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Development and Characterization of Oats and Banana Powder Muffins against Hypertension

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A B S T R A C T

In the current era, hypertension commonly known as high blood pressure has become one of the leading health challenges. Hypertension can increase the risk of life threatening conditions, heart disease, stroke, kidney failure, obesity and diabetes. Managing blood pressure through healthy diet choices is an important way to reduce these risks. Current study was designed to developed muffins using oat flour and banana powder. Muffins were prepared using different combinations of the ingredients and were assessed for their proximate composition, antioxidant activity and sensory evaluations over a 30 day storage period. The proximate composition results showed non-significant variation across treatments for moisture content from 5.11 ± 0.16% to 5.18 ± 0.03%, protein 6.14 ± 0.03% to 6.17 ± 0.02%, fat content 4.13 ± 0.04% to 4.19 ± 0.03%, ash content ranged from 2.13 ± 0.08% to 2.18 ± 0.02% and crude fiber 10.17 ± 0.02% to 12.99 ± 0.01%. Antioxidant activity was determined using the DPPH method with significant level of $p<0.05$. The overall mean DPPH values were 29.77 ± 0.06 for T_0, 30.37 ± 0.06 for T_1, 31.95 ± 0.07 for T_2 and 32.69 ± 0.08 for T_3. The overall mean TPC across treatments was 32.62 ± 0.02 for T_0, 32.90 ± 0.03 for T_1, 33.25 ± 0.03 for T_2 and 33.99 0.04 for T_3. Among the treatments, T_3 showed the best overall results across nutritional, functional and sensory evaluations.

Keywords: Banana powder, Hypertension, Oat powder, Stevia.

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INTRODUCTION

Hypertension is defined as the elevation of systemic arterial pressure above a fixed onset value (Bakris et al., 2019). Normal blood pressure is equal to systolic blood pressure is 120 mmHg and diastolic blood pressure is 80 mmHg. Hypertension is also defined as systolic blood pressure level of greater or equal to 140 mmHg and diastolic blood pressure greater or equal to 90 mmHg. If its range between 120 to 139 mmHg for systolic blood pressure and 80 to 89 mmHg for diastolic blood pressure then it is called as pre-hypertension (Singh et al., 2017). According to the national health survey (2023) 18% of 15 years of age is affected with it and its prevalence 16.2% in rural population and 21.6% in urban population in Pakistan (Iqbal et al., 2023). In Pakistan hypertension occur alone and also cause chronic diseases such as diabetes mellitus, cardiovascular diseases (CVD), chronic kidney diseases (CKD). Hypertension can result from factors such as smoking, obesity, lack of exercise, and a family history (Shafi and Shafi., 2017). Cardiovascular disease (CVD) is the leading cause of death worldwide, and hypertension is the most important preventable risk factor for CVD. High blood pressure is associated with at least 7.6 million deaths per year worldwide (13.5% of all deaths) (Irazola et al., 2016).

Banana (*Musa acuminate*) is one of the most consumed fruits in tropical and subtropical regions of southeast Asia, belongs to family (Musaceae) and class (Liliopsida). It is the fourth largest fruit cultivated all over the world. Banana is cultivated in 120 countries in the world. They are available for the entire year and affordable (Chauhan and jethva, 2016). Banana can be consumed as a fresh pulp or dried powder form and used in many foods like pudding, jam, puree, bakery items, pastes and cakes. Processed bananas that are dried ground to create a fine, versatile powder packed with nutrients. It has been appreciated to eat for centuries due to their good effects on health including brain health, improves heart health, good for bones, enhance digestive health, valuable for diabetes, brightens the teeth, strengthens the immune system, manage hypertension, helpful against cancer and useful in skin and hair care, and helps to treat diarrhea and migrains. Banana produces huge waste in the form of peels, leaves, fruit stalk and rhizome which can be used for several applications (medicinal use, as bio sorbent, as fiber source, as bio fertilizers and livestock feed). In recent years, banana powder extract has been utilized for hypertension management. It is a good source of starch, fibers, minerals (potassium, calcium, magnesium, phosphorus and manganese), and vitamin B6 (Mengstu et al., 2021). The banana fruit consists of two main parts the peel and the pulp. The peel is considered a secondary by product and it has traditionally been discarded as waste which leads to large amounts of organic material ending up in landfills. The pulp is the edible part and is known for its high nutritional value. Research has explored its potential in food fortification and the extraction of valuable compounds such as different types of starch cellulose and bioactive phytochemicals (Bashmil et al., 2021).

