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Formulation and Quality Evaluation of Multigrain Bread Incorporated Grape Seed Powder

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Abstract

The aim of the study is to enrich multigrain bread with grape seed flour without affecting its sensory properties. The multigrain bread was prepared with different composite flours such as wheat flour, barley flour and grape seed powder according to the recipe. Products such as sugar, seeds (flax seeds, pumpkin seeds, chia seed), yeast are added to the composite flours. The prepared dough was kept in baking tray at 225ºC. The samples were taken into proportion, the highly acceptable treatment was Treatment 2 which has 35% (each of wheat and barley flours) and 15% of grape seed powder. Nutritional quality evaluation was conducted on the multigrain bread. The values were recorded for 100 grams showed energy value is 178.17kcal/100gm, for protein 9.63g, for fat 1.6g, for moisture 37.23%, fibre 25.03 %, for carbohydrate 35.22gm. Antioxidant was measured using DPPH scavenging showed 78%. Conclusion of this study that fortification was successfully carried out, this multigrain bread contains more diverse range of nutrients including vitamins, minerals and antioxidant contributes to improved digestion and helps to regulate blood sugar levels, making it a healthier choice for overall well-being.

Key words: Grape seeds, Dietary fibre, Antioxidant compounds, By-products, Healthy lifestyle

Many by-products rich in valuable compounds are produced by the food industry and can be useful for future uses, particularly as ingredients in functional foods. Because of the favorable effects on the environment, human health, and the profitability of the production process, this is a trend that is becoming more and more popular. Because consumers have good attitudes about these foods, there is a steady increase in the production of functional foods enhanced with by-products [8]. Grape pomace, a biological waste comprised of seeds, skins, stems, and leftover pulp, is produced in vast quantities during the winemaking process [2]. If not used appropriately, it creates significant environmental and financial problems [2]. Currently, waste-free technologies are being studied to find effective ways to employ byproducts as components for functional foods [6]. Grape pomace can be used for a variety of purposes, such as cattle feed, composting, or as a substrate for the manufacturing of flour and seed oil. The final two are made when the seeds are extracted from the grape pomace, the leftover residue is ground to make grape seed flour, and the oil is extracted by cold pressing [9].

India is a developing country with a large segment of population depending upon wheat, rice and maize as staple food which provide calories and proteins. Traditionally only wheat has been used as a whole wheat meal in production of chapattis, parathas and poori whereas refined flours find great application in manufacture of bakery foods like bread and cookies. It has been proved that regular consumption of single items affects health directly example: regular consumption of wheat causes lysine deficiency while gluten protein may be cause allergic reaction in some people. The multigrain snacks combine different grains, including wheat, oats, barley, maize, rice, flax, and others. They give snack makers the chance to create goods with unique looks, fresh colors and textures, and healthy nutritional profiles. Naturally, for multigrain products to provide the most nutritional benefits, they must be whole grains. They improve the texture and flavor of goods, and consumers easily embrace their health advantages. Products made from whole grains can help maintain a healthy digestive tract, aid with weight management, lower the risk of diabetes, lower the risk of heart failure, and lower the risk of colon cancer.

The three kinds of flax seeds are usually available: whole, ground, or powdered. The majority of the benefits associated with flax seeds are thought to be attributed to their high content of fiber, lignans, and alpha linolenic acids. Flax seeds are reported to have plenty of health benefits e.g. The most popular application for flax seeds is as a laxative. They can also be used to treat a number of ailments, including arthritis, lower cholesterol, and lower the risk of cancer. Given its importance in our daily nutrition, bread is a perfect example of a functional food. Across the world, bread is widely consumed in a variety of forms and quantities based on cultural customs. Typically, bread is created from dough made with wheat flour and yeast, which is then allowed to rise and baked in an oven. According to reports, multigrain breads are the healthiest option. Compared to other bread varieties, multigrain

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breads provide the diet with higher fiber. Additionally, multigrain breads supply the necessary amounts of pantothenic acids, calcium, iron, fiber, zinc, copper, phosphorus, potassium, riboflavin, and thiamine. Vitamin B from the multigrain bread aids in the conversion of food into energy [10].

