

FORMULATION AND CHARACTERIZATION OF TEXTURE IN DYSPHAGIA-ADAPTED FOOD FOR USE IN 3D PRINTER

Ivet Coll Camps

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INTRODUCTION

Dysphagia is defined as the difficulty to swallow liquid or solid foods[1,2].

Causes: Aging, neurological-degenerative illnesses, oncological injuries, and surgeries.

Consequences: Malnutrition, dehydration, pneumonia, death.

The treatment for people suffering from dysphagia is to follow a modified texture diet for a safer eating. This type of diet changes the structure of food and makes it less appealing.

The **International Dysphagia Diet Standardization Initiative (IDDSI)** has established texture levels in order to standardize an international classification of textures for dysphagia (figure 1) [3].

3D print can make the dishes more attractive. This technology can print any extrudable food. Using texture 4 (IDDSI) puree the food can be shaped into original designs (Figure 2).



Figure 2: Salmon and pepper purees (left) and Algae Matisse 3D desing (right)

MATERIAL AND METHODS

Formulation purees level 4 (IDDSI): ingredients, nutritional values and print design.

- Hot purees: potato, rice, vegetable, salmon, pepper, lentils.
- Cold purees: apple compote, fruit, biscuit, cheese, jam, iogurt.

Purees Texture analysis

Firmness
Consistency
Cohesiveness
Viscosity index

Day 0:
Hot purees: n=9 T1=65°C T2=37°C
Cold purees: n=9 T1=4°C T2=15°C

↓ 48 h
2-3°C

Day 2:
Hot purees: n=9 T1=65°C T2=37°C
Cold purees: n=9 T1=4°C T2=15°C

Purees Extrusion analysis

Firmness
Consistency

Day 0:
Hot purees: n=9 T1=65°C
Cold purees: n=9 T1=4°C

↓ 48 h
2-3°C

Day 2:
Hot purees: n=9 T1=65°C
Cold purees: n=9 T1=4°C

OBJECTIVES

- Determine with a texturometer the firmness, consistency, cohesion and viscosity index of hot and cold purees depending on the time and temperature.
- Determine the firmness and consistency from the analysis of extrusion on hot and cold purees depending on the time and temperature.
- Establish intervals of firmness, consistency, cohesion and viscosity index equivalent to a level 4 (IDDSI).
- Establish a standardized method of measuring texture from a texturometer, which can be used for analysis and quality control of this type of product.

RESULTS AND DISCUSSION

Most purees have significant differences in firmness, consistency, cohesion and viscosity index values depending on the time and temperature. It has been observed after 48 hours the values have increased because of the hydration of components. Depending on temperature the values have increased on cold purees caused by less flow of components.

The results of purees are used to stablish intervals equivalent to IDDSI level 4 (Table 1).

Table 1: Firmness, consistency, cohesion and viscosity index intervals equivalent to IDDSI level 4.

Treatment	Firmness (g)	Consistency (g-s)	Cohesion (g)	Viscosity Index (g-s)
Texture hot purees	100 to 650	1.000 to 7.500	-50 to -500	-600 to -5.000
Texture cold purees	60 to 600	800 to 7.000	-30 to -500	-400 to -3.500
Extrusion hot purees	1500 to 5.000	20.000 to 65.000		
Extrusion cold purees	500 to 2.500	6.000 to 35.000		

CONCLUSIONS

- 3D Food print improves the aspect of dishes for dysphagia people.
- Most purees have significant differences in firmness, consistency, cohesion and viscosity index values depending on the time and temperature.
- Values increased after 48 hours and when temperature is colder
- A standard quality method for level 4 (IDDSI) purees has been established.

