



# **FDM PRINTER TYPES**

## **B) FDM PRINTER ACCORDING TO PRINT MATERIALS**

**B6) FOOD PRINTERS**

## **B6) FOOD PRINTERS**

The FDM method, which has been adapted to the food field since the last years, uses print heads capable of movement on the x, y and z axes. In these headers, it is ensured that the food material which is extruded and transferred to the platform just above the melting point rapidly becomes solid. Then, the head moving in the z axis begins to print the second layer on the food material, which is transferred to the platform and has now become solid. In this way, 3D production is completed in layers. One of the key points in this system is the relationship between the temperature of the outdoor environment and the temperature of the printed material. The printing temperature should be just above the melting point of the material and the temperature of the outdoor environment must be lower than the melting point. Thus, the printed food material can rapidly convert to solid form. Foodini 3D Printer model of Natural Machine, which Michelin star chefs use to add creativity to their dishes, is one of the most recent examples of such printers.

[https://www.researchgate.net/publication/318581962\\_Uc\\_Boyutlu\\_3D\\_Yazici\\_Teknolojisi\\_ile\\_Gida\\_Uretimine\\_Genel\\_Bakis](https://www.researchgate.net/publication/318581962_Uc_Boyutlu_3D_Yazici_Teknolojisi_ile_Gida_Uretimine_Genel_Bakis)

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On the other hand, 3D food printer applications are not limited to this. Devices that can be printed in food with an extruder change, although they have different functions, are also available from devices designed to print only 3D food. Dovetailed 3D fruit printer, The Choc Creator chocolate printer, The F3D 3D printer are produced only for food printing, while the Zmorph 3D Printer, Discovery Extrud3r can actually print everything but printers can print food products with an extruder change.

Process in food printer applications; it starts by turning the desired food into a puree first. This mash is filled into the print capsules to define the desired geometric shape. And the 3D printer forms the defined shape with mash. In fact, the latest 3D devices in the industry can now cook. In other words, the printed product is cooked without being removed from the appliance and is completely ready to eat. The F3D 3D printer is one of the best examples of this.

## EXPERIMENTAL APPLICATIONS OF GASTRONOMY 3-D PRINTER

Chef Paco Perez de Foodini, one of the masters who won a Michelin star with the restaurant La Enoteca of the Hotel Of Arts in Barcelona, is one of the people who use it to enrich their presentations by adding creativity. Perez created an impressive floral design with a blend of food printer and mix of caviar, fresh sea urchin and carrot. The food called Merc Sea Coral çağr evokes the sea and its colors and textures.

The coral-shaped design was created with the Foodini 3D printer, which is difficult to do manually or even impossible for some.



[https://gigazine.net/gsc\\_news/en/20160302-3d-printer-food](https://gigazine.net/gsc_news/en/20160302-3d-printer-food)

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There is an unknown fact about the 3D food printer. From time to time, the freshness of food printed on a 3D printer can be questioned by those who are not very familiar with the industry and innovation. But the freshness is not about the device, but about the mash put into it. When completely fresh ingredients are used, the device prints fresh, healthy and delicious foods.

It should be noted that the variety of foods that can be produced with the 3D food printer is also very wide. Everything that can be pureed can be printed. However, the most preferred; chocolate, potatoes, seafood and fruit.

[https://gigazine.net/gsc\\_news/en/20160302-3d-printer-food](https://gigazine.net/gsc_news/en/20160302-3d-printer-food)



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For now, the Foodini 3D printer is only used in some luxury restaurants. But the founder of the brand, Lynette Kucsma, stated that this technology will be used more in the near future, adding that people who come to restaurants will become accustomed to the food printed on 3D printers over time, and when they learn that these dishes are made with fresh and real foods, change will begin.



[www.3ders.org](http://www.3ders.org)

[https://www.fiyatimbu.com/blog/gastronomie-3d-gida-yazicisi-uygulamalari\\_213](https://www.fiyatimbu.com/blog/gastronomie-3d-gida-yazicisi-uygulamalari_213)

The use of 3D printers in the food industry can be a luxury for now. However, considering the benefits, it is inevitable that the area of use will become widespread in the future. The most important benefit; As in all other industries, the 3D food printer enables the printing of customized products extremely quickly. In other words, personal taste preferences can be printed quickly with 3D printer and presented in highly aesthetic forms for those who will have to follow a certain diet program.