Creating products with both good sensory qualities and health advantages is a new trend in the industry. People nowadays don't have enough time to prepare a healthy dinner because of the intense workload. In order to provide their bodies with the nutrients they need, people always favor rapid bits or fast food. in order to overcome such malnourishment issues. With all these nutrients included, it was believed that bread, in the form of composite flours and the idea of multigrain bread, might be used as a supplement. A mixture of wheat flours and non-wheat flours together is known as composite flours. The hue of grape seed flour is brown, and it smells pleasant. It is abundant in fiber, minerals, and phenolic components such phenolic acid, flavonoids, procyanidins, and resveratrol that lead to a strong antioxidant capacity [14].

Flavonoids' antioxidant activity is strongly associated with their ability to prevent and treat a number of fatal illnesses, including cancer, heart disease, and a number of skin conditions. Many fruits and vegetables have color due to pigmented flavonoids, but nature also contains a large number of colorless flavonoids. According to [7], flavonoids found in grape seeds have antibacterial and antioxidant properties that may help prevent or treat a variety of human illnesses. This millet has a great potential of being utilized in different food system by virtue of their nutritional quality and economic importance. There is an enormous scope of growing this crop to explore the technological possibilities and its utilization in development of healthy new food product [11].

The main objective of the study

- To formulate and standardize multigrain bread using different composite (grains and millets) flours incorporated with grape seed flour.
- To examine the physiochemical properties, organoleptic, proximate analysis and antioxidant analysis of the formulated product.
- To examine the microbial analysis and shelf life of the developed product.

MATERIALS AND METHODS

Procurement of raw ingredients

The raw ingredients like barley, wheat flour, yeast, grape seed powder, baking powder, flax seeds, pumpkin seeds, chia seeds, sugar were purchased from the Provisional store in Chennai, Tamil Nadu, India.

Preparation of multigrain bread incorporated with grape seed powder

Until they were utilized, the flours were kept apart in airtight plastic containers in a refrigerator. Shortening, crushed yeast, flax seeds, and sugar were added. Blended flours (wheat, oat, barley, maize, and rice) and flax seeds were used to make breads. Precise measurements were taken for the ingredients, and warm water (55°C) was used to activate the yeast. After combining all the ingredients in a container and measuring out the water, yeast was added. After that, the dough was put in an incubator set at 37°C to ferment. After 2.5 hours, the dough was removed and the excess gases were knocked back. After 30 minutes, the dough was taken out of the incubator and shaped into pans before being left to ferment for an additional 35 minutes. After that, the pans were baked for 30 to 35 minutes at 225°C. After being removed, the breads cooled down before being sliced. Room temperature was used to store the breads [10].

Fig 1 Multigrain bread incorporated with grape seed powder

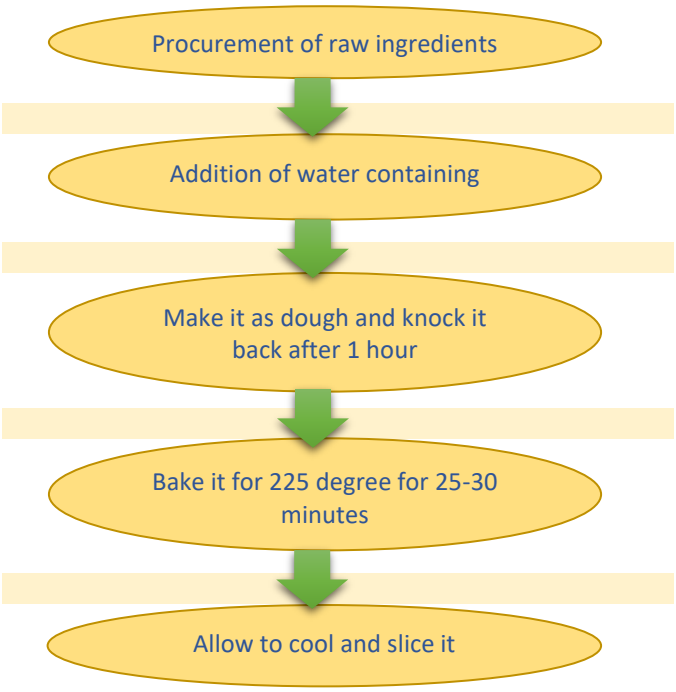

Fig 2 Flow chart of formulation of multigrain bread incorporated with grape seed (*Vitis vinifera*) powder

Organoleptic evaluation

The consumer acceptability of the developed multigrain bread was evaluated by 20 untrained panellists by determining the sensory characteristics of one control group and three treatment groups. The panellists ratings were recording through forms based on the multigrain bread's appearance, colour, texture, flavour. Taste and overall acceptability using 9- point hedonic scale.