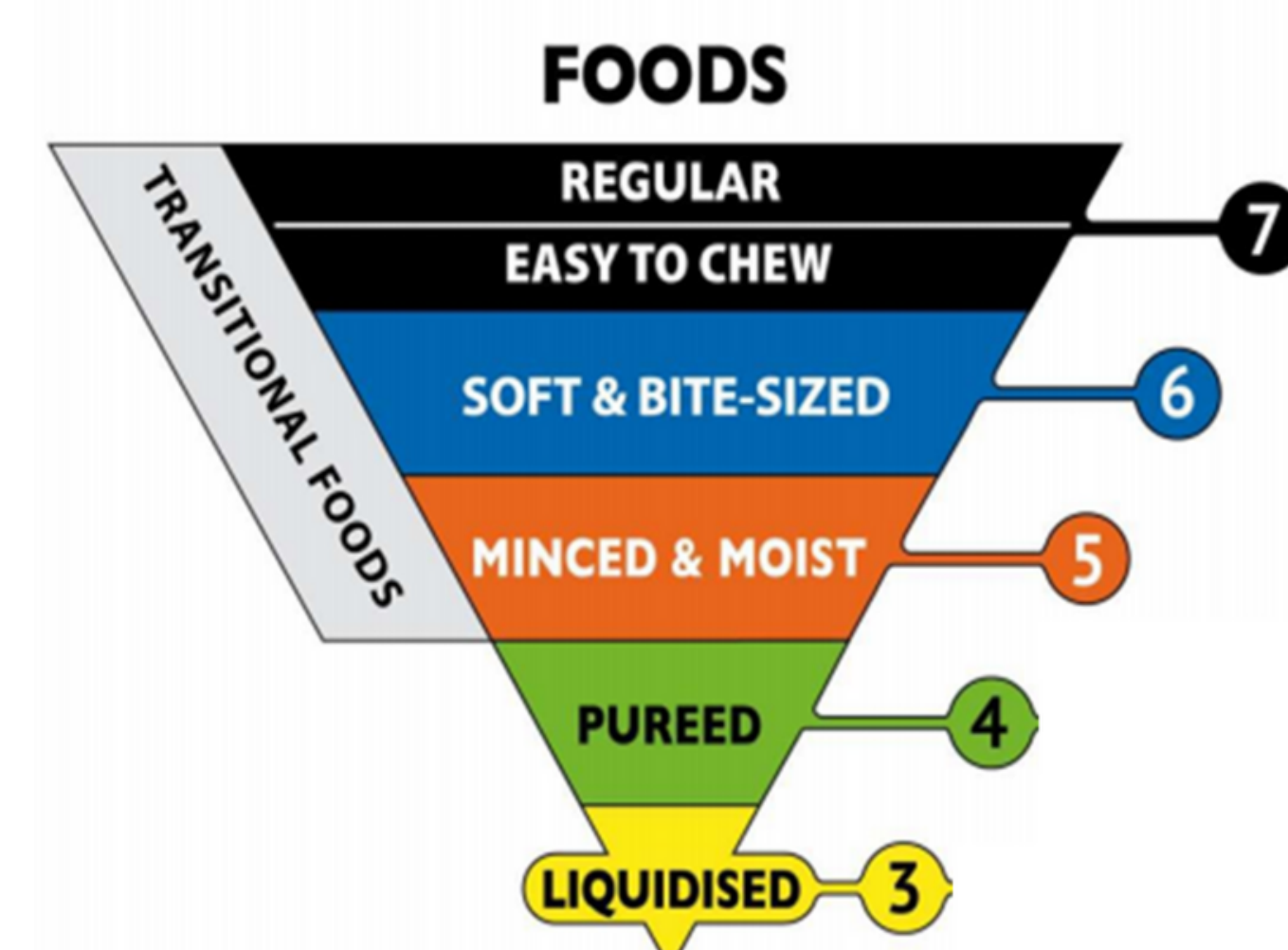


Figure 1: Texture levels IDDSI

[1] María Luisa García González, Josep García Raurich, Mercè Raventós Santamaría MAM. 2016. Viscosidad en la dieta de pacientes diagnosticados de disfagia orofaríngea.
 [2] Rojas Jiménez C, Corregidor Sánchez AI, Gutiérrez Bezón C. 2007. Situaciones clínicas mas relevantes. Disfagia. Tratado Geriatria para Resid.:545-553. <http://envejecimiento.csic.es/documentacion/biblioteca/registro.htm?id=52043>.
 [3] International Dysphagia Diet Standardization Committee. 2016. Detailed descriptions, Testing methods and Evidence, Food: Levels 3-7. :1-32. <http://iddsi.org>.