COMPOSITIONAL AND NUTRITIONAL PROPERTIES OF TEF AND TEF-BASED FOOD PRODUCTS

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Outline

- Study background
- Objective
- Results and discussions
- Conclusions and future perspectives
- Very small kernel
- Originated in Ethiopia
- Grown by 6.3 million subsistence farmers
- 20% of all the cultivated area
- Lowest yield 1.3 tonnes/hectare
- Low risk crop - drought and weather conditions

1 wheat kernel = mass of 167 tef kernels
Forms of phenolic compounds in cereals

Phenolic compound

Soluble

Bound

Acosta-Esarada, 2014
Bioaccessibility of minerals in cereals?
Starch digestibility & glycemic index (GI)

- **RDS**: Digest in 20 min
- **SDS**: Digest in 100 min after RDS
- **RS**: Non-digestible

8.8% High GI
Protein: Gluten content digestibility?

EU classification

- Gluten free: < 20 mg/kg
- Low gluten: 20-100 mg/kg
- Gluten containing: > 100 mg/kg
Why is TEF important?
OBJECTIVES

Bioaccessibility of iron and zinc

Phenolic content, bioaccessibility and antioxidant capacity

Compositional & nutritional properties of tef flour and its food products from the perspective of:

Protein characterization and digestibility

Starch digestibility and glycemic index
Sampling

7 tef varieties

- Zezew
- Zagurey
- Tsedey
- Boset
- Simada
- Dega
- Quncho

Milled

Milled

Milled

Milled

Milled
Phenolics and antioxidant capacity

Bioaccessibility of iron and zinc

Starch digestibility and glycemic index

Protein characterization and digestibility

Flour

Extraction

Soluble

Bound

Profiling, TPC, TFC, DPPH, FRAP

HPLC & Spectrophotometric methods
**Phenolic content: Flour**

Major phenolic compounds:
- **p-Coumaric**
- **Ferulic**
- **Rosmarinic**
- **Catechin**

**Bound** 84% of total

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<th>Flour</th>
<th>Soluble (mg GAE/100g)</th>
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- **TPC**
- **Starch digestibility and glycemic index**
- **Bioaccessibility of iron and zinc**
- **Protein characterization and digestibility**
FRAP: tef varieties flour

FRAP (µM Fe$_{2+}$/g)

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Phenolics and antioxidant capacity
Bioaccessibility of iron and zinc
Starch digestibility and glycemic index
Protein characterization and digestibility
In vitro bioaccessibility of Fe and Zn

Fermentation

Bioaccessible Fe & Zn

Fe, Zn and Phytic acid

ICP-MS
Bioaccessibility of iron and zinc

- Phenolics and antioxidant capacity
- Bioaccessibility of iron and zinc
- Starch digestibility and glycemic index
- Protein characterization and digestibility

**Bioaccessibility of iron and zinc**

![Graph showing bioaccessibility of iron and zinc for different samples.](image)
Tef starch digestibility
GI of injera and porridge

Dry matter
- 34-42
- 27-29

GI
- 94-137
- 78-98

GI chart
- LOW GI < 60
- Medium GI 60-85
- High GI > 85
Effect of sourdough (SD) on GI of fresh bread

- Control (0% SD): 75
- 10% SD: 83
- 20% SD: 85
- 30% SD: 89

GI chart:
- LOW GI (< 60)
- Medium GI (60-85)
- High GI (> 85)
Effect of bread storage on GI

- Fresh: 75-89
- 24 h: 70-74
- 48 h: 66-74
- 120 h: 57-67

GI chart:
- LOW GI < 60
- Medium GI 60-85
- High GI > 85

Phenolics and antioxidant capacity
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Protein characterization and digestibility
Tef protein characterization

Gluten content
SDS-PAGE
Digestibility
Gluten content & SDS-PAGE molecular distribution of tef protein

Gluten
7-15 mg/kg
Tef protein digestion

Starch digestibility and glycemic index

Phenolics and antioxidant capacity

Bioaccessibility of iron and zinc

Protein characterization and digestibility

Flour

Injera

%IVPD

Quncho

Tsedey

Zagurey

Zezew
Conclusions and future perspectives

• Tef is potential source of phenolic compounds and minerals.
✓ Effect of phenolic compounds and/or fibers on mineral bioaccessibility needs to be investigated.
✓ Use of mineral bioaccessibility enhancers could help to increase Fe and Zn bioaccessibility.

• Tef can be used to produce low GI food products depending on the processing steps.
• Tef is gluten free and its protein is highly digestible and molecular distribution is different from wheat.
✓ Further analysis of other protein allergens is needed.
✓ In vivo studies on phenolics & mineral bioaccessibility and on starch and protein digestibility are necessary.
Thank You

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