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# BEST 3D FOOD PRINTERS AND PRICES

**Mmuse – Delta Model Desktop Food 3D Printer – 1000 USD**



<https://www.3dprintersonlinestore.com/mmuse-desktop-food-3d-printer>

**Mmuse – New Desktop Chocolate 3D Printer – 4000 USD**



<https://www.aniwaa.com/product/3d-printers/mmuse-chocolate-3d-printer/>

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**3D Systems – ChefJet –  
5000 USD**



<http://imprimalia3d.com/services/chefjet>

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**Createbot - 3D Food Printer**

multiple materials available– 2500 USD seviyelerinde

**CREATEBOT  
Specification of 3D Printer**

Build Size : 150×150×100 ( Unit : mm )

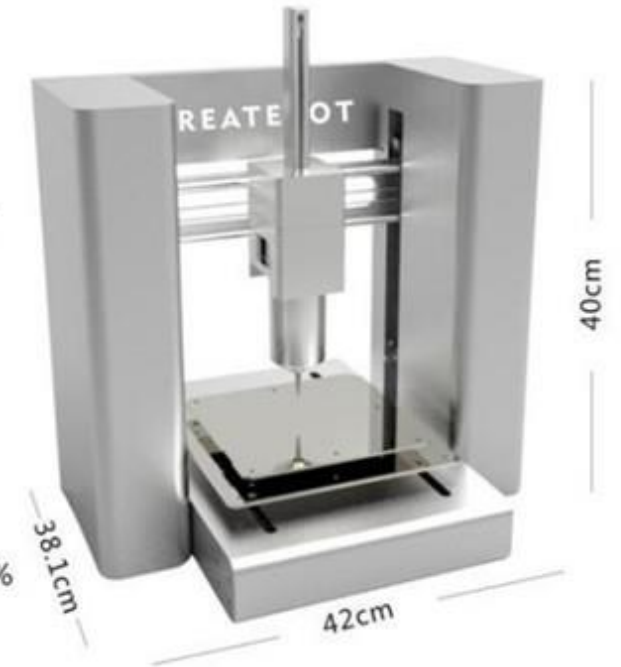
Positioning Accuracy : XY Axis : 0.1/100mm

E Axis : 1/100mm Z Axis : 0.01/100mm

Nozzle Size : 0.4mm—1.55mm

Printing Speed : 20—30mm/s

Magnification of Nozzle Movement Speed : 50—160%



Printing Material	Pinhole Minimum Diameter ( mm )	Extruder Temperature ( °C )	Printing Speed ( mm/s )	Magnification of Nozzle Movement Speed	Printing Max Height ( cm )	Pumpback Volume ( mm )	Pumpback Speed ( mm/s )
Biscuit	0.6	Normal Temperature	30	100	7	0.2	30
Purple Sweet Potato	0.6	Normal Temperature	30	100	10	0.3	30
Dark Chocolate	0.4	33	20	100	9	0.2	30
Red Bean Paste	0.84	Normal Temperature	30	100	10	0.3	30
Green Bean Paste	0.6	Normal Temperature	30	100	10	0.3	30
Lotus Seed Paste	0.6	Normal Temperature	30	100	10	0.4	30
Sesame	1.2	Normal Temperature	30	100	10	0.2	30

