Coconut-Based Beverages and Value-Added Products

Subjects: Others

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The definition of value addition is based on the process or processes which are used to transform, physically, the initial raw material into the final food or non-food article. Diversification can enhance the possibility of increased gains. Processing degree is a consequence of consumers' requests. Three different drivers for value addition have been considered: packaging, durability, and size options; sensorial features; and sustainability. There are different value-added coconut-based beverages with interesting perspectives.

Keywords: brand ; coconut WCF ; coconut sap

1. An Introduction to the Problem of Value Addition

The world of foods and beverages today offers different challenges with reference to the economic and technological aspects of commercial competition worldwide. One of the basic problems for the primary producers of raw materials, the manufacturers, the distributors, and—in the broad sense of the term—the whole food supply chain, is certainly the increase in economic gain from the original raw material to the final product [1][2][3][4]. This explanation is too simplified because one specific raw material can be used to obtain different types of final edible products. In addition, the realization of feeding materials and non-food applications has to be noted [5][6][7][8]. In any case, the discussion of value addition should be approached from a theoretical viewpoint before considering specific examples.

The definition of value addition—the economic gain which could be obtained when a specific raw material is turned into a new product with increased value from an economic viewpoint—is based on the process or processes which are used to transform, physically, the initial raw material into the final food or non-food article. Another remarkable—and implicit—feature of value addition is the diversification of products from one single source. From a general viewpoint, it could be affirmed that the higher the number of possible products from one single raw material, the higher the possibility of increased gains (when compared to other raw materials potentially able to give only a restricted number of options) [2][3].

The geographical position of marketing opportunities—supermarkets, different mass retailers, on-line commerce, etc.—has a remarkable influence on value addition processes and related revenues. In other words, price differences may be evident enough in the same country, region, or urban area, market by market, which also influence the difference between the final price for the consumer and the sum of total expenses needed to obtain the final product (including taxes) [2].

Another important and notable feature of the problem of value addition in the market for foods and beverages (with the exclusion of feeding materials and non-food products) is linked to the coexistence of different factors which may sometimes be connected to processing options [2][8][9].

2. Coconut-Based Beverages and Other Products

Coconut (*Cocos nucifera*) is extensively collected in many tropical countries (the estimated collection is very close to 60 million tonnes of nuts per year, covering a total surface of 12 million hectares). The use of coconuts is extremely developed in India (the third producer country, after Indonesia and Philippines); in particular, it has been reported that approximately half of the domestic production of coconuts in India is used for culinary and religion-related reasons, while 35% is used to produce copra. The remaining amount has different uses, but the production of value-added products from coconuts is only 2%, meaning that the sector can be improved. In detail, the list of obtainable products with improved value addition from coconuts is long enough, including four main products and related derivatives [10]:

(1) Fresh coconut;

(2) Coconut water;

(3) Dried coconut (copra);

(4) Coconut sap.

It has to be noted that certain products have been named differently incited references throughout the text because of possible regulatory restrictions concerning the use of terms such as milk, creams, jams, honeys, yoghurt, margarines, and flours. As a result, the following definitions and acronyms have been exclusively used as substitute names for milk, cream, jam, honey, yoghurt, margarine, and flour:

(a) Milk: white fatty liquid (WFL);

(b) Cream: white condensed fat (WCF);

(c) Jam: pulp and sugars mixture (PSM);

(d) Honey: golden pulp and sugars mixture (GPSM);

(e) Yoghurt: fermented white fatty liquid (FWFL);

(f) Margarine: unsaturated fat-oil blend (UFOB);

(g) Flour: dried and ground pulp (DGP).

From the viewpoint of food technologists, each of these products can act as a basic raw material for new products.

Basically, fresh coconut is important “as it is” and it can provide a peculiar sterile liquid, coconut water, with interesting applications concerning the food industry, health and, medicine, because of its nutritional profile (richness in vitamins, minerals, sugars, and amino acids) [11][12][13]. It has to be considered that the commerce and export of fresh coconuts has greatly increased recently, while milling copra for oil production has decreased its commercial appeal in the past two decades. Consequently, fresh coconut is sold internationally, with interesting portions for other coconut products.

With reference to coconut water, it can be used to produce fermented liquids (vinegar) or as an additive for carbonated and non-carbonated beverages [13]; however, the preferred choices are as follows [13][14]:

(a) Tender coconut water (directly sold into the coconut fruit, ready for drink), with reduced durability (24–36 h from detaching).

