Lebanon 2020: How the explosion impacted the food safety of the Lebanese population?

A critical opinion

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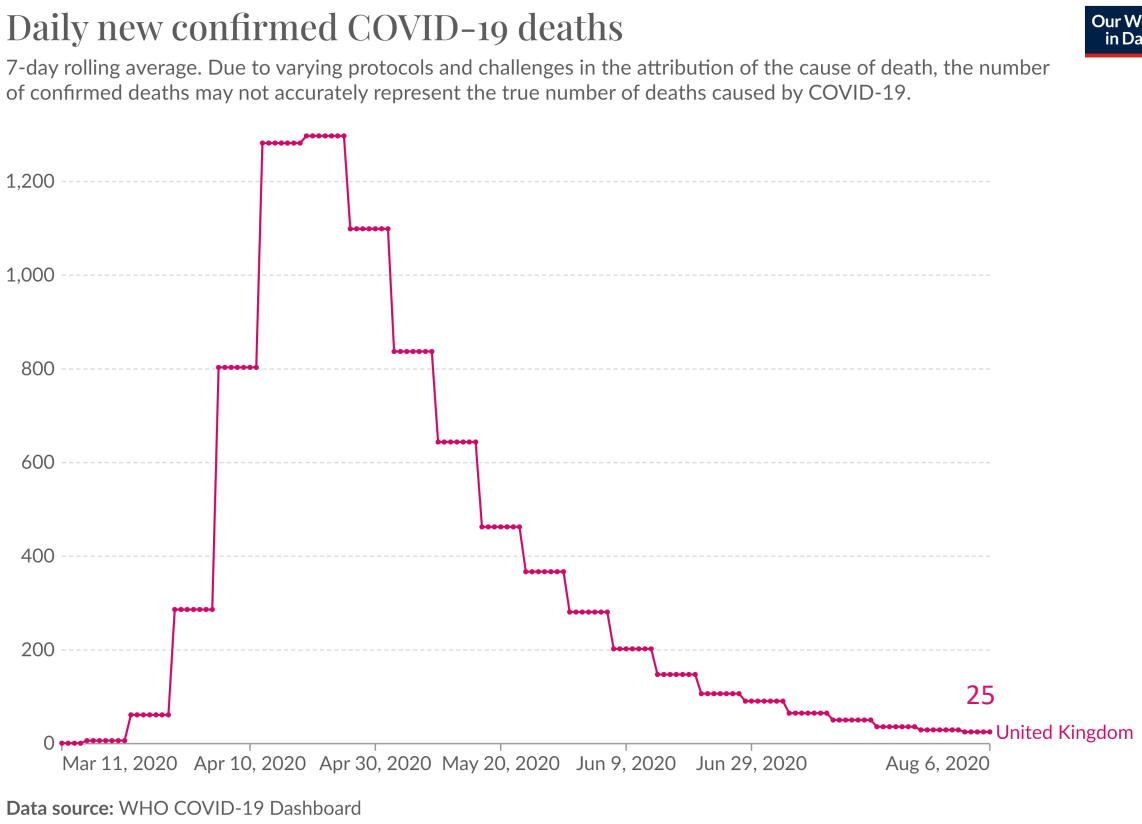
www.cranfield.ac.uk

We all remember… in the UK

August 4th, 2020



https://www.bbc.co.uk/news/uk-67658106

We all remember… in Lebanon!

August 4th, 2020

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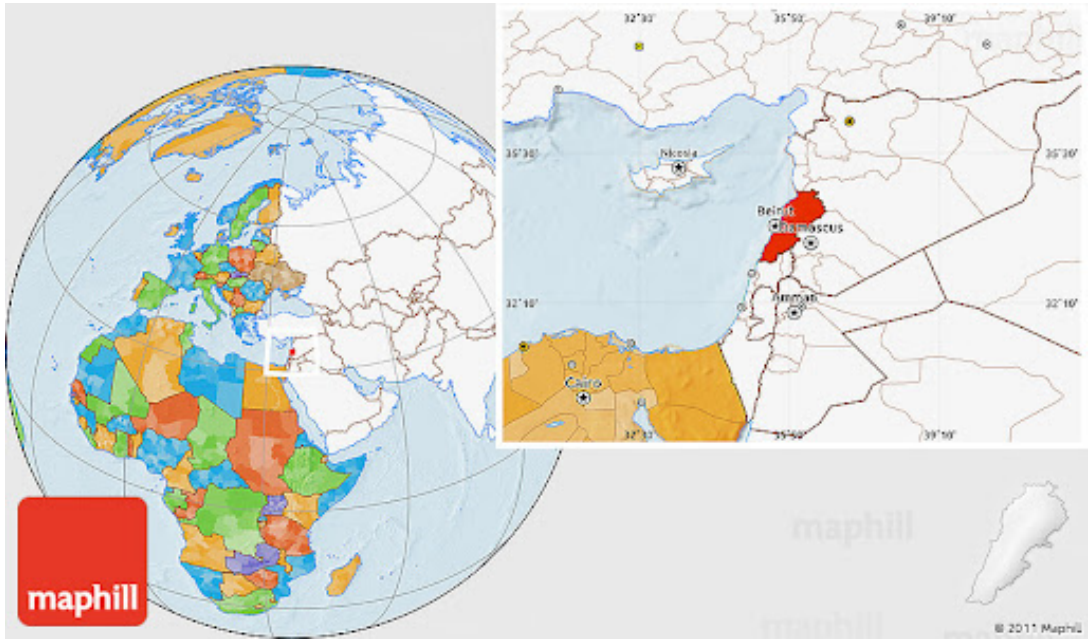


