

Red beetroot modification and application on the ASIFA menu

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Abstract

This study aims to modify the ASIFA menu by adding red beetroot to several basic foods, animal-based side dishes, plant-based side dishes, vegetables and snacks. Acceptance was assessed by ASIFA students' preference for the food served. The menu at ASIFA needs to be modified because of waste, especially vegetables waste is >20%. ASIFA students (56.3%) have a low consumption level (70 - <100%), and only 50% of the consumption level comes from the ASIFA menu, the rest comes from outside food. Red beetroot is a root vegetable rich in bioactive compounds, known as the NO diet because it is rich in nitrates so it is useful in increasing the VO₂ Max of athletes. A total of thirty volunteers (15-30 years old) were randomly selected to participate in the study in 2021. Volunteers were given a modified menu and then judged which one they liked the most (color, scent, taste texture). The menus have been standardized in the laboratory to get the exact composition of red beetroot in each menu. Beetroot spaghetti is preferred for basic foods, beetroot rolled beef is preferred for animal-based side dishes, beetroot tofu perkedel are preferred for plant-based side dishes, beetroot sweet corn stir fry are preferred for vegetable menus, beetroot lumpur cake and beetroot sponge cake are preferred for snacks menu. The menu that has been modified with the addition of red beetroot is preferred, hence it can be used as an alternative menu variation for ASIFA students.

1. Introduction

Beetroot is a type of tuber vegetable that is rich in natural antioxidants (Chhikara *et al.*, 2019), rich in bioactive compounds, especially nitrates and is known as the NO Diet (Baião *et al.*, 2017; Nowacka *et al.*, 2019), because beets are high in nitrates (Lidder and Webb, 2013). Dietary nitrate acts as an effective NO donor in conditions of hypoxia and ischemia (Bryan and Ivy, 2015). NO causes a vasodilating effect, and increases blood flow to muscles (Moazami *et al.*, 2015). The high nitrate content in beetroot juice is able to increase the athlete's VO₂ Max which biologically affects the utilization of O₂ regulators by muscle contractors so that the distribution of O₂ according to muscle needs. Nitrate supplementation until day 15 can increase mitochondrial mass thereby increasing the use of NO (Nitric oxide) in mitochondria to produce energy (Sanrebayu *et al.*, 2020). The addition of beetroot to the ASIFA (Aji Santoso International Football Academy) menu modification is needed to improve the intake of ASIFA students. As many as 56.3% of ASIFA students have a low level of

consumption (70 - <100%), and only 50% of the level of consumption comes from the ASIFA menu, the rest comes from outside food, so that waste, especially vegetables, is >20% (Fitriah *et al.*, 2020). Red beetroot is also one of the food ingredients that is useful as a natural dye in the manufacture of food products. The color comes from betacyanin compounds which are different from anthocyanin pigments in other plants because they contain nitrogen compounds that have a positive effect on free radical activity and cancer, function as natural antioxidants in addition to natural dyes (Winanti *et al.*, 2013).

ASIFA is the first football academy in Indonesia that is highly oriented towards producing quality, professional, outstanding football players and upholds sportsmanship (ASIFA, 2018). Professional football athletes are expected to be produced by ASIFA by improving the quality of food to support growth and development so that training can be carried out optimally. Football coaching has long been carried out

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by the parent organization of football in Indonesia (PSSI), but the expected achievements have not been fulfilled (Husaini, 2012). One of the contributing factors is that the stamina of Indonesian football players is far behind European football players. Indonesian football players are very good at running but stamina only lasts up to 60 minutes, after which players will be tired (Zainudin, 2020). Continuous activity will increase the production of radicals resulting in oxidative stress that triggers fatigue and causes decreased endurance (Chiu, 2010). Endurance and performance during competition are affected by the uptake of oxygen during the maximum excretion of exercise that the body can use during exercise which is called VO_2 Max capacity. The ideal value of VO_2 Max will indirectly affect football achievement (Nafita, 2012; Hendra *et al.*, 2016). The VO_2 Max value can be increased by giving beetroot juice, where the increase in VO_2 Max value is caused by an increase in hemoglobin levels triggered by the high iron content and nitrate content in beetroot (Arimbi and Usman, 2020).

To become a professional football athlete, one must go through the level of football education that has been determined by the parent organization of Indonesian football, namely the Football School, which starts at the age of 11 years (PSSI, 2014). The phenomenon that occurs in football schools is that students exercise with high intensity but are not supported by good nutritional intake. The students' lack of understanding of the importance of food to move is also a separate reason why the consumption of nutrients is neglected. Errors in preparing menus and meal timings are also a problem for children. Parents of students do not understand the intake of food and nutrients for their children. Even though with less intake, the movements in exercise will not be able to be carried out optimally. ASIFA's menu does not vary and is not adapted to existing consumer variations, and there is no standard portion for each food served. 100% of students eat outside because they are bored with the food at ASIFA and the taste is not standard (Fitriah *et al.*, 2020). This study aims to modify the ASIFA menu by adding red beetroot to several basic foods, animal-based side dishes, plant-based side dishes, vegetables and snacks.