High potassium content in banana powder can help decrease blood pressure by regulating the heart rate and fluid balance in the body. It has the potential to protect the liver from free radicals like lead exposure by working as an antioxidant. According to research eating banana powder can lower serum triglyceride levels and can lower blood cholesterol because they contain important compounds such as, carotenoids, phenolics, biogenic amines, fiber, flavonoid and phytosterols (Rafi et al., 2023). Oat (Avena sativa) is a species of cereal grain which is classified into common oat and naked oat (Avena nuda) (Zhou et al., 2019). Oat is classified as a whole grain. Recent studies show that consumption of oat help in reducing the risk of variety of diseases. Oat diet is useful in certain biological functions, such as reducing blood sugar and blood pressure, preventing cardiovascular diseases, promoting intestinal health, along with antiallergy, antioxidation and cancer preventive effects. Currently cancer is the second leading cause of death worldwide, the natural products of oat are useful breakthrough for developing new strategies of cancer prevention (Li et al., 2022). Hypertension is a major risk factor for cardiovascular disease and cognitive decline. Increases in blood pressure lead to hypertension can be found young adults with increase prevalence as people age. Oats are known to decrease cardiovascular disease (CVD) risk. Oats have several beneficial dietary components with putative important effects on blood pressure or endothelial function, such as B-glucan, y-amino butyric acid (GABA) and phytochemicals like that avenanthramides. Oats contains high contents of lipids, proteins, carbohydrates, minerals, vitamins and phytochemicals (like that polyphenols, flavonoids and saponins) (Liska et al., 2022).

Cereal-based products mainly baked constitute basic food for diet of people due to its sensorial and nutritional quality (Harastani et al., 2021). Baked products like muffins are very popular because they are consumed at breakfast or as a snack. They are very appreciated by consumers due to their good taste and smooth texture. The common mix for preparing traditional muffins is formulated with banana flour, oat flour, vegetable oil and stevia. In the aqueous phase, proteins, sugar and minerals are dissolved, while lipids are usually emulsified and starch granules and insoluble proteins are dispersed in the batter emulsion. The heating process during baking produce starch gelatinization and protein denaturation, leading to gelation and the formation of a baked matrix with air bubbles inserted in. Muffins usually present high volume with a porous structure that confers a spongy texture. Muffins obtained presented very good physical and sensory characteristics. Nutritional analysis of the muffins indicate that those products presented with the higher amount of magnesium and dietary fiber and lower of lipids. These muffins presented a high amount of polyphenols and the highest antioxidant activity (Sciammaro et al., 2018).

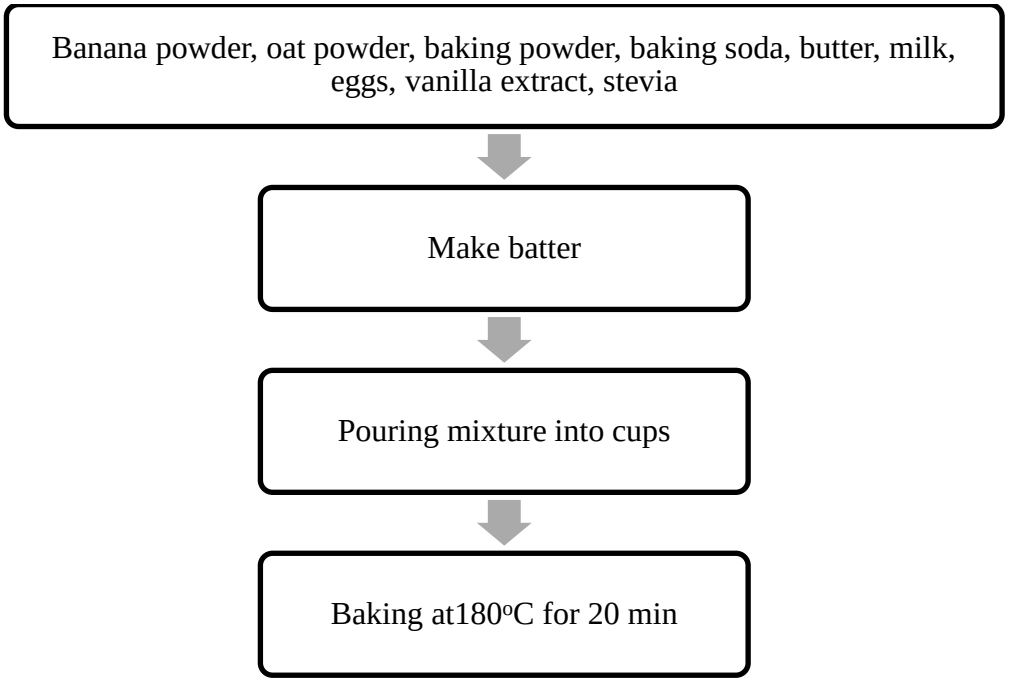
MATERIAL AND METHODOLOGY

The current study was conducted at Riphah International University in Faisalabad analysis carried out in the Product Development and Nutritional Assessment laboratory at the same institution. The research aimed to explore the health benefits of incorporating oat and banana into muffins to help manage hypertension. Cupcakes were selected to combine oat and banana as the primary ingredients.

First ingredients were divided into dry and wet ingredients.