Short-term hero… long term consequences ….

What are the implications?

The wheat perspective

Main staple food for

5.5M inhabitants

80% from import

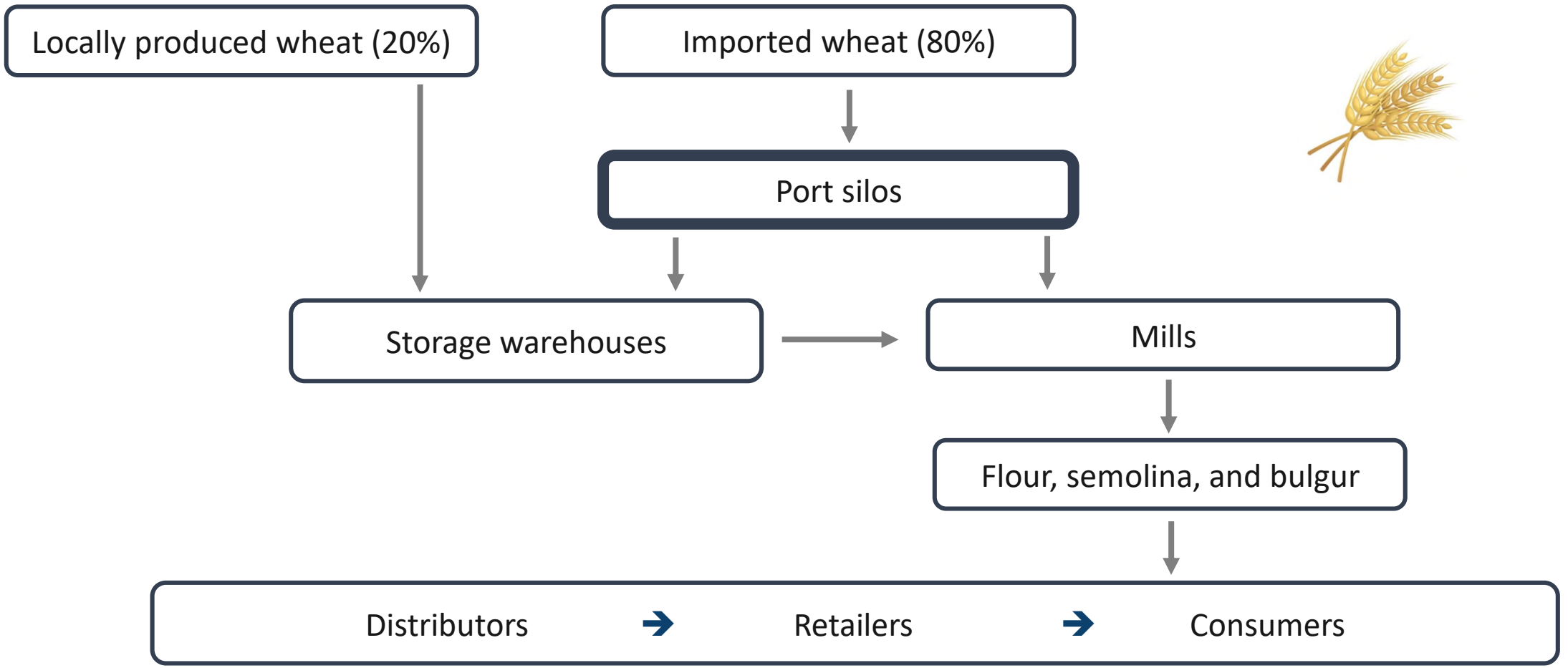
400-450k tonnes equivalent to £198M in 2021/2022

Contamination by toxic fungal compounds:

Mycotoxins

Before…

The wheat system



Before… the wheat food system was safer

Wheat arrived in Beirut port → Silos (months) → Optional: Warehouse (weeks)

The silo was ensuring:

- ✓ Food security: 120k tonnes of grain storage capacity
- ✓ Food safety:
  - ✓ At arrival: In port sanitary inspection
  - ✓ During storage: prevention of mycotoxin accumulation due to constant monitoring

What about mycotoxins?