2. Materials and methods

In this research, a recipe trial was conducted in a laboratory to determine the amount of red beetroot that can be added to the menu. Several menus are processed with the addition of red beetroot, tested in the laboratory, then served to ASIFA students to assess the most preferred menu.

The study population was ASIFA students living in dormitories. The sampling technique used is a stratified random sample by grouping the samples into age groups. Sample age was between 15–20 years. Thirty ASIFA students volunteered in this study. The different menus were served for 20 days in the afternoon. The first day begins by serving a menu of basic foods (2 menus), the second day by serving a menu of animal-based side dishes (3 menus), day 3-4 menus of plant-based side dishes (6 menus, 3 menus a day), day 5-10 vegetable menus (21 menus, 3–4 menus a day), and on the 11th – 20th day a snack menu was given (20 menus, 2 menus a day).

Acceptance was assessed from ASIFA students' preference for the food served by conducting an organoleptic quality assessment with a hedonic test. The organoleptic qualities assessed are color, scent, taste, and texture. Preference data through color, scent, taste, and texture assessment with the following criteria: Like (L) and Dislike (DL). Preference data (L) was presented in the form of a percentage.

3. Results and discussion

3.1 Basic food

There are only two modified basic foods, because ASIFA students still like the menus served, so the menu modifications can be used as a reference for alternative basic foods to students.

Based on Table 1, it is found that Beetroot spaghetti is preferred by students (color, scent, taste and texture) compared to Beetroot porridge. Beetroot spaghetti can be used as a new menu at ASIFA because it tastes good (accepted by students), the scent of the beetroot didn't come out too much, and the texture is like eating noodles. Hence, this menu can be used as an alternative to serving basic foods for ASIFA students.

Table 1. Acceptance of basic food menu modified.

Menu	Color	Scent	Taste	Texture	%
Beetroot Porridge	90	72	72	72	77
Beetroot Spaghetti	87	95	95	95	93

3.2 Animal-based side dishes

There are 3 types of modified animal-based side dishes on the menu. All menu modifications using beef, are expected to replace black pepper beef that has waste up to >20%. Chicken, fish and eggs which are served in the form of dishes are already acceptable to students so it is prioritized to modify the meat by adding red beetroot to cooking.

Table 2 shows that the Beetroot rolade beef menu is preferred by students (color, scent, taste and texture)

compared to Beetroot beefsteak and Beetroot beef semur. Students revealed that the Beetroot rolade beef tastes good, the scent is also appetizing to eat, and the color and texture are interesting. The scent of beetroot does not smell because it is covered by the scent of scrambled eggs to coat the mixture of meat and beetroot used as a filling. It is this variation that causes ASIFA students to like Beetroot rolade beef.

Table 2. Acceptance of animal-based side dishes menu modified.

Menu	Color	Scent	Taste	Texture	%
Beetroot Beefsteak	80	76	83	80	80
Beetroot Rolade Beef	90	100	90	83	91
Beetroot Beef Semur	75	75	75	80	76

3.3 Plant-based side dishes

The plant-based side dishes that are often served on the ASIFA menu are tofu and tempeh. Both of these food ingredients are served most often by frying. Therefore, this study modifies tofu and tempeh and adds other food ingredients such as potatoes and corn which can be used as an alternative to varying the plant-based side dishes menu. The modified plant-based side dishes menu is also not too much (6 menus), because the plant-based side dishes served are still acceptable to students and is low waste (< 20%).

Table 3 shows that the students preferred the Beetroot tofu perkedel menu (color, scent, taste and texture) compared to other plant-based side dishes (Beetroot corn bakwan, Beetroot tofu stir fry, Beetroot tempeh stir fry, Beetroot potato perkedel and Beetroot mendol). Students said that the Beetroot tofu perkedel was delicious, the scent of the beetroot was not smelled because it was covered by the tofu scent, the color was interesting, and the texture was soft. Tofu is rarely varied, so it is this variation that causes ASIFA students to like Beetroot tofu perkedel.

Table 3. Acceptance of plant-based side dishes menu modified.