The dry ingredients included banana powder, oats powder, baking powder and stevia. The wet ingredients were eggs and butter. The eggs were beaten for 2 min, butter and stevia were creamed for 10 min separately. In a separate bowl all dry ingredients along with beaten eggs and creamed butter and stevia were mixed to obtain muffin batter. The batter was filled in paper muffin cup. The muffins were baked at 180^{o}C in oven for 20 min (Baniya, 2022).

Treatments	Oat powder %	Banana powder %
$T_{\circ}$	100	0
T_1	90	10
T_2	80	20
T3	70	30



The moisture, crude fiber, crude protein, crude fat, ash and nitrogen free extract (NFE) of the cupcake samples were determined using the techniques following the standard methods described in (AOAC, 2016). The samples were analysed for DPPH described by the method (Oluwajuyitan et al., 2021) the sample extracts (0.0256 mL) were mixed with 10mL of the ethanol after that the 3ml of freshly dissolved 1mg DPPH mixed in 100mL of methanol was added into each test tube. The prepared samples were placed in the dark for 15 mins. The absorbance was estimated at 517nm by using the UV-visible spectrophotometer. During the whole process the highly stable and oxidizing radical, DPPH produced a yellow-coloured hydrazine which was further associated with the removal of free radicals with the hydrogen atom of phenolic compound. Total polyphenols of muffin were estimated using the method followed by (Panach, 2020) using the Folin-Ciocalteu method. In the mentioned method the phosphotungstic acid is reduced to phosphotungstic acid blue due to increase in the number of aromatic phenolics which cause an increase in the absorption. For this purpose, 50µL of extract was added in the test tubes and 250µL Folin-Ciocalteu regent along with 750 µL of sodium bicarbonate were added and a final volume was made using 5mL of distilled water and aluminum foil was used to cover the test tubes in a dark place for about 2 hours. After the mentioned time, the absorbance was calculated by using spectrophotometer at a wavelength of 765nm against the control having all reaction reagent except the sample aqueous extract.

The texture of the muffin samples was determined by using a texture analyser (Mod.TA-XT2 Stable Micro System, Surrey, UK) with a 5 Kg load cell. The data analysis was done by using the Texture Expert program. The texture was determined by using a 3-bend ridge for a bend test. The

muffin were bent to determine whether the structural change happened as a result of the force exerted on the muffin according to the procedure described by (Hou, 2020). The colour of the muffin was determined by calorimeter by following the protocol of AOAC, (2016). The colour of the cupcake was measured by using a lab colorimeter measuring system (model) and recorded as Ł α b. The Ł α b colour system consists of luminance or lightness component 'Ł' for lightness or darkness the component 'α' for green (-α) to red (+α) and 'b' for blue (-b) to yellow (+b) colour. The colorimeter was calibrated using a standard white plate. Values of the white standard, α, and b Colour were measured in a quartz cuvette of 50 ml capacity. Each measurement was replicated**.** Muffin samples were evaluated for general appearance, color, flavor, taste, texture, softness and overall acceptability by (Kaur et al., 2017) trained taste panel using a 9-point Hedonic Score System following the procedure described with the following individual scores liked extremely-9, liked very much-8, liked moderately-7, liked slightly-6, neither liked nor disliked- 5, disliked slightly-4, disliked moderately-3, disliked very much-2 and disliked extremely-1 to find out the most suitable composition of muffin for commercialization. The data collected from all treatments were analyzed using appropriate statistical tools to ensure accurate results. To determine the differences and relationships between the treatments the data was subjected to Analysis of Variance (ANOVA).

RESULTS AND DISSCUSSION

Food plays a vital role in maintaining human health and is especially important in preventing chronic conditions. Eating a diet rich in natural whole foods fruits, vegetables, nuts, seeds and legumes provides essential nutrients including fiber, antioxidants, vitamins and minerals all of which help regulate blood pressure and support healthy body function. Hypertension is a long term condition that develops gradually and can lead to serious health problems including heart disease, stroke and kidney failure. It is one of the leading causes of death and disability worldwide. Maintaining a balanced and nutritious diet is a key strategy in reducing the risk of hypertension and managing its effects. Recent research has focused on the benefits banana powder and oat powder both is rich in fiber and antioxidants. In a recent study, muffins were developed using these ingredients to evaluate their nutritional value and health promoting effects.