Silo storage

- Good management practices
- 1 study investigated the concentration (Sampling July 2020)
  - No increase of toxin during storage

"Potentially safe storage practices"

Warehouse storage

- Increase of mycotoxin accumulation due to poor management practices:
  - 24.4% with Aflatoxin B1 > UK maximum limit
    - ➔ Hepatocellulocarcinoma risk
  - 27% with Ochratoxin A > UK maximum limit
    - ➔ Suspected kidney cancer risk
    - ➔ Kidney failure

(Daou et al., 2021; Joubrane et al., 2020)

INDEPENDENT

A city in ruins

- Beirut death toll passes 135
- Over 300,000 made homeless
- Chemical stockpile blamed
- Port officials arrested for blast

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A-level results 2020 All your biggest questions answered in our 8-page guide inside →

BRITAIN'S BEST QUALITY NEWSPAPER

The Daily Telegraph

LORENZO TUGNOLI / THE WASHINGTON POST / CONTRACTO / ISTOCK

An army helicopter drops water yesterday at the smouldering scene of Tuesday's explosion in the port of Beirut. A massive blast devastated the dock area of Lebanon's capital, killing at least 135 and wounding thousands

Pity Beirut, but this darkness was of its own making

Josie Ensor

God knows the Lebanese have suffered. They stumbled out of one of the most brutal civil wars in modern times into a conflict with Israel. Just as the country was recovering from that, neighbouring Syria exploded in protest – sending a wave of refugees its way.

Lebanon miraculously weathered the storm, only to be hit by an economic crisis so deep it has plunged most of the country into poverty. Trauma – its citizens often grimly joke – has become part of the national psyche.

Yet Tuesday's explosion was something else. I fear it is more than anyone, even the famously resilient Lebanese, can bear.

I spent more than four years in the capital, Beirut, as a Middle East correspondent for this paper. It's a complicated and tumultuous place where tempers and passions run high. If you don't fall in love with it, you've misunderstood it. If you don't hate it, you've probably done something wrong. Anyone who has ever left it – which I did in February – knows you leave a piece of your heart behind.

Checking yesterday on friends and old neighbours who had become more like family to me, there was no good news. Most live in and around the

Continued on Page 5

Pupils face exam chaos 'life sentence'

Head teachers raise concern over Covid-19 grading system as children are denied right of appeal

By **Camilla Turner** EDUCATION EDITOR

PUPILS face being handed a "life sentence" if they are not allowed to appeal incorrect grades in their GCSE or A-level exams, it is warned today.

The majority of teenagers in England will next week receive grades that have been calculated using a statistical model after coronavirus interrupted exam season.

However, the exam regulator has decreed that appeals will only be allowed on technical grounds and not simply if a student believes they have been awarded an unfair grade.

Fears are growing that next week's results day could descend into chaos with thousands of pupils handed questionable results. One source familiar with the predicted grades model said that "all hell would break loose". Leading head teachers are now urging Ofqual to overhaul the system amid concerns it could punish a generation of teenagers.

Dr Martin Stephen, the former High Master of St Paul's Boys' School in London, said that the current results system was tantamount to "imposing a life sentence on children, with no effective right of appeal".

Ian Power, the general secretary of the Headmasters' and Headmistresses' Conference, warned that allowing students the right to appeal against their grades this summer was a matter of "natural justice" and warned that exam boards could face a wave of legal challenges unless the rules were changed.

Earlier this week in Scotland, exam results day was labelled a "shambles" after close to 125,000 predicted grades were downgraded by the Scottish Qualifications Authority.

The Scottish and English regulators drew up statistical models to generate pupils' grades after all public exams were cancelled. Both models take into account factors including data on a school's historic grades in subjects.

A source told *The Daily Telegraph* that the statistical model being used to predict English exam results shared the same "basic principles" with the Scottish one.

But while pupils in Scotland are able to appeal against their results, English students are currently banned from doing so apart from on narrow technical grounds. Pupils who believe their GCSE or A-level marks are lower than what they could have achieved are only allowed to appeal by sitting a new set of exams in the autumn.