Physiochemical properties analysis

Assessment of Physicochemical Analysis of multigrain bread's colour analysis, texture analysis, specifc volume, water activity, moisture.

Nutrient analysis

Energy, protein, moisture content, fat, carbohydrates, fiber, and ash are the nutrients evaluated in the proximate composition of Multigrain bread incorporated with grape seed

powder. DPPH and total phenol content analysis also been examined.

Microbial analysis

Assessment of Total Bacterial Count and Total Yeast and Mold Count were evaluated for the Multigrain bread incorporated with Grape seed powder. The highly accepted experimental sample was analyzed for total mesophilic (total viable bacterial counts) and fungi counts (yeast and mould counts) will be evaluated.

Shelf-life analysis

Following preparation, the loaves containing polyols and control were packaged using low density polyethylene and polypropylene. They were then kept at room temperature (30 ± 1 °C) and in a refrigerator (4–6 °C) for a period of 10 days. To evaluate the shelf life, periodic analyses for moisture, water activity, and free fatty acids were performed. The shelf-life analysis of Multigrain bread incorporated with grape seed powder was examined on the 7th, 15th, and 30th day.

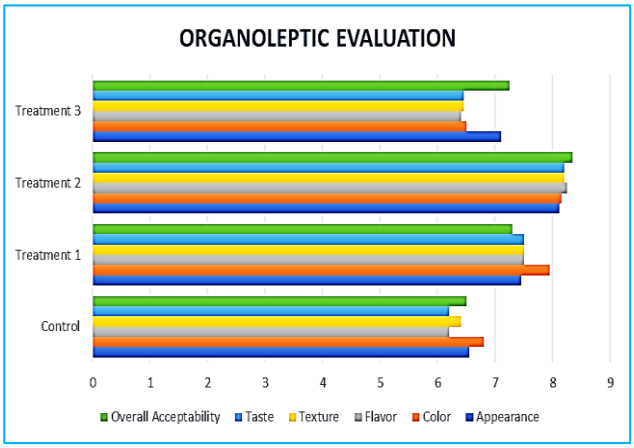

Fig 3 Mean score of organoleptic evaluation

RESULTS AND DISCUSSION

Organoleptic evaluation

The multigrain bread is organoleptically evaluated by a semi-trained panel of 20 judges from the Department of Home Science by using 9- point hedonic scale to judge the acceptability of the multigrain bread. Appearance, colour, flavour, texture, taste and overall acceptability of different proportions were considered for evaluation. Significantly, treatment 2 exhibited the highest mean scores of the other samples. The mean scores: colour (8.15±0.48), Texture (8.15±0.74), Appearance (8.12±0.52), Taste (8.2±0.52), Flavour (8.25±0.63), and Overall Acceptability (8.35±0.48).

Physicochemical properties of sorghum

Texture analysis

Hardness and fracturability were measured using the TA.XT.PLUS Texture Analyzer (Stable Micro Systems, Godalming, UK) to determine texture. The multigrain bread was divided into quarters, and various sample fragments were measured. The samples were positioned on the Circular Support Rig (A/CS), and penetration tests were 68 conducted around the mid-region of the sample using a 5-mm puncture probe (SMS P/5). The pre-test, test, and post-test speeds were set at 1.5 mm/s and 10.0 mm/s, respectively, while the probe penetrated samples to the nearest 5 mm [1]. The results showed that the texture analysis of hardness (9.73±0.22), gumminess (7.70 ±0.31), cohesiveness (0.89 ± 0.25). A Study [10] reported that hardness (10.87), gumminess (0.76), cohesiveness (0.43). The value differences are shown in the above statement.