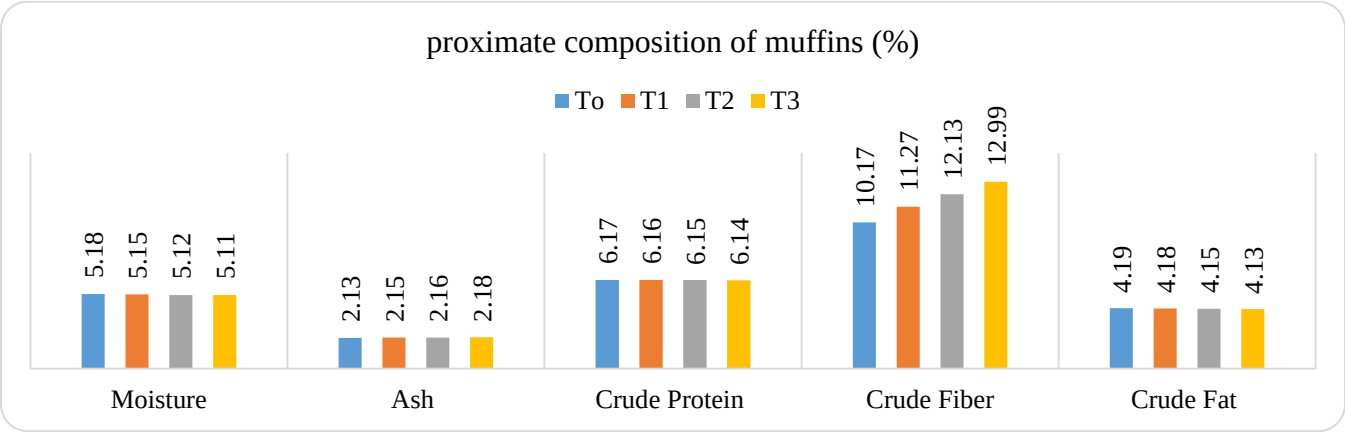


Figure 1: *proximate composition of muffins (%)*

The moisture content (%) of muffins under four different treatments T_0, T_1, T_2 and T_3. The moisture content decreased from 5.18% in the control T_0 to 5.11% in T_3. The moisture content gradually decreased the relatively small differences suggest overall moisture levels were consistent across all treatments. Abotaleeb & Arafa (2021) investigated the formulation of gluten free cookies using a combination of oat and unripe banana flours assessing various quality parameters. The moisture content was found to be 5.99% indicating that flour blends can contribute to maintaining appropriate moisture levels in gluten free bakery products.

The ash content of muffins prepared with different treatments T_0, T_1, T_2 and T_3. The recorded values were 2.13 ± 0.08 for T_0, $2.15 \pm 0.03\%$ for T_1, $2.16 \pm 0.08\%$ for T_2 and $2.18 \pm 0.02\%$ for T_3. These values show slight differences in ash content among the treatments. In the study by Singh et al. (2022) a novel functional snack bar was formulated using a blend of amaranth, rolled oats and

unripe banana peel powder. The ash content of the developed snack bar was recorded at 2.19% indicating a significant level of minerals. This value shows the combined nutritional contributions of the three ingredients amaranth which is rich in calcium and magnesium rolled oats known for their iron and phosphorus content and unripe banana peel powder which is particularly high in potassium and dietary fiber. These findings support the functional value of incorporating ingredients banana peel powder into snack products and muffin formulations as demonstrated by current research which highlights their role in enhancing the nutritional profiles of modern food products.

The crude protein content of muffins prepared with treatments T_0, T_1, T_2 and T_3. The protein levels were similar across all treatments, ranging from 6.17% to 6.14%. T_0 recorded 6.17±0.02% and T_3 had 6.14±0.03% showing minor difference between the treatments. Abotaleeb & Arafa (2021) explored the development of gluten free cookies made from a blend of oat and unripe banana flours focusing on their quality characteristics. The study found the crude protein content to be 7.99% supporting the findings of current research.

The crude fiber content of muffins for different treatments T_o, 10.17 ± 0.02%, T_1, 11.27 ± 0.06%, T_2, 12.13 ± 0.04% and T_3, 12.99 ± 0.01%. The values indicate the fiber levels in each treatment. These results suggest that the combination of ingredients influences the fiber content. In the study by Ariyanti et al. (2022) the fiber content of food bars formulated with banana and oat flour was evaluated. The recorded fiber content was 13.1±0.01 which contained a higher proportion of composite flour with more banana flour. The study shows that increasing amount of composite flour resulted in a higher fiber content in the food bars. These findings are valued for the current research as they support the observed trend in fiber content variations and their impact on product quality.

The crude fat content of muffins subjected to different treatments T_o, T_1, T_2 and T_3. The crude fat content was 4.19 ± 0.03% in T_o. 4.18 ± 0.21% in T_1, 4.15 ± 0.04% in T_2 and 4.13 ± 0.04% in T_3. In the study conducted by Abotaleeb and Arafa (2021), the development of gluten free cookies using a blend of oat and unripe banana flours was investigated by assessing the quality characteristics of the final product. The crude fat content was found to be 5.99 ± 0.04% supporting current research that shows the potential of flour blends to produce gluten free baked goods with favorable fat content.