Last night, education chiefs heaped pressure on Ofqual to allow students a broader set of grounds on which they can appeal.

Mr Power said that appeals were the "biggest concern" about this year's process for HMC, which represents the country's most exclusive schools including Eton, Harrow and Winchester.

"Having the right to appeal a result is natural justice," he said. "The appeals process this year is even more narrow than normal. Parents will take the action they feel they have to, and if that involves legal action that could happen. That is part of the frustration."

Writing in today's *Telegraph*, Dr Stephen explains that the current system works fairly "only for those schools whose performance has been static for three years", adding that it is "grossly unfair to year groups who are unusually gifted".

Appeals are only allowed by Ofqual if

'We currently have an appeals process that only serves the well-heeled and the sharp-elbowed'

a school can prove that the process was not followed correctly, for example, if an error was made during the calculation process.

Robert Halfon MP, the Tory chairman of the education select committee, said that as things stand, students' parents would need to enlist a lawyer to navigate the appeals process. "We currently have an appeals process that only serves the well-heeled and the sharp-elbowed. If you are not an upwardly mobile professional you don't have a chance," he said.

"It has got to change, it has to be a level playing field for all students. Everyone should have a chance at getting a fair grade."

The exam regulator launched a consultation in June that proposed some additional grounds on which students could challenge results.

The consultation, which Ofqual is due to respond to this week, outlined plans that would allow students to appeal if they believed they were the victims of discrimination or bias.

Under the proposals, teenagers would be allowed to appeal to exam boards if they believed there was evidence of "serious malpractice" by their school.

Yesterday, Kate Green MP, the shadow education secretary, wrote to Gavin Williamson to demand answers over A-levels and GCSEs, following the "disastrous" handling of Scottish results.

"Ministers must urgently set out how they'll ensure the results next week will not exacerbate existing inequalities, and what extra support they'll give to students who feel they've been unfairly graded to navigate the appeals process," she said.

An Ofqual spokesman said: "It is important that students understand their options, including the possibility of an appeal, if they do not receive the grade they expected.

"Students will be able to appeal, through their school or college, if they believe a mistake has been made or that something has gone wrong in their case.

"We are committed to helping students, and their families, understand the options available to them and will be publishing information on how appeals will operate this summer."

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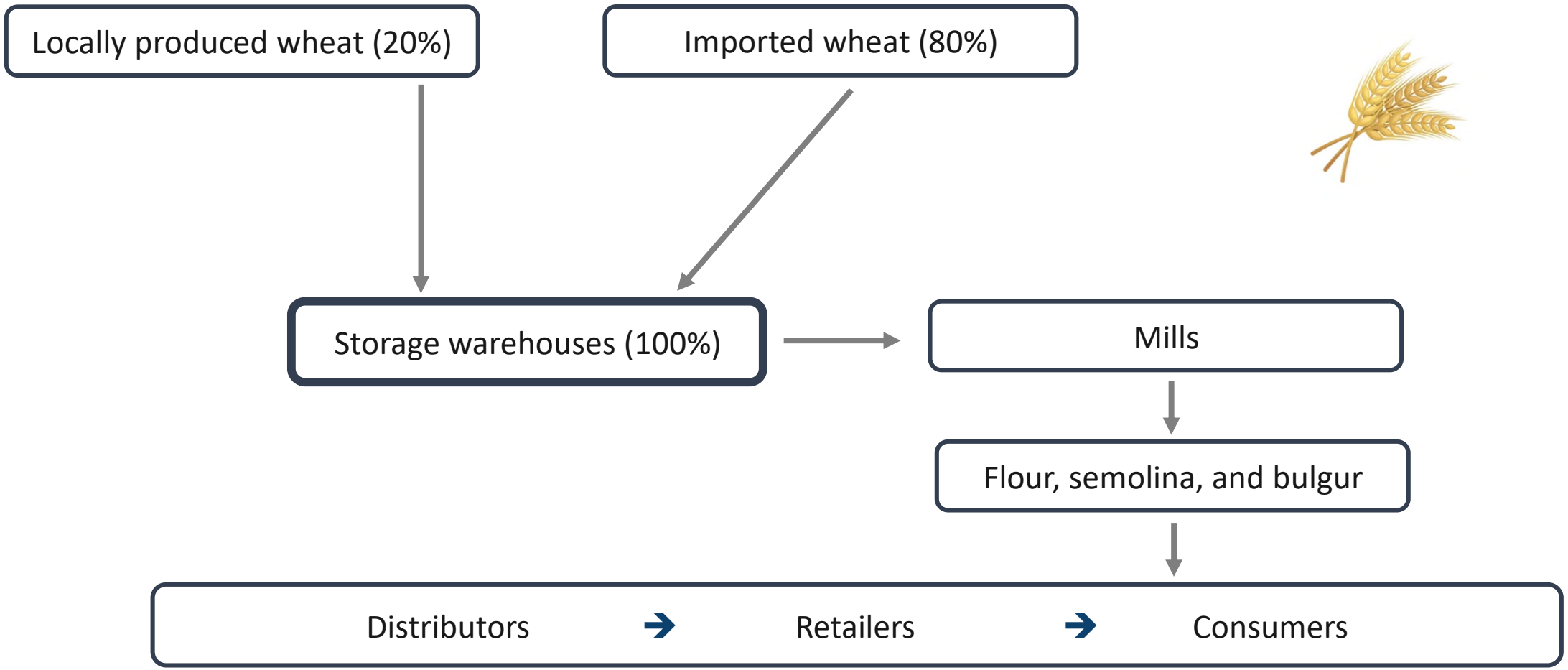
Martin Stephen: Page 16
Editorial Comment: Page 17