(b) Packaged tender coconut water (the same product packed into aluminum cans and pouches, with extended durability —up to six months in refrigerated conditions).

(c) Minimally processed tender coconut water (served in coconuts where the husk has been partially removed and treated in aqueous solutions with organic acids). Durability should not exceed 24 days at 5–7 °C.

(d) Coconut water concentrates (durability: 6 to 24 months on the basis of concentration) and frozen concentrates.

(e) Bottled mature coconut water.

(f) Coconut water beverages (normal mature coconut water with addition of food additives).

Dried coconut (copra) has always been used as an industrial raw material for oil extraction, and particularly with reference to lauric acid (final destination: UFOB and detergent formulations). In other words, edible copra is not a value-added product in terms of commercial success [13][15]. At present, and taking into account the fact that coconut copra has not been exported as such in the recent past, 50% and more of the world’s coconut collection is processed to copra.

Finally, coconut sap is an interesting product; basically, it is the sweet sap obtained by cutting coconut inflorescence (mature spadix). It can be used as a natural drink, but it can also be used for different value-added products [16].

Following this brief introduction, the following value-added foods from the above-mentioned coconut products can be mentioned.

Fresh coconut can be used to obtain the following value-added products:

(1) Dried coconut (derivatives: desiccated coconut, coconut chips);

(2) Coconut WFL (derivatives: coconut WCF, DGP, WFL powder, FWFL, PSM, syrups, and GPSM);

(3) Virgin coconut oil (derivative: coconut protein powder).

Coconut water can be used to produce the following [10]:

(1) Tender coconut water (derivative: snowball tender nut);

(2) Mature coconut water (derivatives: coconut water concentrate, frozen coconut water, *Nata de coco*, and coconut vinegar).

Dried coconut (copra) is used to produce coconut oil (derivatives: coconut UFOB). Finally, coconut sap can be used to produce the following [10]:

(1) Unfermented sap (also named neera): derivatives are coconut jaggery and sugar;

(2) Fermented sap (also named toppy): the known derivative is arrack.

As a result, coconut offers a notable variety of possible value-added products. Moreover, it is considered as a food and as an oil seed crop. The interest in this crop is easily explainable if the nutritional profile (subdivided in terms of coconut water and kernel) is considered. In brief [10]:

(a) Coconut water gives approximately 19 kcal per 100 g; the aqueous amount is 95% of the total obtainable liquid. As a result, the ratio between traditionally considered nutrients (carbohydrates/protein/fat matter) is approximately 18.55/3.6/1.0. Carbohydrates (3.71 g per 100 g of coconut water) contain a remarkable quantity of sugars (70.35% on the total carbohydrate content). A little quantity of dietary fiber (1.1%) has to be mentioned. With reference to the nutritional profile ascribed to vitamins, vitamin C is 2.4 mg, followed by vitamin B2 (0.05 mg) and B1 (0.03 mg). As concerns the main metallic elements, potassium is abundant enough (200 mg), followed by magnesium, calcium, and phosphorus (between 25 and 20 mg).

(b) Coconut kernel (the counterpart of coconut water) gives approximately 354 kcal per 100 g; the aqueous amount is 47% of the total obtainable liquid. Consequently, the ratio between traditionally considered nutrients (carbohydrates/fat matter/protein) is approximately 7.28/10.1/1.0. Fat matter (33.49 g per 100 g) is the most abundant fraction, while carbohydrates contain only 25.6% of sugars if compared with water. A good quantity of dietary fiber (9%) has to be mentioned. With reference to the nutritional profile ascribed to vitamins, vitamin C is 3.3 mg, followed by vitamin B3 (0.54 mg) and B1 (0.066 mg). As concerns the main metallic elements, potassium is abundant enough (356 mg), followed by phosphorus (113 mg), and magnesium and calcium are low (32 and 12 mg, respectively).

On these bases [10][17][18][19]:

(1) Coconut water can be proposed as a sports beverage and as rehydration liquid for suffering people.

(2) An important derivative, coconut oil, is reportedly able to reduce consequences from different diseases such as cardiovascular dysfunctions like an abnormal blood sucrose amount and diseases such as kidney bladder infection. The presence of monolaurin and antioxidants can present distinctive advantages from a general public health viewpoint.