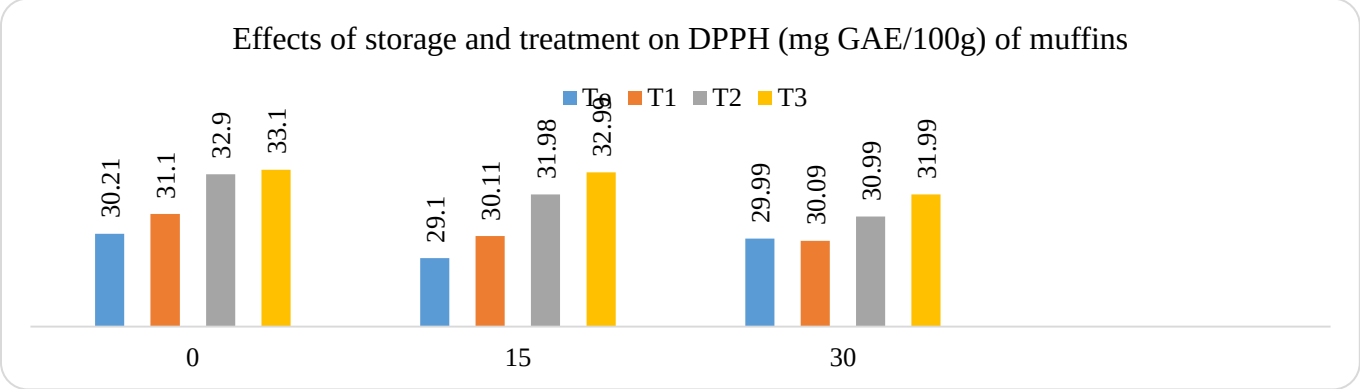


Figure 2: *Effects of storage and treatment on DPPH (mg GAE/ 100 g) of muffins*

The effects of storage and treatment on the DPPH of muffins over three different time periods measured at days 0, 15 and 30 days. At day 0, the DPPH values for the treatment T_0 were 30.21±0.07, T_1, 31.1±0.08, T_2, 32.9±0.09 and T_3 33.1±0.10 with an overall mean of 32.08±0.08. At day 15 the values for T_0 were 29.1±0.08, T1, 30.11±0.09, T_2, 31.98±0.10 and T_3, 32.99±0.11 with an overall mean of 31.09±0.09. At day 30, the values were 29.99±0.09, 29.89±0.10, 30.99±0.11 and 31.99±0.012 with an overall mean of 30.72±0.10. Kupaeva et al. (2022) investigated the antioxidant potential of oat based drinks enriched with plant components bananas, blueberries and elderberry powder known for their high anthocyanin content. The study recorded the antioxidant capacity of 35.0 ± 0.02 using both the FRAP and DPPH methods. Results showed a significant increase in antioxidant activity in the enriched drinks compared to the control. Their findings support the current research by demonstrating how plant based ingredients like banana and oat can enhance antioxidant properties contributing to the development of functional foods with improved health benefits.