Half a million patients have 'long Covid'

Trees in every street to end 'identikit estates'

… after

The wheat system



Consequences on food safety and health

Only an estimate…

- Estimated increased of mycotoxin accumulation due to poor management practices:
  - x12-fold increase of aflatoxin B1 exposure (11.74 ng/kg bw/d)

    ➔0.97 liver cancer case per 100k persons per year

  - X1.81-fold increase of ochratoxin A exposure (13.8 ng/kg/ bw/d)

    ➔equivalent to the Provisional Tolerable Weekly Intake (PTWI) of 100 ng/kg bw as set by Joint Expert Committee on Food Additives

Without considering …

Consequences

Need for Action

Proposal for the development of new resilient infrastructure

- New storage capacity in Bekaa
  - Targeted District-level storage facility
- Energy-efficient solutions
- Increased storage capacity to cope with disruption and price volatility
- Cope with war-related threats (border Syria/Israel)

Request for collaboration….

Dr Carol Verheecke-Vaessen
email: c.verheecke@cranfield.ac.uk

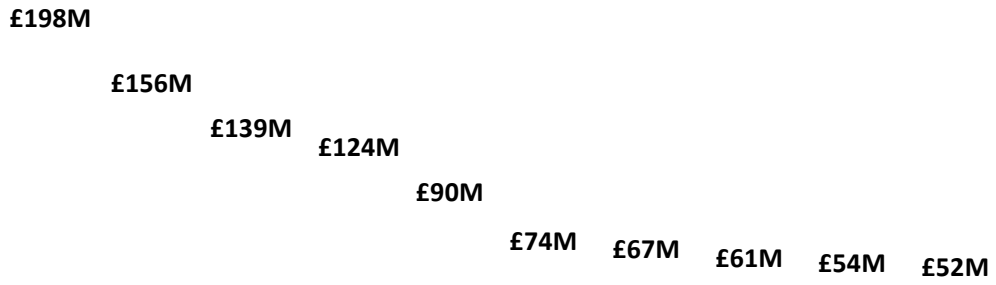
Supplementary slides

Imported Food

Total Food Imports (2019-2022)

(World Food Programme, 2023)

Main imported food items (Dec 21-Dec 22)



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Agriculture in Lebanon

- The main agricultural region is the Bekaa area in which 42% of agricultural activity is located (Ministry of Environment/UNDP, 2011)
- Agriculture is supported there by adequate climatic conditions including a long period of sunny days over the year, fertile soil and adequate average of rainfall
- The main products are wheat, barley, corn, legumes, vegetables, and fruits

Bekaa Valley 17

Wheat Consumption

- Wheat the most consumed grain in Lebanon and used for the production of many food items
- Wheat and wheat products are the most consumed in the country, accounting for 35% of total energy intake (Nasreddine et al., 2006) and 120 kg/capita/year (Berytech, 2022)
- Bread is almost consumed with every meal

- Local production of wheat amounts to 60,000 tonnes and covers almost 10% of the national consumption (Daou et al., 2021)
- Wheat cultivated is durum wheat that is unsuitable for pita bread production and is used for the production of two less popular products → semolina and bulgur
- **So to cover the local needs, Lebanon relies heavily on imports**
- In 2022, Lebanon imported 552,000 tonnes of wheat (Food and Agriculture Organization of the United Nations, 2023)