Menu	Color	Scent	Taste	Texture	%
Beetroot Corn Bakwan	84	78	78	78	80
Beetroot Mendol	92	92	92	95	93
Beetroot Potato Perkedel	88	92	83	95	90
Beetroot Tofu Perkedel	100	98	100	100	99.5
Beetroot Tofu Stir Fry	86	92	92	92	91
Beetroot Tempeh Stir Fry	86	78	83	90	84

3.4 Vegetables

The vegetable menu at ASIFA has the highest waste (> 20%). Therefore, there are 21 types of modified vegetable menus as a reference to replace or modify the

menu at ASIFA. From 21 types, students are uninterested, but there is a menu with the highest acceptance (acceptable by students).

Table 4 shows that ASIFA students (94%) liked the Beetroot sweet corn stir fry menu (color, scent, taste and texture), although the students also liked the color from the Beetroot snaps stir fry menu, it is just that the taste, scent, and texture were not as much as Beetroot snaps stir fry. Beetroot sweet corn stir fry can be used as an alternative to a new menu offered for ASIFA students. Thus, with various alternative vegetable menus, ASIFA Management can choose a vegetable menu that students can accept.

Table 4. Acceptance of vegetables menu modified.

Menu	Color	Scent	Taste	Texture	%
Beetroot Sour Soup	79	79	84	84	82
Beetroot Bean Stir Fry	81	81	87	87	84
Beetroot Snaps Stir Fry	94	86	86	86	88
Beetroot Cassava Leaf Coconut Milk	80	84	84	84	83
Beetroot Eggplant Stir Fry	82	82	78	82	81
Beetroot Water Spinach Stir Fry	83	89	89	89	88
Beetroot Soup	78	80	78	78	79
Beetroot Snaps Garlic Stir Fry	73	70	76	82	75
Beetroot Sweet Corn Stir Fry	93	93	98	93	94
Beetroot Chayote Stir Fry	84	76	76	84	80
Beetroot Chinese Cabbage Stir Fry	70	70	76	76	73
Beetroot Broccoli Carrot Stir Fry	75	75	75	82	77
Beetroot Spinach Soup	75	75	77	84	78
Cheerful Stir Fry	77	70	79	77	76
Karedok	75	75	75	78	76
Beetroot Pokcoy Stir Fry	81	81	81	83	82
Capcay Sauce	72	76	74	82	76
Terancam	80	84	80	82	82
Caisim Roll	68	68	70	77	71
Rainbow Stir Fry	73	78	78	80	77
Beetroot Macaroni Stir Fry	76	76	76	76	76

3.5 Snacks

Snacks at ASIFA are only given once a day in small portions, so ASIFA students are not satisfied with the snacks served. The number of modified snack menus is also a lot, with about 20 menus. It is hoped that this snack menu can be used as an alternative to the new menu for ASIFA students' snacks and can be given 2 times a day snacks (morning and afternoon).

Table 5 shows that the snacks served are liked by students, especially lumpur cake and sponge. 100% of students liked the color, scent, taste, and texture of the cake. In those cakes, the red beetroot feels tasteless. The attractive colors of cakes can increase the appetite. Therefore, some of these snack menus can be used as an alternative to the menu variations given to ASIFA students.

Table 5. Acceptance of snacks menu modified.

Menu	Color	Scent	Taste	Texture	%
Klepon	94	91	91	98	94
Donut	93	93	93	95	94
Cup Cake	95	95	93	93	94
Talam Cake	93	91	84	91	90
Churros	93	93	96	96	95
Putu Ayu	94	94	94	96	95
Brownies	88	88	90	86	88
Sponge	100	100	100	100	100
Risoles	83	81	83	83	83
Lumpia	82	80	84	84	83
Lumpur	100	100	100	100	100
Small Martabak	88	88	86	90	88
Pukis	100	95	100	98	98
Pudding	100	96	96	96	97
Pastel	95	93	93	93	94
Kroket	90	88	85	88	88
Cucur	88	88	88	90	89
Pancake	95	92	95	95	94
Gethuk Lindri	100	98	96	96	98
Dadar Gulung	100	97	97	100	99

4. Conclusion

The results of this study obtained several alternative menus that have been modified by adding red beetroot to the basic food menu, animal-based side dishes, plant-based side dishes, vegetables, and snacks that ASIFA students like because of the attractive color and tasteless aroma of beets. Several alternative menus have been offered to make the menu at ASIFA more varied so that ASIFA students' intake can be increased through the food served. Beetroot spaghetti is preferred as basic food, beetroot rolled beef is preferred as an animal-based side dishes menu. Beetroot tofu perkedel is preferred as a plant-based side dishes menu, beetroot sweet corn stir fry is preferred as a vegetable menu, and lumpur cake and sponge are preferred as a snack menu, although almost all the snacks offered are liked by students.

Conflict of interest

The authors declare no conflict of interest.

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