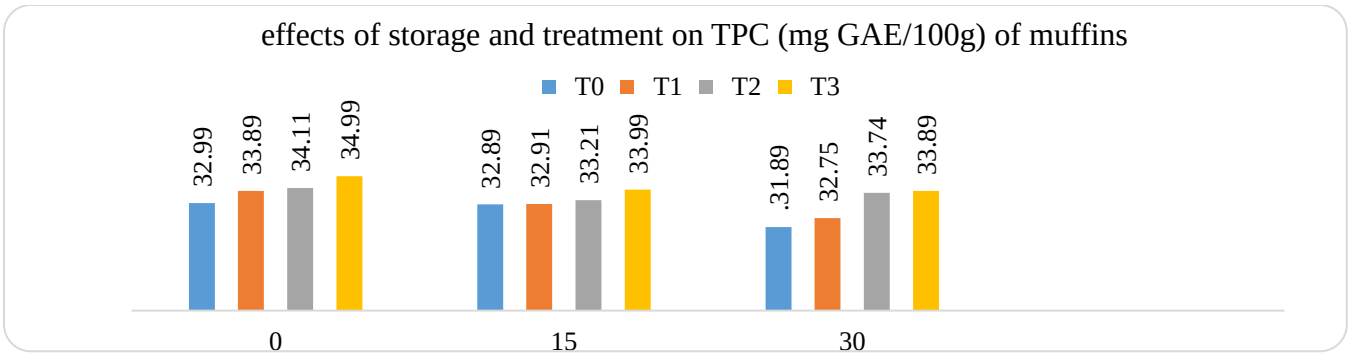


Figure 3: *Effects of storage and treatment on TPC (mg GAE/ 100 g) of muffins*

The Total Phenolic Content (TPC) of muffins with different treatments T_0, T_1, T_2, and T_3 over a 30 day storage period. At day 0, T_0, T_1, T_2 and T_3 values were 32.99±0.02, 33.89±0.03, 34.11±0.04 and 34.99±0.05 respectively. At day 15 values were 32.89±0.03, 32.91±0.01, 33.21±0.04 and 33.99±0.05 respectively. At day 30 values were 31.89±0.04, 32.75±0.05, 33.74±0.06 and 33.89±0.07 respectively. The present study findings are following Kupaeva et al. (2022) they investigated total phenolic content (TPC) of the oat based functional drink enriched with bananas, blueberries and elderberry powder was determined using the Folin Ciocalteu method. The analysis shows that the TPC of the experimental drink was 37.6 ± 0.04 mg GAE/L. The taste scores of muffins varied across treatments and storage durations. At day 0 T_0, T_1, T_2, T_3 recorded values were 4.12±0.15, 5.18±0.12, 6.59±0.15, 7.10±0.19 at day 15 were 3.99±0.16, 4.99±0.08, 6.12±0.12, 6.93±0.17 at day 30 were 3.21±0.11, 4.71±0.05, 5.21±0.11, 5.91±0.17 respectively. In the study by Harastani et al. (2021) they investigated the formulation of muffins using inulin and green banana flour (GBF) with a focus on physical, sensory, nutritional and shelf life characteristics.

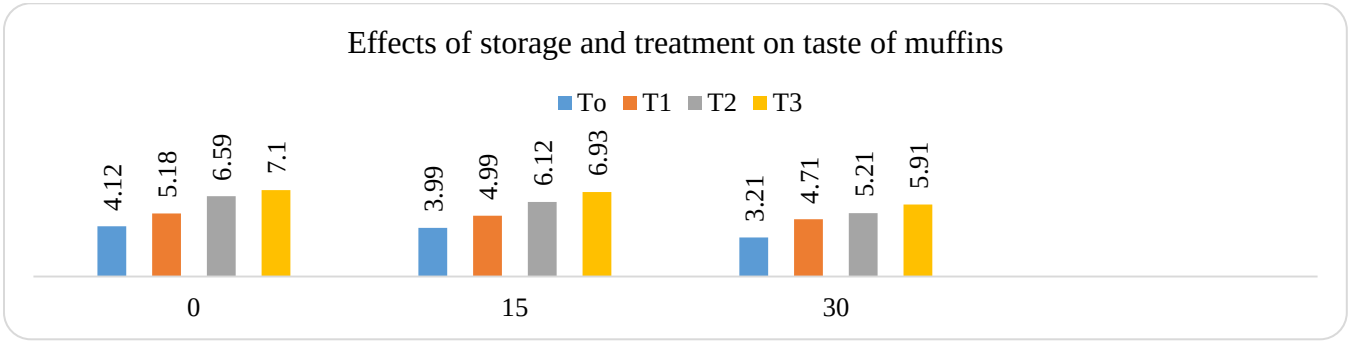


Figure 4: *Effects of storage and treatment on taste of muffins*

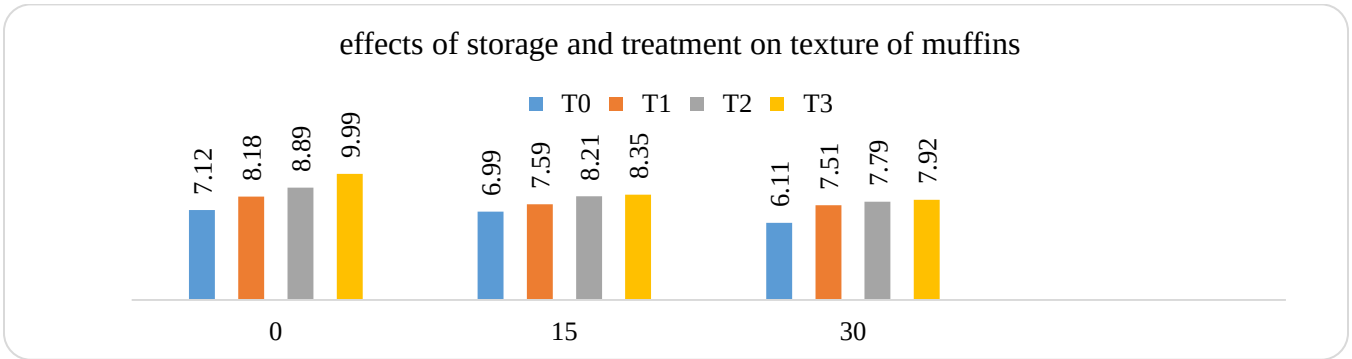


Figure 5: *Effects of storage and treatment on texture of muffins*

The study reported high taste scores with values reaching 9.91 ± 0.08 and found that the microbial quality and sensory attributes remained stable during storage indicating strong shelf life potential. These findings support the present study where muffins enriched with banana powder demonstrated sustained taste quality over a 30 day period particularly in treatments with higher banana content shows the effectiveness of banana based ingredients in enhancing both flavor and storage stability.