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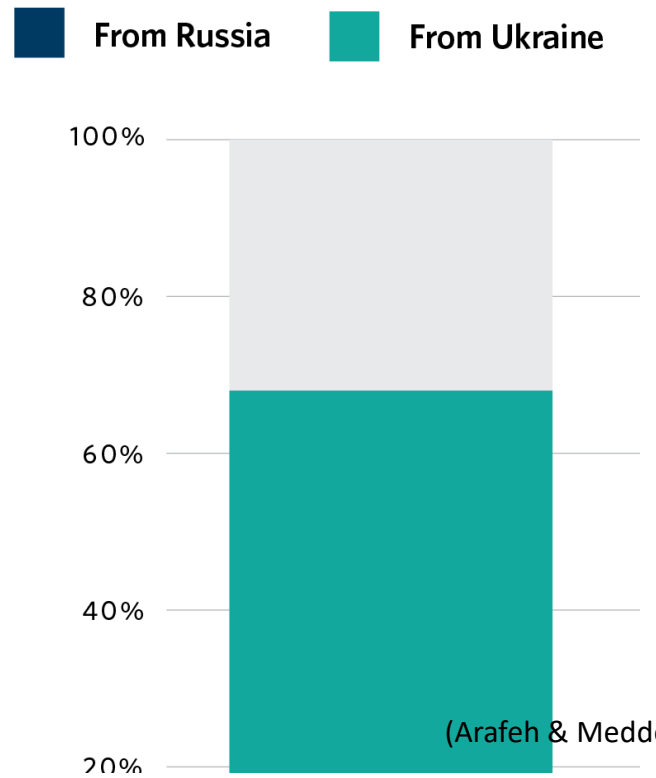
Wheat Imports

Wheat imports in US dollars (Dec 21- Dec 22)

(World Food Programme, 2023)

Percentage of source of wheat imports to Lebanon in 2020

Figure 1. Percentage of Wheat Imports in 2020



(Arafeh & Meddeb, 2024)

Common Food Safety Issues in Wheat -Mycotoxins

- Produced naturally as secondary metabolites by filamentous fungi that attack crops on field or during storage due to climatic conditions including temperature and humidity

- Mycotoxins have several health effects most commonly nephrotoxicity, hepatotoxicity, immunosuppression, carcinogenicity, and teratogenicity (Janik et al., 2020)

- Mycotoxins can also lead to increased food waste and economic problems specifically in developing countries

- Vardon et al. (2003) estimated the total annual losses due to three mycotoxins – aflatoxin, fumonisin, and deoxynivalenol – reach as high as 1 billion US$

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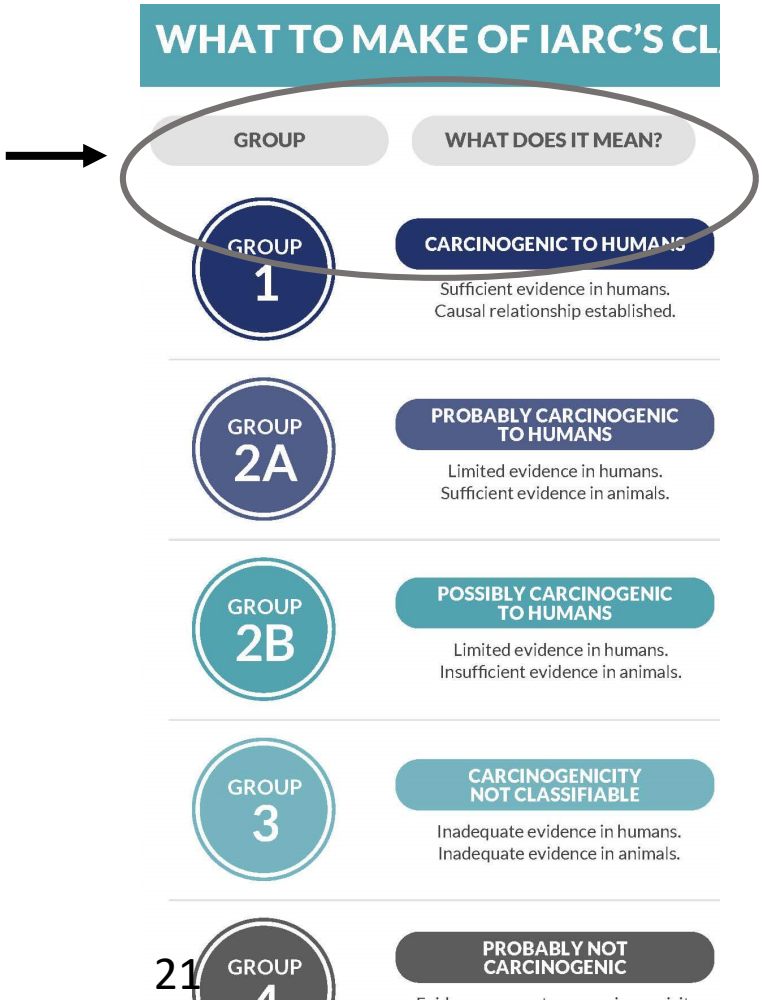
Aflatoxins and Ochratoxin A

