

3 Dimensional Food Printing: How this Pioneering Technology will Change the Way We Eat

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ABSTRACT

With the advancing technology and growing population the urge to feed this population is increasing rapidly. 3 Dimensional Food Printing technique offers a wide range of potential benefits. The food prepared can be customized in shape, size, texture and even in nutrition, which makes this advanced technology a need for this generation. Since long time, hand-made skills were required for food customization and even for creative designs, but now this technology can overcome this problem with low cost and high production rate. In this review, we have discussed the two food printers (Foodini and Choc Creator V2.0 Plus) which are presently used in some parts of the world. Along with this, the advantages, health benefits and future of this technology has also been discussed. As this technology is still advancing therefore it may take a few more years to be accepted and applied globally.

1. Introduction

In 1980, relatively a new technology was introduced: 'The Three Dimensional' printing which is also known as 'additive manufacturing' (Paphakorn, 2018). This idea came into consideration and thereafter, NASA began researching on the same, in the year 2006 (Carlota, 2019). 3D Food printing is one of the most recent and emerging technologies in the past few years and is also known as 'Food Layered Manufacturing' (Chaofan et al., 2019; Jie et al., 2015). As the technology is advancing day by day, various pastes and materials are used in 3D Food printing so as to prepare various mouth watering cuisines around the globe. All this seems as if we are getting more closer to the science-fiction notion. The foremost aim of 3D printed foods is to make life of astronauts more pleasing and to bring it to an ease, along with this it will be beneficial for people belonging to older age category who face difficulty in swallowing and chewing (Joanna et al., 2016 and Carlota, 2019). With the aid of this novel technology, even edible insects will be brought under the banner of cuisines, as insects are superbly nutritious, produce less greenhouse gases, environmentally friendly and even consume less water (Carlota, 2019). 3D printed foods even offer new plausibilities such as convoluted designs, automated cooking and many more along with the prospectus of alteration, efficiency and personalization. Healthy foods with new sensory properties and varying tastes could be prepared so as to appeal the

consumers (Paphakorn, 2018; Kathy Groves and Rhys Watkins, 2018).

As this technology is entirely different from various robotics based food manufacturing technologies, therefore the foremost challenge now is precision of the structure and stability of shape. As this technology is developing, therefore it's important for us to acknowledge its basic utility and the applications, so as to reduce the cost of manufacturing and to increase production efficiency (Chaofan et al., 2019; Jie et al., 2015). The work is still in progress and even the researchers interested in the particular aspect are increasing, as the novel printed products with accurate consistency and alluring designs that mimic the traditional meat could be a solution to this drastically increasing population. Hence, some further development in this field is required so as to introduce this innovative technology to popularization (Joanna et al., 2016).

2. Types of Printers available in Market

1) Foodini

The Foodini is a 3d food printer manufactured by natural machines, a manufacturer from Spain. Lynettekucksma, chief marketing manager quoted that vying with the world class chefs is not something foodini is looking for, as it includes both professional and non-professional users. Foodini is a beast of kitchen, earlier how the microwave did it (Renata Franco, 2014).





(A 3D printed food from foodini)

• **How does Foodini works?**

The foodini 3D printer works with a capsule system and is absolutely open. This makes printer more interesting as users can load fresh materials into the capsule (food materials must be in the form of paste either raw or cooked) (aniwaa contributors,2019). Foodini comes with five steel capsules, which pushes food down through the nozzle and prints food with several ingredients. A fine operating system moves the capsule in a precise way, fabricating shapes which then can be piled layer upon layer which makes them appealing 3 dimensional creations. Foodini has built in touch screen in which operators can choose recipes they want to print followed by inserting the ingredients and select to print. It comprise a 3d scanner which enables it to print different shapes, this customization made foodini alluring (Katy Askew,2017).

Foodini managed to hasten tasks that are arduous to do by hand such as forming a dough, creating chocolate

sculptures, preparing ravioli. Foodini creators managed to print bread sticks to ravioli, chocolate vases, burgers, cookies, pizza. Here comes the question, how much time does foodini takes to print? The print time seemingly varies, tangled chocolate creations take 2 hours while a simple plate decorations, crackers will take a few minutes to print. The exhilarating attribute of foodini is its potential to print with a broad range of fresh ingredients and even the operators are given liberty to fabricate their foods by giving an unbolted capsule system.