The effects of storage duration and treatment on the taste of muffins over the 30 day storage period. At day 0, texture values for T_0, T1, T_2 and T_3 were 7.12±0.09, 8.18±0.02, 8.89±0.05 and 9.99±0.09. At day 15 values were 6.99±0.06, 7.59±0.08, 8.21±0.02 and 8.35±0.07. At day 30, values were 6.11±0.01, 7.51±0.05, 7.79±0.01 and 7.92±0.04 respectively. In the study by Abotaleeb & Arafa, (2021) on gluten free cookies prepared from oat and unripe banana flour blends the sensory evaluation focused on assessing the texture of the cookies which was recorded 10.1. The results indicated that cookies containing 25% and 50% unripe banana flour (UBF) received the highest sensory scores suggesting that these cookies were more preferred and are supporting the current research.

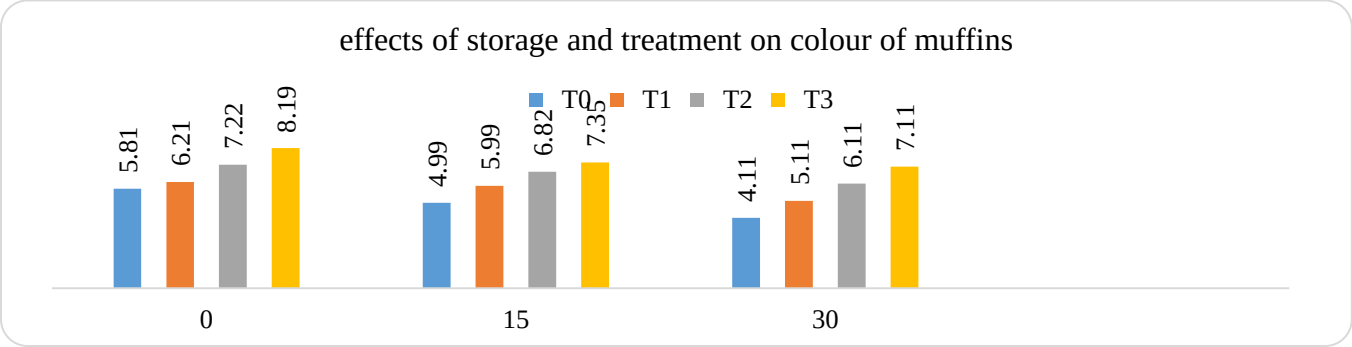


Figure 6: *Effects of storage and treatment on colour of muffins*

The effects of storage duration and different treatments on the colour of muffins. At day 0, T_0, T_1, T_2 and T_3 colour values were 5.81±0.09, 6.21±0.02, 7.22±0.05 and 8.19±0.09 respectively. At day 15, T_0, T_1, T_2 and T_3 colour values were 4.99±0.06, 5.99±0.08, 6.82±0.02 and 7.35±0.07 respectively. At day 30, T_0, T_1, T_2 and T_3 colour values were 4.11±0.01, 5.11±0.05, 6.11±0.01 and 7.11±0.04 respectively. In the study by Abotaleeb &Arafa. (2021) the sensory evaluation of gluten free cookies were made from oat and unripe banana flour blends found that cookies with a 25% to 50% blend of unripe banana flour (UBF) was most preferred. These cookies had the best overall sensory scores in terms of taste, texture and color. The recorded color values for these cookies were 7.91 ± 0.01 showing favorable color quality.

CONCLUSION

The present study emphasizes the potential health benefits of incorporating oat flour and banana powder into muffin formulations, particularly in relation to improving the nutritional profile, antioxidant activity, and sensory appeal of the product. The results showed that muffins with higher levels of crude fiber, protein, and antioxidants, all of which contribute to the overall health benefits. These muffins were not only nutritionally enriched but also exhibited better taste, texture, color and overall acceptability compared to the control group making them a viable alternative for individuals aiming to manage hypertension or improve their diet. T_3 showed the best overall performance in nutritional, functional and sensory evautlaion compared to the other treatments. The functional food approach demonstrated through this study supports the development of food products that not only address specific health concerns such as hypertension but also contribute to a balanced and nutritious diet. These findings underscore the importance of utilizing natural, whole food ingredients like banana powder and oat flour to create more health-conscious food options without compromising sensory qualities, ultimately promoting long-term wellness.

REFERENCES

Abotaleeb, H., & Arafa, R. M. (2021). Quality characteristics of gluten-free cookies prepared from oat and unripe banana flour blends. *Egyptian Journal of Food Science*, *49*(*2*), 187-198.

AOAC. 2016. Official Methods of Analysis. The association of official analytical chemists. Inc. *18th Ed. Arlington*, USA 1-48.

Ariyanti, A. I., Dwiyanti, H., & Prasetyo, T. J. (2022). Formulation of Food Bar Based on Banana, Oat, and Spinach Flour As a Source Fiber Snack for Dash Diet (Dietary Approaches To Stop Hypertension). *Journal of Global Nutrition*, *2*(1), 119-131.