Aflatoxins (AFs):

- Best known and most widely studied
- Produced by *Aspergillus* species mainly in hot and humid climates contaminating products including wheat
- Can colonize crops under uncontrolled storage conditions
- Chronic exposure was reported to increase the risk of liver cancer – the most potent form is aflatoxin B_1 (AFB1)

International Agency for Research on Cancer (IARC) carcinogens classification



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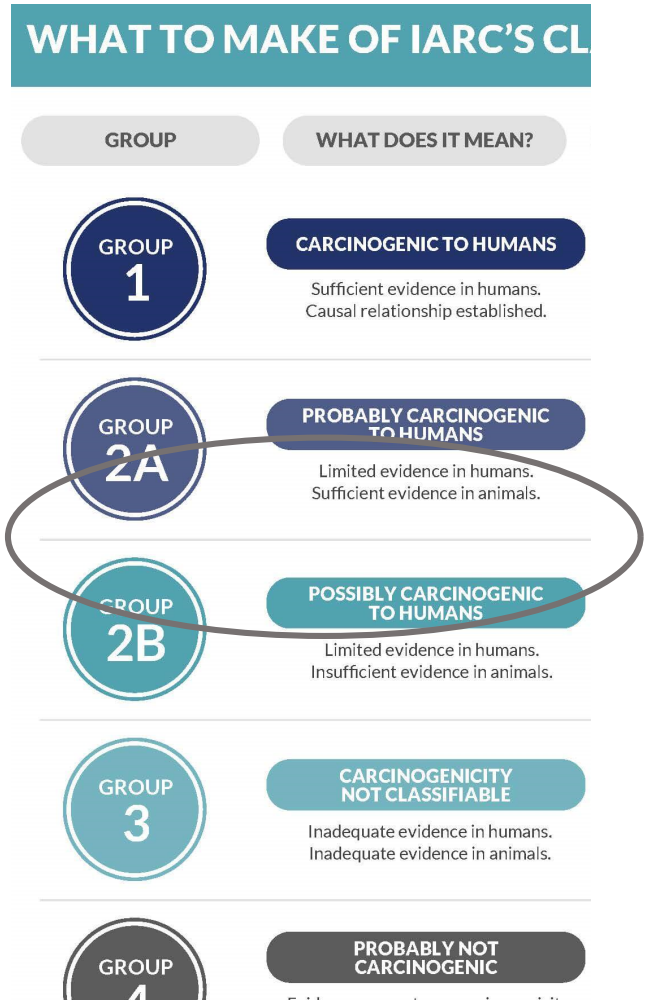
Aflatoxins and Ochratoxin A

Ochratoxin A (OTA):

- OTA is produced by widespread *Aspergillus spp.* and *Penicillium spp.*
- Contamination usually happens during storage
- Can be found in wheat
- OTA consumption can cause toxic effects mainly nephropathy and kidney cancer
- OTA is classified as a possible carcinogen to humans - group 2B by IARC

International Agency for Research on Cancer (IARC) carcinogens classification



Mycotoxins in Lebanon

Previous studies done in Lebanon showed contamination of Lebanese food with mycotoxins including AFs and OTA

This could be due to several factors mainly:

1- The Lebanese weather and climate

2- Poor agricultural practices

3- Poor storage practices

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Mycotoxins in Lebanon

2- Poor agricultural practices

Poor agricultural practices can lead to contamination with mycotoxins on field

A study showed the contamination of Lebanese cultivated wheat samples collected from the field where AFB1 and OTA were found in 71.8% and 84.6%, with 35.2% and 23.7% of samples with contamination levels exceeding the maximum limits, respectively. (Joubrane et al., 2011)

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Mycotoxins in Lebanon

3- Poor storage practices:

Uncontrolled conditions can lead to contamination in storage

This was previously demonstrated in a study, that showed the contamination of Lebanese stored wheat samples collected from the storage warehouses where AFB1 and OTA were found both in 48.3% of samples with 24.3% and 27% of samples with contamination levels exceeding the limits, respectively. (Joubrane et al., 2020)