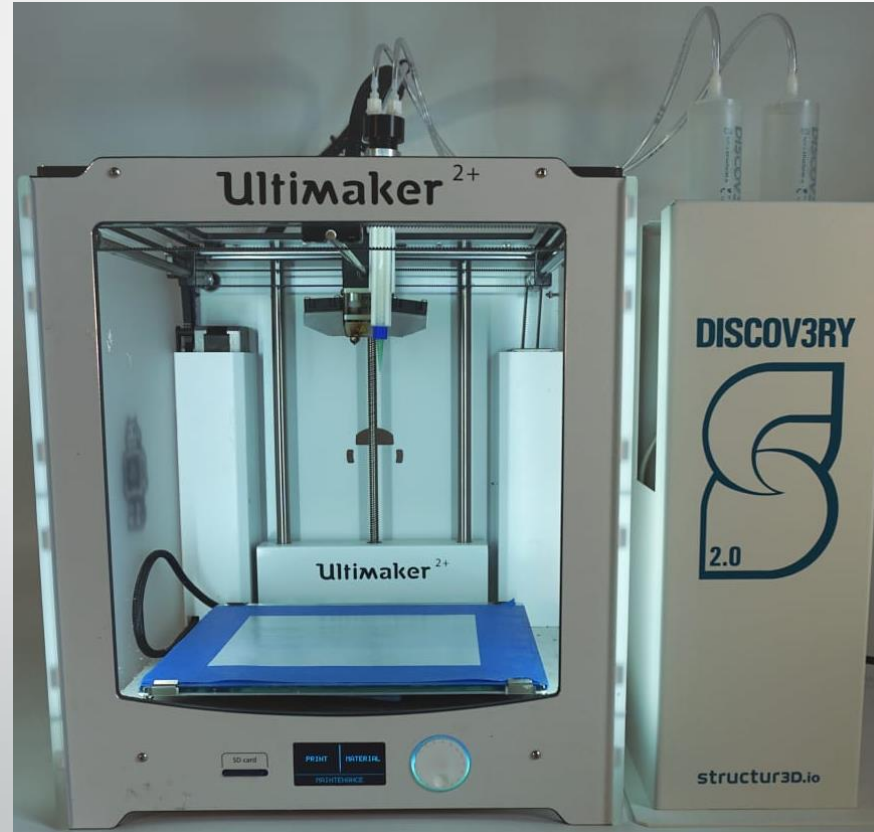
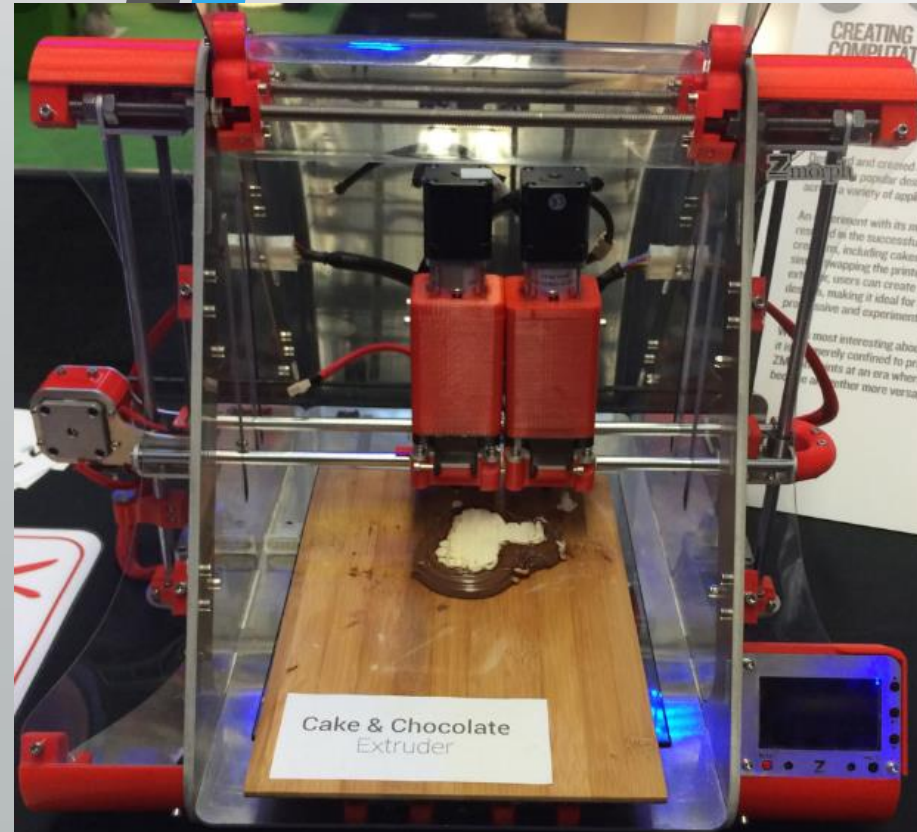
<https://www.3dprintersonlinestore.com/createbot-3d-food-printer>



Some 3D printer manufacturers produce models for food printing with a few modifications. Among the manufacturers and extruder models of these devices you can modify by purchasing an extruder that provides food processing; is located.

**Zmorph – Cake And Chocolate Extruder**

**Structur 3D – Discov3ry Extruder**



# COMMERCIAL 3D FOOD PRINTERS

## 1. The ChefJet

The ChefJet was developed by The Sygar-Lab and was subsequently acquired by 3D Systems and the product was restructured and improved. This product is aimed at restaurants, chefs and anyone who wants to eat desserts with different shapes from 3D Printer.



## 2. The Foodini

The initiative Foodini, developed by Natural Machines, aimed at 3D modeling of fresh foods, is one of the most well-known studies with ChefJet.



