results of the milk chocolate buying interest test show that for PM respondents, socio-demographic factors, consumer habits of buying chocolate bars, knowledge of Arthrospira, and the benefits of consuming Arthrospira influence their buying interest, whereas for non-PM respondents, consumer habits of buying chocolate bars influence their buying intention. The results of the dark chocolate buying interest test show that respondents' knowledge of the benefits of consuming chocolate bars and the conditions under which they consume chocolate bars influence their purchasing intention. Based on the results of the buying interest test, it was discovered that there were still many respondents who were unaware of Arthrospira, so the buying interest test results provided a good picture for developing a marketing strategy for Arthrospira carotenoid dark chocolate bar.

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