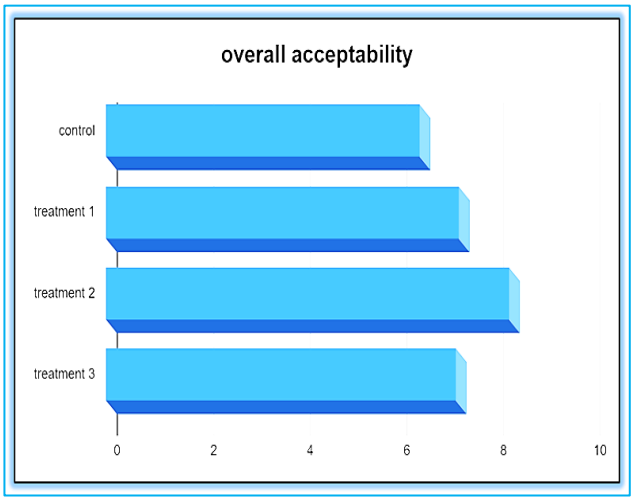

Fig 4 Mean score of overall acceptability

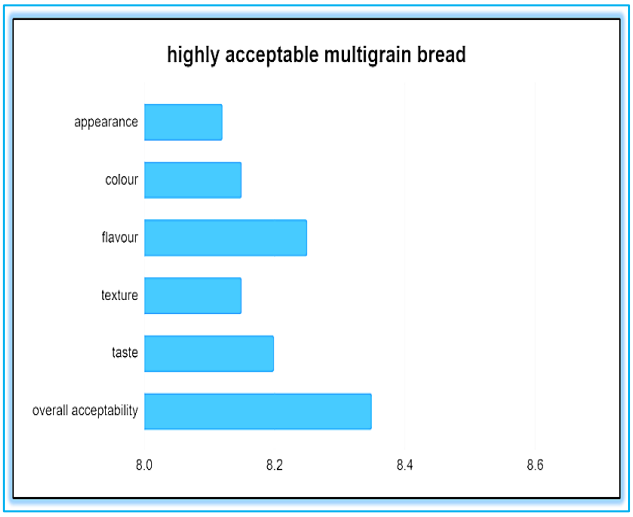

Fig 5 Mean score of highly acceptable treatment

Table 1 Variation table

Ingredients	C (gm/ml)	T1 (gm/ml)	T2 (gm/ml)	T3 (gm/ml)
Wheat flour	50	40	35	30
Grape seed flour	-	10	15	20
Barley flour	35	35	35	35
yeast	1	1	1	1
Baking powder	1	1	1	1
sugar	10	10	10	10
Seeds (flax seeds, pumpkin seeds, sesame seeds)	5	5	5	5

Colour analysis

Colour analysis of multigrain breads was done by using Hunter Lab colorimeter (model SM-3001476 micro sensors New York). The instrument was calibrated with user supplied black plate calibration standard that was used for zero setting, white calibration plates were used for white calibration settings. The instrument was placed at three different exposures at different places were conducted. Readings were displayed as L*, a* and b*colour parameters according to CIELAB system of colour measurement. The value of a* ranged from -100 (redness) to 100+ (greenness), the b* values ranged from -100 (blueness) to +100 (yellowness) while as L* value indicating the measure of lightness, ranged from 0 (black) to 100 (white) [10].

The multigrain bread was examined for colour analysis. The results shown was L (64.45), A (3.85), b (18.98). According to the study of [10] the value depicts that L (61.26), A (2.13), B (27.65).

Moisture

The moisture content of multigrain bread was analyzed. The results shown was 36.5%. A Study by [10] shown results as 38.00%.

Table 2 Values of nutrient analysis

Nutrients/100g	Control	Treatment 2
Energy	325.08±9.55	178.17±7.58
Protein	10.13±5.00	9.63±4.14
Fat	9.76±5.01	1.6±0.52
Carbohydrates	48.51±7.70	35.22±10.0
Fiber	17.18±10.0	25.03±10.0
Ash	7.40±2.50	5.64±4.077
Moisture	6.24±4.33	37.23±8.64

Nutrient analysis

The data in (Table 2) depicts the proximate composition of the Control group and the highly accepted experimental sample (Treatment 2). Nutrients like energy, protein, fat, carbohydrates, fibre and ash were analyzed and the results are discussed below:

The energy of the Treatment 2 sample was calculated to be 178.17±7.58 Kcal/100g. The energy of the control group was found to be 325.08±9.55 Kcal/100g. A study by [13] showed that the energy of gluten free muffins with grape seed powder was 325.08±9.55 Kcal/100g. This clearly shows that calorie is less in treatment 2 when compared with control group. The protein content of the Treatment 2 was found to be 9.63±4.14 g/100g. The Control group's protein content was measured to be 10.13±5.00 g/100g. A study by *[13]* showed that the protein content of multigrain bread made with cassava flour, rice flour, corn flour, grape seed flour was found to be 3 g/100g. It is evident that the fat content of the control group was found to be 9.76±5.01 g/100g, which was higher when compared to the Treatment 2 multigrain bread. The Fat content of the Treatment 2 was measured to be 1.3±0.52 g/100g. A study by [13] revealed that muffins contain about 9.57±0.80 g/100g of fat. The carbohydrate content of the Treatment 2 was found to be 35.22±10.0 g/100g which was lower than the control group. The Control group's carbohydrate content was found to be 48.51±7.70 g/100g. The incorporation of the cereals was the reason behind the increased carbohydrate content of Treatment 2 multigrain bread. A study by *[13]* stated that commercial multigrain bread contains up to 40.09±2.94g/100g of carbohydrates. The fibre content of the control group and Treatment 2 was found to be 17.18±10.0 g/100g and 25.03±10.0g/100g respectively.

The fibre content was higher in Treatment 2 of multigrain bread when compared with the control group. This was due to the addition of the grape seed flour and cereal based flours. A study by, *[13]* stated that the muffins prepared with grape seed flour contained about of 23.11±1.64 g/100 carbohydrates. The Ash content of Treatment 2 multigrain bread was lesser than the control group. The ash content of Treatment 2 was found to be 5.64±4.077%/100g whereas the ash content of the control group was measured to be 7.40±2.50 %/100g

Table 3 Shelf life of the formulated product

Interval	Total bacterial count x 10^4 cfu/gm	Yeast and Mold10^4 cfu/gm
7^{th} day	15	nil
15^{th} day	25	nil
30^{th} day	40	nil

DPPH activity

The Functional properties such as Antioxidant properties and total phenol of the formulated product were examined. The Antioxidant Analysis of the Highly Accepted Experimental Sample (treatment 2), the results shown as the antioxidant content of the treatment 2 was 78µg. A study by [1] states that the Antioxidant activity of waffles was 65.66%.

Total phenol content

Phenols are phytochemicals or bioactive substances that have been researched for a long time because of their potential to treat or prevent a variety of illnesses in humans. Phytochemicals produce antioxidant properties. Research has shown that phenol shields against dangerous diseases including heart disease and cancer. Reactive oxygen species-induced oxidative stress exacerbates the pathophysiology of neurological disorders, atherosclerosis, and neoplasia. Treatment 2 was analyzed for its Total Phenol content which was found to be 3.14 mg/g. The total phenolic content was 5.58 mg/g for the waffles which was reported by [1].

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Microbial analysis

In this research study, the microbial analysis includes the total bacterial count and total yeast and mold count of the control and Treatment-2 was discussed below:

The Total Bacterial Count of Treatment 2 was measured to be 1.5×10^5 CFU/g, when the maximum permitted is 200,000 to 300,000 UFC/g mL-1 according to NTC 267 (NTC 2007). TYMC, or total yeast and mold count, is the number of colony-forming units present per gram of product (CFU/g). A colony-forming is the scientific means of counting and reporting the population of live bacteria or yeast and mold in a product. There was no growth of yeast and mould recorded in Treatment 2.

Shelf-life analysis

The data in (Table 3) depicts the shelf life of Treatment 2 which is stored on the 7 th day is $15x10^4$, on the 15th is 25 $x10^4$, and on the 30th is 40 $x10^4$ days. There is no growth of yeast mold on the 7th, 15th, and 30th day.

CONCLUSION

In conclusion, the incorporation of grape seed powder into multigrain bread offers a promising avenue for enhancing

both nutritional value and health benefits. Through this fusion, consumers can enjoy a delicious bread option that not only provides essential nutrients from a variety of grains but also harnesses the antioxidant properties of grape seeds. The potential health advantages, including cardiovascular support and inflammation reduction, make this innovative bread a favourable choice for those seeking to optimize their diet. Moreover, the integration of grape seed powder into multigrain bread presents an opportunity for diversification in the bakery industry, catering to the increasing demand for functional foods. As research continues to uncover the numerous benefits of incorporating natural ingredients like grape seed powder into everyday foods, this trend holds promise for both consumers and food manufacturers alike.