## 3. The f3d

Developed by students at Imperial College London, this food printer can print dough, tomato sauce and cheese. This makes it possible to make almost any pizza on a 3D Food printer.

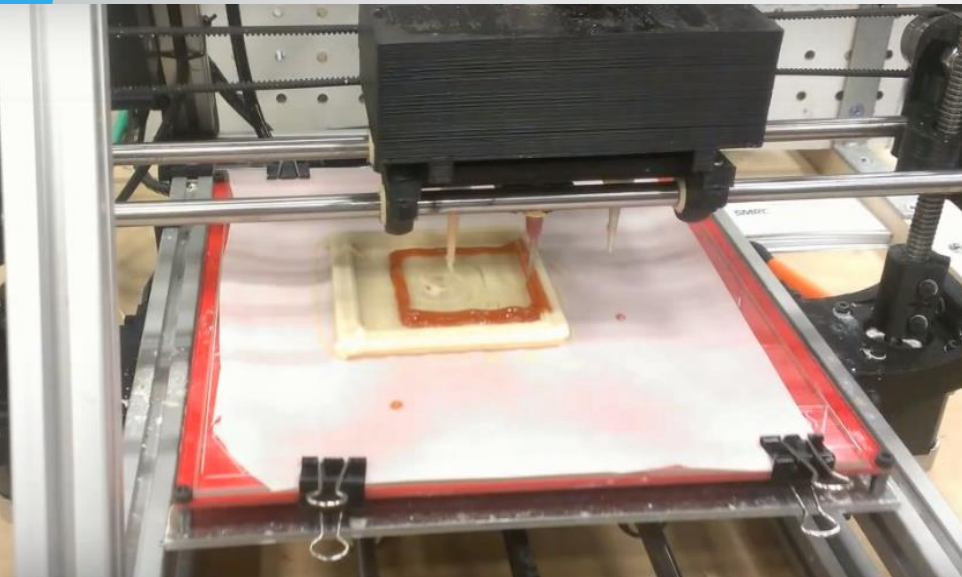


## COMMERCIAL 3D FOOD PRINTER (continued)

<https://priyoid.com/haberler/yakin-gelecekte-yemegini-yiyecegimiz-11-3d-gida-yazicisi/>

### 4. The NASA Food Printer

Nasa did not stay away from this issue, the astronauts began to work on behalf of healthy nutrition. With the current technology, a pizza can be printed on a 3D printer and is ready 70 seconds after printing, and the aim is to produce healthy foods other than pizza.



### 5. The Choc Creator



Choc Edge, one of the 3D printer brands that make chocolate printing, entered the market in 2012 with the Choc Creator model. Thanks to this chocolate printing printer, it gives you the designs you draw in 2D by adding the third dimension as chocolate.

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# COMMERCIAL 3D FOOD PRINTER (continued)

## 6. ZMorph Cake and Chocolate Extruder



ZMorph has made the extruder part of its 3D printer interchangeable and has added the Pasta Extruder between the interchangeable heads. However, the machine used as a normal 3D printer can be turned into a food printer that cooks at once.

<https://priyoid.com/haberler/yakin-gelecekte-yemegini-yiyecegimiz-11-3d-gida-yazicisi/>

## 7. The Discov3ry Extruder



If you already have a 3D Printer, you can convert it to a 3D Food Printer with Discov3ry from Structur3d.

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# COMMERCIAL 3D FOOD PRINTER (continued)

## 8. The 3D Fruit Printer



With the 3D fruit printer developed by the UK Dovetailed company, you can reproduce fruits with the geometries of your choice. Although it seems to be a gastronomic study for now, it will increase its usability with the development of fruit in the consistency of jelly.

## 9. The 3D Everything Printer from TNO



Developed by TNO, this printer allows users to produce the food they want according to their desired food size.

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# COMMERCIAL 3D FOOD PRINTER (continued)

## 10. The Palatable-Looking Goop Printer



It is a product that aims to produce gel foodstuffs by using 48 different nozzles.



## 11. The Original Food Printer



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Fab @ home, an Open Source project, allows you to make your own 3D Food Printer in the most convenient way.

