



Ethiopian egg-powder – an initiative to improve daily diet diversity

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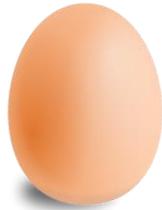


First food innovation contest

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Feasibility: How can it be processed and what will be the added value?

Eggs into egg powder



Processing the whole eggs into powder and product prototypes can have the following advantages : **i)** Relative to fresh eggs, the powder could be more **accessible**; **ii)** Egg powder is a **shelf-stable** and safer product; **iii)** It can fill local production gaps through **cost-effective transportation**; **iv)** It **reduces food loss** through breakage, spoilage, etc.; and **v)** It can be easily **integrated into traditional and commercial recipes**



Spray drying

Oven drying

Exotic yield: 23.5%
1.070kg produced by 120 eggs

Habesha yield: 25.3%
1.070kg produced by 140 eggs

Exotic yield: 22%
1.315kg produced by 150 eggs

Habesha yield: 24%
1.350kg produced by 150 eggs

Dry Oven

Spray drying



2 methodologies tested

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RESULTS

- The spray drying of both egg types resulted in whole egg powders with **optimal physical and techno-functional properties** as reflected by the low water activity, > 97% yield, and high nutrient composition;
- The high emulsion and oil absorption capacity suggests that a **homogenous mix with other ingredients is possible**
- The high foaming capacity also suggests that the drying process **did not induce significant denaturation of proteins**
- With just **6 g** of whole egg powder, the **protein requirements from CF can be fulfilled**, and with only ~**4 g** (about 1/3 of an egg= 49 mg choline), **100% of choline requirements** (45.9 mg) can be fulfilled
- **Long shelf life** above 12 months

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Physico-chemical and functionality of air and spray dried egg powder: implications to improving diets

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ABSTRACT

Weak market linkages, unavailability of cold-storage, and the significant loss of eggs due to breakage and low shelf-life contribute to the unaffordability and the low consumption of eggs in low-income countries like Ethiopia. The effect of spray- and oven-drying of eggs from local (Ethiopian) and exotic (imported) chicken breeds on physical, techno-functional, and nutritional composition of egg-powders were evaluated. Exotic ($n = 150$) and local ($n = 140$) eggs were spray/oven dried. The yield, bulk-density, flowability, and the foaming-, emulsification-, and water/oil absorption-capacity of the egg powders were assessed. The concentrations in energy, proteins, fat, ash, and minerals were determined. The egg-powders' contribution to nutrient requirements for a child and their potential use as an alternative protein source in ready to use therapeutic foods (RUTF) were estimated. The low moisture (<5%) and water activity (<0.4-0.5) of the egg-powders implied unfavorable conditions for microbial growth. Local eggs had higher energy and fat content, whereas protein was higher in the exotic eggs ($P < 0.05$). About 12.5 g of egg powder (one egg) can fulfill ~75%, 30%, and 40% of fat, energy, and calcium requirements for children 6-23 months of age, respectively. Only 6 g and 4 g of egg-powder are needed to fulfill protein and choline requirements, respectively. Considering the quality/quantity of proteins, egg powders can be alternative protein sources in RUTFs. The drying of local and exotic eggs with oven- and spray-drying yielded egg powders with acceptable techno-functional properties, but future studies should elucidate differences observed by egg type and drying, and investigate the shelf-life. Drying eggs can be a viable food systems' intervention that can improve the safety and quality of diets in low-income countries like Ethiopia.

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KEYWORDS

Food system; affordability; nutrient composition; protein; complementary food

Introduction

Child malnutrition is highly prevalent in low- and middle-income countries (LMICs) as reflected by growth faltering, nutritional deficiencies, and the related poor cognitive outcomes.^[1] The timing of child growth faltering illustrates that poor complementary feeding is a key determinant.^[2] Indeed, a large majority of children in LMICs have suboptimal diets, characterized by low consumption of fruits, vegetables, and nutrient-dense animal source foods.^[3] Low dietary diversity, particularly the low consumption of animal source foods has consistently been linked to child stunting.^[4,5]

Egg is one of the most versatile and nutrient-dense food that, relative to other animal source foods, is more available and accessible.^[6] For example, poultry are the most widely owned livestock in LMICs like Ethiopia, but paradoxically they are still unaffordable for a large share of population in these countries.^[7,8] The poor infrastructure (e.g., absence of cold-chain) and the weak market linkages in

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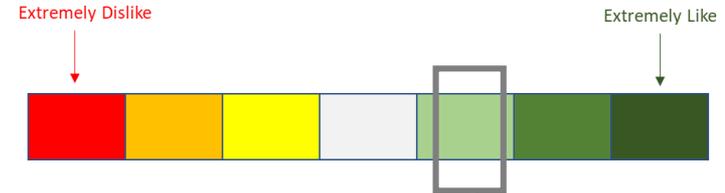
Abreha, E., Getachew, P., Lailou, A., Chitekwe, S., & Baye, K. (2021). Physico-chemical and functionality of air and spray dried egg powder: implications to improving diets. *International Journal of Food Properties*, 24(1), 152-162.