Bakris, G., Ali, W., & Parati, G. (2019). ACC/AHA versus ESC/ESH on hypertension guidelines: JACC guideline comparison. *Journal of the American College of Cardiology*, 73(23), 3018-3026.

Baniya, B. (2022). Effect of avocado puree as fat replacer in the composite flour (wheat and oats) muffin (Doctoral dissertation, Department of Food Technology Central Campus of Technology Institute of Science and Technology Tribhuvan University, *Nepal* (2022).

Bashmil, Y. M., Ali, A., Bk, A., Dunshea, F. R., & Suleria, H. a. R. (2021). Screening and Characterization of Phenolic Compounds from Australian Grown Bananas and Their Antioxidant Capacity. *Antioxidants*, *10*(10), 15-21.

Chauhan, N., & Jethva, K. R. (2016). Drying characteristics of banana powder. *Indian Journal of Science*, *23(*77), 75-88.

Harastani, R., James, L. J., Ghosh, S., Rosenthal, A. J., & Woolley, E. (2021). Reformulation of muffins using inulin and green banana flour: physical, sensory, nutritional and shelf-life properties. *Foods*, 10(8), 18-83.

Hou, R. R. (2020). Investigation of nutritional content, texture analysis, and sensory evaluation of steamed cupcakes produced from gluten-free purple sweet potato flour. *Nutrition and Health 1*(1), 31-77.

Iqbal, M., Akram, M., Rashid, A., Zainab, R., Laila, U., Khalil, M. T., & Ibadi, A. K. (2023). Prevalence of hypertension and associated co-morbidities in Pakistan. *Mathews Journal of Nursing and Health Care*, 5(1), 1-7.

Irazola, V. E., Gutierrez, L., Bloomfield, G. S., Carrillo-Larco, R. M., Dorairaj, P., Gaziano, T., ... & Rubinstein, A. (2016). Hypertension prevalence, awareness, treatment, and control in selected communities of nine low-and middle income countries: results from the NHLBI/UHG Network of Centers of Excellence for Chronic Diseases. *Global heart*, 11(1), 4-7.

Kaur, K., Singh, G., & Singh, N. (2017). Development and evaluation of gluten free muffins utilizing green banana flour. *Bioved*, *28*(2), 359-365

Kupaeva, N. V., Ilina, M. A., Svetlichnaya, M. V., & Zubarev, Y. N. (2022). Study of the antioxidant potential of oat drinks enriched with plant components. *Food systems*, *5*(2), 157-163.

Li, X., Zhou, L., Yu, Y., Zhang, J., Wang, J., & Sun, B. (2022). The potential functions and mechanisms of oat on cancer prevention: a review. *Journal of Agricultural and Food Chemistry*, 70(46), 14588-14599.

Liska, D. J., Dioum, E., Chu, Y., & Mah, E. (2022). Narrative review on the effects of oat and sprouted oat components on blood pressure. *Nutrients*, 14(22), 47-72.

Mengstu, A., Bachheti, A., Abate, L., Bachheti, R. K., & Husen, A. (2021). Health-promoting benefits, value-added products, and other uses of banana. *Non-Timber Forest Products: Food, Healthcare and Industrial Applications*, 339-364.

Oluwajuyitan, T. D., Ijarotimi, O. S., & Fagbemi, T. N. (2021). Plantain based dough meal: nutritional property, antioxidant activity and dyslipidemia ameliorating potential in high-fat induced rats. *Clinical Phytoscience*, *7*, 1-1.

Panach, S. (2020). Total phenolic compounds of fruit and vegetable powders in Thailand. *Applied Mechanics and Materials*, *901*, 3-9.

Rafi, I. K., Sanyal, A., & Hoque, M. (2023). The Impact of Banana Consumption on Bangladeshi Rickshaw Pullers' Assessing Cholesterol, Liver and Blood Pressure Functions. *Middle East Res J Biological Sci*, 3(2), 24-28.

Sciammaro, L. P., Ferrero, C., & Puppo, M. C. (2018). Gluten-free baked muffins developed with Prosopis alba flour. *LWT*, 98, 568-576.

Shafi, S. T., & Shafi, T. (2017). A survey of hypertension prevalence, awareness, treatment, and control in health screening camps of rural central Punjab, Pakistan. *Journal of epidemiology and global health*, 7(2), 135-140.

Singh, A., Kumari, A., & Chauhan, A. K. (2022). Formulation and evaluation of novel functional snack bar with amaranth, rolled oat, and unripened banana peel powder. *Journal of Food Science and Technology*, *59*(9), 3511-3521.

Singh, Shikha, Ravi Shankar, and Gyan Prakash Singh. "Prevalence and Associated Risk Factors of Hypertension: A Cross-Sectional Study in Urban Varanasi." *International journal of hypertension* 2017, no. 1 (2017): 549-1838.

Zhou, S., Tong, L., & Liu, L. (2019). Oats. *Bioactive Factors and Processing Technology for Cereal Foods*, 185-206.