<https://priyoid.com/haberler/yakin-gelecekte-yemegini-yiyecegimiz-11-3d-gida-yazicisi/>

[https://www.researchgate.net/publication/318581962\\_Uc\\_Boyutlu\\_3D\\_Yazici\\_Teknolojisi\\_ile\\_Gida\\_Uretimine\\_Genel\\_Bakis](https://www.researchgate.net/publication/318581962_Uc_Boyutlu_3D_Yazici_Teknolojisi_ile_Gida_Uretimine_Genel_Bakis)

## **RAW MATERIALS USED IN FOOD PRODUCTION IN 3D PRINTER**

Raw materials used in food production in 3D printers are classified as printable raw materials, modified printable raw materials and alternative printable sources.

### **RAW MATERIALS WITH PRINTABLE FEATURES**

The desirable property of raw materials that can be used in 3D food printers is that the raw material can flow smoothly from the print cartridge to the printing platform and maintain the solid structure formed on the platform. Accordingly, with hydrogel-forming substances such as starch and protein, cheese, chocolate and humus can easily gain the ability to flow from the print cartridge to the platform. In another study, sugar, starch and crushed potatoes were used as raw materials and positive results were obtained. It should be noted in particular that the foods produced with the raw materials in question generally belong to the group of snacks or desserts, and that none of them can be consumed as a main course.

[https://www.researchgate.net/publication/318581962\\_Uc\\_Boyutlu\\_3D\\_Yazici\\_Teknolojisi\\_ile\\_Gida\\_Uretimine\\_Genel\\_Bakis](https://www.researchgate.net/publication/318581962_Uc_Boyutlu_3D_Yazici_Teknolojisi_ile_Gida_Uretimine_Genel_Bakis).

# MODIFIABLE RAW MATERIALS

Foods such as fruits and vegetables, meat, rice, legumes are not suitable for printing due to their natural structure. However, some foods may become printable after pretreatment and addition of hydrocolloids (agar, xanthan gum, pectin). Lipton et al. (2010) with the addition of transglutaminase enzyme and agar brought turkey meat into printable form and minimized the physical structure of the cooking process after printing. There are many basic foods, especially dried legumes and vegetables, that have not been studied.

[https://www.researchgate.net/publication/318581962\\_Uc\\_Boyutlu\\_3D\\_Yazici\\_Teknolojisi\\_ile\\_Gida\\_Uretimine\\_Genel\\_Bakis](https://www.researchgate.net/publication/318581962_Uc_Boyutlu_3D_Yazici_Teknolojisi_ile_Gida_Uretimine_Genel_Bakis)



# PRINTABLE ALTERNATIVE RESOURCES

In 2011, Walters et al. “Insect Au Gratin” project. In this project, insects seen as alternative sources of protein were studied and powdered insects were mixed with melting cheese to obtain a printable and nutritious raw material. Forming a source of printable material by extracting bioactive compounds, enzymes and certain aroma substances from waste materials resulting from current agricultural practices and food processes is another area of interest for the future.

[https://www.researchgate.net/publication/318581962\\_Uc\\_Boyutlu\\_3D\\_Yazici\\_Teknolojisi\\_ile\\_Gida\\_Uretimine\\_Genel\\_Bakis](https://www.researchgate.net/publication/318581962_Uc_Boyutlu_3D_Yazici_Teknolojisi_ile_Gida_Uretimine_Genel_Bakis)

# 3D FOOD PRINTER APPLICATIONS

FOOD PRODUCT	RAW MATERIALS USED	PRINTER TYPE USED	REFERENCE STUDY
Cookie	Sugar, Flour, Egg, Butter	FDM	Lipton et.al., 2010; Sun et.al., 2015;
Pasta	Durum Wheat Semolina, Water	FDM	Sol et.al., 2015
Chocolate	Cocoa Butter, Sugar, Cocoa, Butter, Lecithin	FDM	Schaal, 2007; Hao et.al, 2010; Zoran and Coelho, 2011; Khot et.al., 2015a; Khot et.al., 2015b;
Melting Cheese, Sauces and Coatings	Cheese, Chocolate, Tomato, Scales, Sugar, Salt	BJ, Inkjet Printer	Periard et.al., 2007; Grood et.al., 2013
Meat and Seafood	Clam, Turkey Meat, Agarose	FDM, Bioprinter	Lipton et.al., 2010; Marga et.al., 2012

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# VIDEOS

<https://www.youtube.com/watch?v=lwCr3hhTG54>

[https://www.youtube.com/watch?v=zP\\_opPeW8aM](https://www.youtube.com/watch?v=zP_opPeW8aM)

<https://www.youtube.com/watch?v=dpxZUjcKC94>

<https://www.youtube.com/watch?v=XQni3wbotyM>