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THE PRELIMINARY FORMULATION OF ZEA MAYS AS EXERCISE RECOVERY GEL

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ABSTRACT

Recovery nutrition play an important role in body adaptation towards exercise and sports performance. Combination of different saccharides and amino acid content fasten recovery result which promotes exercise adaptation and prepared athletes' body for next session of exercise. There are abundant of recovery supplement available but most of it was milk base products which could contribute to lactose intolerance negative effect among consumers. Therefore, *Zea mays* which is plant based is propose as an alternative food supplement for exercise recovery choices. *Zea mays* kernel was grind for the juice and homogenized with sugar, fructose, xanthan gum and pectin. The mixture been cook for 20 minutes using double boiler at 95°C. The gel sample then fill in the gel pack and keep at room temperature for shelve live assessment. Proximate analysis showed the presence of sucrose (20.5g/100g), fructose (9.2g/100g) and total carbohydrate is 51.5g/100g. Essential amino acids that presence is arginine (1.75%w/w), histidine (0.52%w/w), isoleucine (0.17%w/w), lysine (0.08%w/w), threonine (0.15%w/w) and valine (0.31%w/w). After 30 days at room temperature, the *Zea mays* gel showed same texture, colour, smell, and taste. Therefore, the preliminary formulation of *Zea mays* gel showed a possible innovation for local exercise recovery gel.

Keywords: recovery, zea mays, sweet corn, exercise, supplement

INTRODUCTION

Exercise and physical activity will result in fluid loss, glycogen depleted and muscle soreness. Therefore, structured recovery plan with appropriate nutrient content could promote recovery process thus increase body muscle adaptation following exercise. Nutritional strategies post exercise could promote muscle glycogen restoration, fluid loss replacement, synthesize new proteins to counteract both catabolic state and exercise-induced damage, and improve immune system response (Burke, 2010, Zoorob et al, 2013, Ivy & Ferguson-Stegall, 2013). Study showed that muscle glycogen could be restored within 24 hours when adequate amount of carbohydrate are ingested (Beelen et al., 2010), while recovery process shows better result when protein is ingested together (Burke et al., 2004), thus helps in alleviating muscle soreness (McBrier et al. 2010). Review by Bonilla et al, 2020 summary that using 4R's approached to optimized exercise recovery. 4R's referring to rehydration, refuel, repair and rest which the

recommended for each athletes applied it every training and competition session for better adaptation and recovery process. In order to meet the rehydration, refuel and repair, customized nutrient of food product is needed to ease achieve the recovery objective. Therefore, nutrient dense food or product that contain recovery nutrients are needed.

There is abundant food product or supplement for recovery are available but most of it contain milk base as to meet the recovery requirement. Unfortunately, there are many people unable to digest milk due to lactose intolerance. A study done by Asmawi and colleagues (2006) have shown that the prevalence of lactose intolerance was high in Asian population with 88% in Malays, 91% in Chinese, and 83% in Indians. Similarly, more than half of the studied population in Thai (Densupsoonton et al., 2004) and Singapore (Bolin et al. 1970) suffer from this digestive problem. Pelly & Burkart (2013) conducted a survey on dietary regimens among athletes competing in 2010 Commonwealth Games in Delhi reported that 10% of the athletes from Southeast Asia countries were likely to follow a low and/or lactose-free diet to avoid the symptoms of lactose intolerance. Based on this statistic, it is imperative for manufacturers and researchers to produce lactose-free recovery supplement. Therefore, this study is to purpose *Zea mays* or sweet corn as a plant-based alternative to innovate the recovery gel as recovery choices that could meet the recovery need as well as lactose-free product.

Zea mays is a sweetcorn specie that contain nutrient needed for recovery. Analysis done by Jusoh, Ahmad & Tengah, (2019) found that *Zea mays* juice contained carbohydrate (9.8g/100 ml), protein (2.4g/100ml) and sodium (64.3mg/100ml) which are the main nutrients recommended for optimal recovery. The present of 16 types of amino acid (Jusoh, Ahmad & Tengah, 2019) offer muscle recovery opportunity. *Zea mays* contained leucine, valine and isoleucine that been found to promote muscle synthesis that could fastened recovery process (Bongiovanni et al, 2020). The unique contain of plant sources of *Zea mays* offer an opportunity in developing lactose-free recovery product.

MATERIALS AND METHODS

Zea mays L. or sweet corn (Nelson's Franchise Sdn. Bhd) was N28 specie that produces succulent kernels with a high sweetness level been used to formulate the recovery gel. Corn kernel was brought in frozen form and keep in low temperature in the ice box during travelling before keeping it at the MARDI lab freezer. *Zea mays* kernel was defrost by rinse the kernel under running water. *Zea mays* kernel was grind for the juice and homogenized with sugar, fructose, xanthan gum and pectin. The mixture been cook for 20 minutes using double boiler at 95°C. The gel sample then fill in the gel pack and keep at room temperature for shelve live assessment. Some of the sample was sent to lab for proximate analysis.