LITERATURE CITED

1. Antonic, Bojan & Dordević, Dani & Dordevic, Simona & Holeckova, Denisa & Tremlová, Bohuslava & Kulawik, Piotr. (2021). Effect of Grape Seed Flour on the Antioxidant Profile, Textural and Sensory Properties of Waffles. Processes. 9. 131. 10.3390/pr9010131.
2. Balbinoti, T.C.V.; Stafussa, A.P.; Haminiuk, C.W.I.; Maciel, G.M.; Sassaki, G.L.; de Matos Jorge, L.M.; Jorge, R.M.M. Addition of grape pomace in the hydration step of parboiling increases the antioxidant properties of rice. Inter. J. Food Sci. Technol. 2019, 55, 2370–2380. [Google Scholar] [CrossRef].
3. Bender, A.B.B.; Speroni, C.S.; Moro, K.I.B.; Morisso, F.D.P.; dos Santos, D.R.; da Silva, L.P.; Penna, N.G. Effects of micronization on dietary fiber composition, physicochemical properties, phenolic compounds, and antioxidant capacity of grape pomace and its dietary fiber concentrate. *LWT-Food Sci. Technol.* 2020, *117*, 108652. [Google Scholar] [CrossRef].
4. Dwyer, K.; Hosseinian, F.; Rod, M.R. The market potential of grape waste alternatives. J. Food Res. 2014, 3, 91. [Google Scholar] [CrossRef]
5. Ghosh, Jai & Jog, Riddhi. (2017). Nutrition and Toxicogenomics: A short Review. Nutrition and Toxicology. 3. 300-304.
6. Gorodyska, O.; Grevtseva, N.; Samokhvalova, O.; Gubsky, S.; Gavrish, T.; Denisenko, S.; Grigorenko, A. Influence of grape seeds powder on preservation of fats in confectionary glaze. East.-Eur. J. Enterpr. Technol. 2018, 6, 36–43. [Google Scholar] [CrossRef] [Green Version]
7. Harborne JB, Williams CA. Advances in flavonoid research since 1992. Phytochemistry. 2000 Nov;55(6):481-504. doi: 10.1016/s0031-9422(00)00235-1. PMID: 11130659.
8. Helkar, P.B.; Sahoo, A.K.; Patil, N.J. Review: Food industry by-products used as a functional food ingredients. *Int. J. Waste Resour.* 2016, *6*, 1–6. [Google Scholar].
9. Lutterodt, H.; Slavin, M.; Whent, M.; Turner, E.; Yu, L.L. Fatty acid composition, oxidative stability, antioxidant and antiproliferative properties of selected cold-pressed grape seed oils and flours. Food Chem. 2011, 128, 391–399. [Google Scholar] [CrossRef]
10. Malik et al., J Food Process Technol 2015, 7:1 DOI: 10.4172/2157-7110.100054.
11. Rajni Devi, Richa Thakur and M.K. GuptaIsolation and Molecular Characterization of Bacterial Strains with Antifungal Activity from Termite Mound Soil Int.J.Curr.Microbiol.App.Sci.2018.7(4): 1-7 DOI: https://doi.org/10.20546/ijcmas.2018.704.001
12. Shi, J.; Nawaz, H.; Pohorly, J.; Mittal, G.; Kakuda, Y.; Jiang, Y. Extraction of polyphenolics from plant material for functional foods—Engineering and technology. Food Rev. Inter. 2005, 21, 139–166. [Google Scholar] [CrossRef]
13. Yanina Baldán, Rosa Rodriguez, Mathías Riveros, María Paula Fabani 2021.,Grape pomace powder valorization: a novel ingredients to improve the nutritionally quality of gluten-free muffins.
14. Yu, J.; Ahmedna, M. Functional components of grape pomace: Their composition, biological properties and potential applications. Inter. J. Food Sci. Technol. 2013, 48, 221–237. [Google Scholar] [CrossRef]