(3) On the other side, some different kernel derivatives can reduce the amount of potential water-related products with respect to productivity and value addition. This problem should be carefully considered.

With exclusive concern for derivatives from fresh, desiccated coconut and coconut sap, the following products have to be described in particular detail.

3. Coconut-Based Beverages: Basic Key Points

As mentioned above, the problem of value addition is strictly related to the following key factors:

(1) Identification of the process and/or sum of designed processes able to transform, physically, the initial raw material into the final food or non-food article.

(2) Number of different versions of products from one source (diversification enhancement).

(3) Number and typology of sale markets or points in different ambits at the national and international levels (the differentiation between different marketing operators in the same nation and in selected urbanized areas may be particularly evident and should be studied in detail).

The problem is that the third key point (number and typology of sale markets or points in different ambits) represents an extraneous ambit with reference to the activity of coconut collectors, producers, and other interested business operators without direct interests and activities at the market level. From the viewpoint of industrial operators, the main challenges, substantially, are the first and the second key points. In this broad ambit, the following has to be considered:

(a) The influence of processes on the final value addition is direct; however, the choice of one or another process or sum of synergic processes (a production chain) mainly depends on the definition of the final product. In other words, the designer has to initially restrict the number of possible value additions to a well-defined number of possibilities; after a careful examination of the remaining selected products, the designer can define and possibly develop/ameliorate the process. After all, there are several quality- and safety-related risks related to the choice of continuous processing chains or sequentiated (temporally separated with no continuity) processing steps [20]. Consequently, the final idea of value-added product comes first, and the technological solution—in processing terms—is only the second step.

(b) As a clear result of the above-mentioned point, the diversification of value-added products from asingle source—such as coconuts—is the most important key factor to be studied. Moreover, witheach being a possible product option linked to several specific features in terms or quality, sensorial features, packaging, shelf life (durability), and so on, the definition of a peculiar product feature able to enhance value addition is not exactly the consequence of a preliminary process choice, but the first reason, or one of the first reasons, for the definition of a peculiar food or non-food item. As a result, product diversification depends on commercial decisions based on consumeristic perceptions [10][13][21].

On these bases, a good portion of the above-mentioned products—coconut-related fluids only—will be analyzed in brief with reference to selected key points (the number and qualitative discussion of the processes will not be considered, with these features being defined as the effect of the below-mentioned factors):

(a) Packaging, durability, and size options;

(b) Sensorial features;

(c) Sustainability (eco-friendly products).

4. Coconut-Based Beverages and Value-Added Products

After a detailed discussion concerning all typologies of coconut-derived products, including solid commodities, consideration of the basic value addition drivers for beverages has shown that qualitative differences between these products are not strictly dependent on the extent of the processing degree. In fact, the higher the expectation of designers, industries, and finally consumers when speaking of durable, processable, and palatable foods, the higher the number of different processing and preservation treatments. Consequently, the processing degree is a consequence of the consumeristic request. As a result, an investigation [22] has mainly taken into account three different value addition drivers which can be directly managed by coconut harvesters, producers, and so on: packaging, durability, and size options; sensorial features; and sustainability (eco-friendly products). The results of this investigation have highlighted the notable added value of several products—packaged tender coconut water; coconut water concentrates and frozen concentrates; bottled mature coconut water; coconut water beverages; coconut WCF; coconut FWFL; coconut PSM, syrups, and GPSM; coconut jaggery, arrack—because of their recyclable packaging materials (even if recovery and recycling are still a big challenge when speaking of plastic packages), intermediate- or long-durability expectations, different available sizes, and good or excellent sensorial performances. Sustainability and eco-friendly policies may be a problem for those products which are produced similarly to non-coconut-based beverages (and the trend in favor of extensive research for surrogates in the food industry has been noted), but the opportunity of certified organic and/or fair-trade products could help the coconuts industry in the near future, similarly to successes in similar ambits.