Sensory acceptability

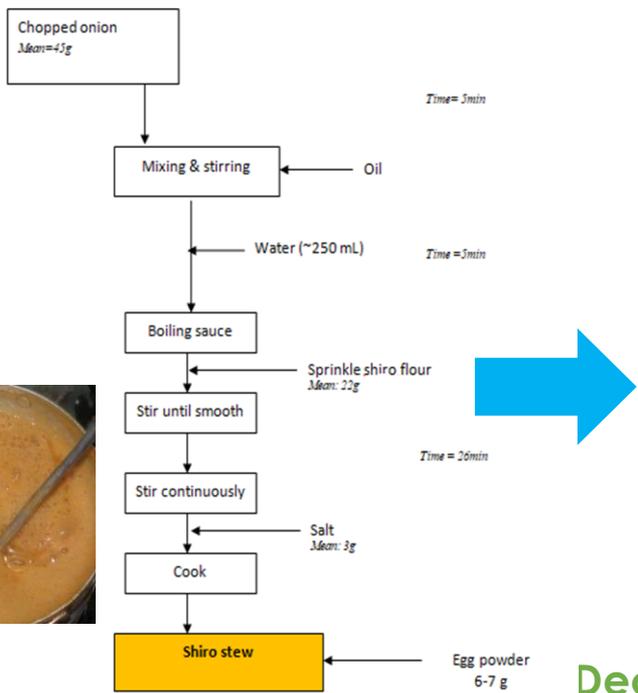


- Semi-trained panelist
 - Tested the acceptability of egg powder
 - Color, odor, taste (in *shiro*), texture, overall acceptability
 - Compared by drying and egg type
 - Used 7 point hedonic scale



The sensory attributes were found **acceptable**

- Oven dried egg powder's color was more acceptable than spray-dried one (deep yellow)
- The sensory acceptability should be repeated using **consumers (mothers)** and **dosage adjusted to a meal of a child**



	Appearance	Color	Odor	Taste (in shiro)	Texture	Overall Acceptability
E-Oven	5.6 ± 1.1	5.3 ± 1.1	5.5 ± 1.1	6.1 ± 0.8	5.9 ± 1.0	5.5 ± 0.8
E-Spray	5.0 ± 1.0	4.8 ± 1.1	5.4 ± 1.0	5.3 ± 0.8	5.3 ± 1.0	5.1 ± 1.0
L-Oven	6.0 ± 1.0	6.3 ± 1.0	5.0 ± 1.1	6.1 ± 0.5	5.7 ± 0.7	5.8 ± 0.9
L-Spray	5.2 ± 1.0	5.5 ± 1.1	5.7 ± 1.0	5.5 ± 0.9	5.9 ± 1.0	5.6 ± 1.0

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VS



Collaboration with

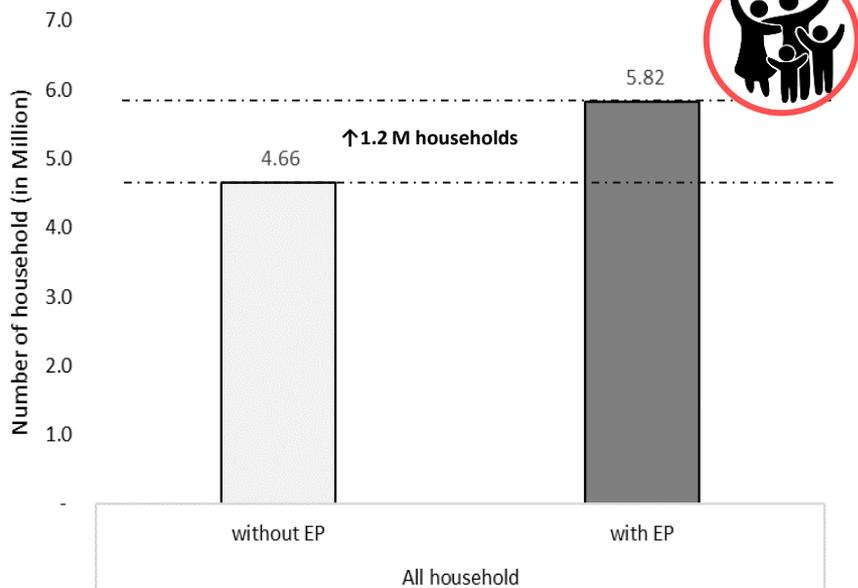


Figure - Number of households (in millions) that can afford the minimum cost nutritious diet before and after integration of egg-powder (EP) into the market

This is an additional ~1.2 million households affording the minimum-cost nutritious diet, representing 4-6 million individuals depending on the size of the households

Table - Share (%) of food expenditure needed to be spent for a child (6-23 months) to consume the minimum nutritious cost diet by household wealth quintile+

Wealth quintile	Total food expenditure (ETB)		Food expenditure (for U2 child)	% of food expenditure for HH with U2 child					
	All HH	HH with U2		CoD baseline	EP 2.0 ETB	EP 1.71ETB	EP 1.5 ETB	EP 1.3 ETB	EP Free
poorest	14,053	15,487	1,434	134.6	128.90	128.87	128.03	127.38	87.87
second	19,400	21,573	2,173	88.9	85.07	85.04	84.49	84.06	57.98
middle	25,313	28,489	3,176	60.8	58.20	58.19	57.81	57.51	39.67
fourth	28,031	33,389	5,358	36.0	34.50	34.49	34.27	34.09	23.52
richest	34,063	45,816	11,753	16.4	15.73	15.72	15.62	15.54	10.72
National	24,171	26,293	2,122	91.0	87.11	87.09	86.52	86.08	59.38

Different delivery will be needed and pricing system:

- Free distribution through donors or gvt system
- Accessible in the market but with price subsidy
- Full market access at higher cost with better packaging to support subsidized price

SUPPLEMENT ARTICLE

Maternal & Child Nutrition WILEY

Whole egg powder makes nutritious diet more affordable for Ethiopia: A cost of the diet and affordability analysis

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Baye K, Abera A, Chitweke S, Getachew P, Dibari F, Laillou A (under review) Whole egg-powder makes nutritious diet more affordable for Ethiopia: a cost of the diet and affordability analyses

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Thank you

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