2) Choc Creator V2.0 Plus

Choc creator V2.0 plus is a 3d food printer which is competent of printing chocolates, manufactured by choc edge, a producer from UK. This printer is mostly picked by confectionary industries.(aniwaa contributors,2019). Choc creator V2.0 plus is an upgraded version of the CCV1 and CCV2, which were discontinued earlier(Choc edge,2020)



(3D printed chocolates from Choc Creator)

• **The Tech behind Choc Creator V2.0 Plus:**

Choc creator comes with a syringe loading system, operators load the tempered chocolate into a 30ml syringe, which then is inserted into the printer. The user interface is more uncomplicated, which involves transforming an idea for a piece of chocolate art into a 3D model (it should be done manually using CAD software) and then converting the 3D model into an instruction code for the Choc Creator V2.0 Plus to read. The code is generated by a computer program called a 'slicer', which slices a 3D model into layers and writes the printing instructions for each of these layers. Once the code is ready, it can be loaded into the Choc Creator V2.0 Plus and the object will be printed layer-by-layer. By slicing STL models into G-codes using ChocPrint, 2D, 2.5D and 3D designs can be printed. It comes with an 5"lcd touch screen which makes its display interface more convenient (choc edge,2020). It is capable of printing personalized chocolate bars, customized chocolate art, cake decorations, dessert garnishes and more.

3. Advantages and Health Benefits

If we bring into consideration the recent scenario's vogue; dairy free products, gluten-free products and veganism are on high rise. Nowadays, people pay a lot of heed to the changing dietic patterns and the healthy cuisines, still the fast food corners, cafes, bars and restaurants are becoming more and more popular. If we want, we can firmly make 3D printed foods come into the limelight. Now if we are considering the 3D food printing technology then apart from the food sector, it could also play an essential role in the hospitals in near future. For the sooner and better recovery of a patient, a meal can be designed flawlessly keeping the patient's nutritional needs into consideration. 3D food printing also provides the opportunity to design the products with complex shapes that are strenuous to achieve with conventional practices which could therefore be applicable in other sectors too. The consistency of the food can be changed so as to boost the quality of living which would directly aid the people belonging to older age category. (Carlota,2019). 3D food printing can emerge as healthy and eco-friendly technology as it can aid in the conversion of ingredients such as proteins from algae, beet leaves and insects into appetizing cuisines. As we know that this novel technology is still advancing, therefore it's a bit difficult to realize it's importance and advantages at this instant, but it also offers some other advantages which are mentioned below:

- Better efficiency and waste generation is less.
- Preparation of meal is easy and unchallenging
- Reduces the time required for preparation of the food
- Shelf-life of the food is apparently increased.
- Transportation becomes easier to remote corners of the globe.
- New textures and designs could be implemented on the food.
- Raw materials are easily available with vast variations.
- Paves the way for competitive advantage.

- Errors are automatically reduced (Joanna et al.,2016).

4. Future of 3D Food Printing

The technology of three dimensional food printing is efficient in presenting artistic, innovative, incomparable and convoluted food items in a captivating pattern. For the future age groups it will possibly be a 'Print and Eat' technology with faster production and better quality of the printed foods. As, 3D food printing technology also averts food wastage by reducing the waste, by utilizing cartridges of hydrocolloids, basically the substances that form gel with water. Therefore we could probably see a rise in the application of this technology in near future as it holds significant word for nutrition too (Sangeeta Prakash and Min Zhang, 2019 ; John Straw, 2015). If we take present scenario into consideration, then this technology has advanced enough that we can see people using it to process and cook ingenious and nutritious cuisines. The day by day increasing interest in 3D printing of food is also because, it is thought that in the near future it could aid the more restaurants to work effectively with better domination on the quality. Once the researchers confirm that which method is best for printing the foods then definitely it will aid in gaining momentum, from the production point of view. By keeping these things in mind, we cannot deny that people actually have put a question to the food scarcity problem (Emily Folk, 2019). Therefore the practical notion of 3D food printing may really sound uncomplicated, but the involvement in upcoming future will be extremely complex and noteworthy. Above all, people from various areas of production and research are satisfied that in the few years, 3D food printing will definitely become the standard in the mass production of many cuisines (Renata Franco, 2014).

5. Conclusion

3D food Printing is not something which has capability of addressing the whole intercontinental food supplies. It has potency to deal with world hunger and even the food security. 3D printing is a newfangled technology and current expansions in this concept are subject to sensitive agreements and the tech behind it is non transparent. 3D Printing will be an incredibly powerful new tool for the evolving companies to have in their repertoire. 3D Food printing can also be managed to reduce the food squander by computing and printing the exact quantity of food and it's calorific content required for an individual. This cutting edge technology is now looking to increase the speed at which 3D printing process operates. The printers cannot print food out of nothing, they even require food ingredients from which to print food. The 3D food printing has another dimension which make an outstanding benefaction, it may be that we can use food scraps for printing and turn them into nutritious food with high quality (Aaron Council and Michael Petch,2015).

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