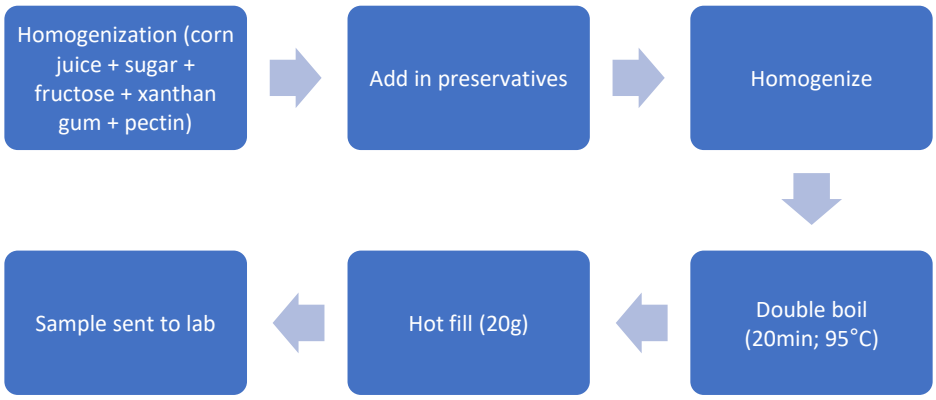

Figure 1: Recovery gel flow chart preparation

RESULT

Proximate analysis was done to determine the nutritional profile of *Zea mays* recovery gel. Result showed that formulated recovery gel contains 51.5g of carbohydrate, 1.4g of protein and 1.0g of fat with total calorie of 221kcal. Table 1 showed the list of proximate analysis of the *Zea mays* recovery gel.

Table 1. Proximate analysis of *Zea mays* gel

Nutrient	Value (per 100g)
Calorie (kcal)	221
Total Carbohydrate (g)	51.5
Protein (g)	1.4
Fat (g)	1.0
Sodium (mg)	59.5

Zea mays gel contain high energy and the protein present gave a positive requirement to fulfil recovery need. As it has an original sweetness level, the additional sugar is the purpose for manufacturing. Gel form is chosen to ease the intake of *Zea mays* during or after exercise with higher content of nutrient value. The process of producing *Zea mays* gel showed promising local product that could be used as a choice for exercise recovery purposes.

Sample then was analysed for type of saccharides and amino acid present as both of this nutrient have a role to fasten recovery process. The list of saccharides and amino acid content as presented in Table 2 and Table 3.

Table 2. Saccharides content in *Zea mays* gel

Nutrient	Value (per 100g)
Fructose	9.2
Lactose	ND<0.1
Sucrose	20.5
Maltose	ND<0.1
Glucose	ND<0.1

Table 3. Amino acid content in Zea mays gel

Nutrient	Value (%w/w)
Arginine	1.79
Aspartic Acid	0.18
Alanine	0.08
Glutamic Acid	0.33
Glycine	0.27
Histidine	0.52
Isoleucine	0.17
Leucine	0.19
Lysine	0.08
Methionine	ND<0.01
Phenylalanine	ND<0.01
Proline	0.47
Serine	0.14
Tyrosine	0.23
Threonine	0.15
Valine	0.13

DISCUSSION

Zea mays or sweet corn have original sweetness that could promoting the acceptance rate of the product. Even though *Zea mays* is plan based, it contains protein and amino acids that could play a role in promoting muscle recovery. Mixture of different saccharides also could give better effect on recovery as it could increase absorption rate in short time periods. The nutritional content through proximate analysis done showed that *Zea mays* contains nutrient that been suggested for recovery. The carbohydrate, protein and sodium present meeting the recovery recommendations.

The present of fructose and sucrose showed a good combination of saccharides. Different saccharides used different pathway to produce energy, thus increase the absorption rate when taking together. Study by Jentjens et al, 2004 showed that when fructose and glucose are ingested simultaneously at high rates during cycling exercise, exogenous carbohydrate oxidation rates can reach peak values of ~1.3 g/min compared to when glucose alone only at 0.8g/min. The result support the saccharide content in *Zea mays* gel could able to fasten rate the sugar uptake in the cell.

Essential amino acids that presence is arginine (1.75%w/w), histidine (0.52%w/w), lysine (0.08%w/w), threonine (0.15%w/w) and valine (0.31%w/w). While branched-chain amino acid (BCAA) such as leucine, isoleucine, and valine also present in minimum amount. BCAA can be oxidized in skeletal muscle when sufficient protein is available whereby the present gel contains moderate protein. It has been discovered that BCAA have beneficial effects in reducing exercise-induced muscle damage effects and promoting muscle–protein synthesis (Negro et al., 2008). In most of commercially available BCAA supplements, at least 5 g of BCAA is needed to produce the beneficial effects of BCAA supplementation. Meanwhile, the suggested ratio for leucine:isoleucine:valine is 2:1:1 o3:1:1 (Kephart et al., 2016) or leucine:valine:isoleucine is 2:1:1 (Bongiovanni et al, 2020). Similar ratio of the BCAA amino acids was obtained in this study which was 2:1:1. Therefore, this finding showed that our product has the potential to be developed as an alternative source of BCAA for muscle recovery purpose.

Protein had been recommended to enhance recovery rate as well as promoting exercise adaptation. The combination of carbohydrate and protein could result in synergistic effect on muscle recovery (Belen at al, 2010). The present of amino acid in *Zea mays* which is plant sources could give an alternative for those who practicing vegan or looking for milk alternative product. As lactose e intolerance prevalence are high, the innovation of plant-based product that have similar of nearly the contain of milk sources-which had proven to promote recovery, could gave a positive sight to promote this product (Jusoh, Ahmad & Tengah, 2019).

CONCLUSION

Zea mays gel nutritional content showed promising option as an alternative recovery gel. This plant source product could be a great choice for those with lactose intolerance issue without compromising the recovery need. At the same time sweet corn used are from local plantation that could boost the agricultural activity as well with the new product innovation.

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