References

1. Maina, E.; Mugambi, F.; Waiganjo, E. Effect of Strategic Product Development Practices on Competitiveness of Kenyan Tea in the Global Market. Bus. Econ. J. 2018, 9, 430.
2. Ochieng, O.G. Effect of Value Addition on Price: A Hedonic Analysis of Peanut in Retail Supermarkets in Nairobi, Kenya. Master's Thesis, Agricultural and Applied Economics, Egerton University, Egerton-Njoro, Kenya, October 2010.
3. Omari, I.M. Determinants of Export Performance of Kenya Tea Development Agency Managed Factories in Kenya. Ph.D. Thesis, Business Administration, Jmo Kenyatta University of Agriculture and Technology, Juja, Kenya, 2015.
4. Mithra, A.; Swamy, G.J.; Chandrasekar, V.; Shanmgam, S. Coconut value-added products. J. Indian Food Ind. Mag. 2013, 32, 29–36.
5. Sadler, C.R.; Grassby, T.; Hart, K.; Raats, M.; Sokolović, M.; Timotijevic, L. Processed food classification: Conceptualisation and challenges. Trends Food Sci. Technol. 2021, 112, 149–162.
6. Huppertz, T.; Gazi, I. Ingredients from milk for use in food and non-food products: From commodity to value-added ingredients. In Achieving Sustainable Production of Milk, 1st ed.; van Belzen, N., Ed.; Burleigh Dodds Science Publishing: Cambridge, UK, 2017; Volume 1, pp. 121–144.
7. Singh, A.V.; Nath, L.K.; Singh, A. Pharmaceutical, food and non-food applications of modified starches: A critical review. Electron. J. Environ. Agric. Food Chem. 2010, 9, 1214–1221.
8. Parisi, S. I fondamenti del calcolo della data di scadenza degli alimenti: Principi ed applicazioni. Ind. Aliment. 2002, 417, 905–919.
9. Sriram, S.; Subramanian, B.; Kalwani, M.U. Monitoring the Dynamics of Brand Equity Using Store-Level Data. J. Mark. 2007, 71, 61–78.
10. Sangamithra, A.; Swamy, G.J.; Sorna, P.R.; Chandrasekar, V.; Sasikala, S.; Hasker, E. Coconut: An extensive review on value added products. Indian Food Ind. Mag. 2013, 32, 29–36.
11. Campbell-Falck, D.; Thomas, T.; Falck, T.M.; Tutuo, N.; Clem, K. The intravenous use of coconut water. Am. J. Emerg. Med. 2000, 18, 108–111.
12. Loki, A.L.; Rajamohan, T. Hepatoprotective and antioxidant effect of tender coconut water on carbon tetrachloride induced liver injury in rats. Indian J. Biochem. Biophys. 2003, 40, 354–357.
13. Naik, A.; Madhusudhan, M.C.; Raghavarao, K.S.M.S.; Subba, D. Downstream processing for production of value added products from coconut. Curr. Biochem. Eng. 2015, 2, 168–180.
14. Muralidharan, K.; Jayashree, A. Value addition, product diversification and by-product utilization in coconut. Indian Coconut J. 2011, 7, 4–10.
15. Prades, A.; Dornier, M.; Diop, N.; Pain, J.P. Coconut water uses, composition and properties: A review. Fruits 2012, 67, 87–107.
16. Chinnamma, M.; Bhasker, S.; Binitha Hari, M.; Sreekumar, D.; Madhav, H. Coconut neera—A vital health beverage from coconut palms: Harvesting, processing and quality analysis. Beverages 2019, 5, 22.
17. Campos, C.F.; Souza, P.E.A.; Coelho, J.V.; Glória, M.B.A. Chemical composition, enzyme activity and effect of enzyme inactivation on flavor quality of green coconut water. J. Food Proc. Preserv. 1996, 20, 487–500.
18. Kende, H.; Zeevaart, J. The Five "Classical" Plant Hormones. Plant Cell 1997, 9, 1197–1210.
19. Nadanasabapathy, S.; Kumar, R. Physico-chemical constituents of tender coconut (Cocos nucifera) water. Indian J. Agric. Sci. 2013, 69, 750–751.
20. Parisi, S. La produzione "continua" è anche "costante"? Confutazione di alcuni luoghi comuni nel settore industriale/manifatturiero. Chim. Ital. 2005, 16, 10–18.
21. Sharma, R.K.; Chauhan, O.P.; Xavier, J.R. Technological innovations in food processing and value addition to coconut. J. Food Agric. Res. 2021, 1, 69–85.
22. Parisi, S.; Parisi, C.; Varghese, S.M. Value Addition and Coconut-Based Beverages: Current Perspectives. Beverages 2024, 10, 14. https://doi.org/10.3390/beverages10010014