“The storage warehouses lack any control of temperature and humidity causing the crops to be prone to fungal attack; pest infestation was reported, and storage hygiene measures were not applied”

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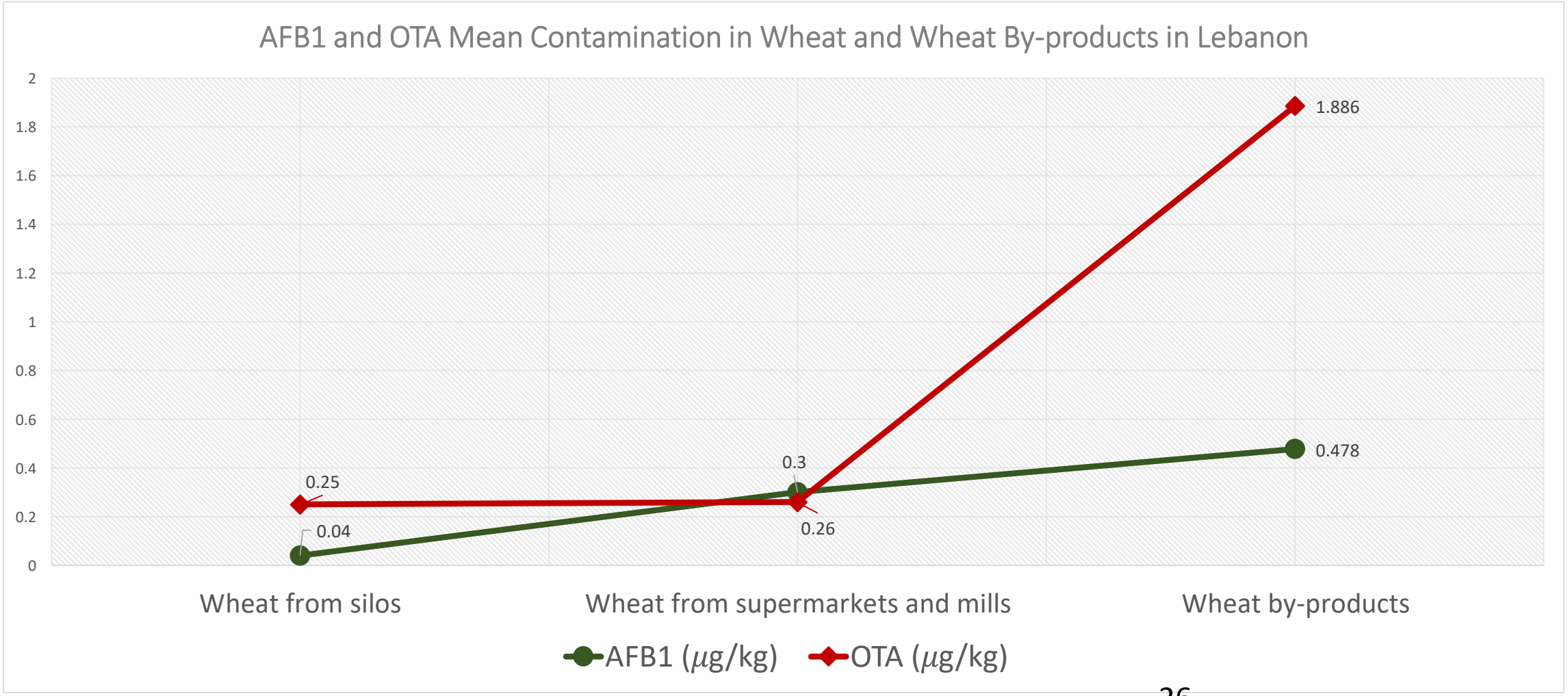
Aflatoxin and Ochratoxin A contamination in wheat and by-products in Lebanon



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(Daou et al., 2021)

Critical Opinion

- The silos were considered as a critical control point to prevent contamination of wheat in storage and maintain their quality

- With the destruction of the silos there is an increased risk of AFB1 and OTA contamination in Lebanon, especially, since previous studies have shown the contamination of wheat stored in warehouses that lack any control on safety measures

- The food security of Lebanese people is threatened as well, taking into consideration that Lebanon does not produce enough wheat that is used to produce the staple food (bread) and relies heavily on imports

- The destruction of the silos coincided with the period of Covid-19 pandemic, followed by Lebanese economic collapse and high inflation, and the Ukraine-Russia war in making it almost impossible to establish new controlled storage facilities to ensure food safety due to limited resources

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Conclusion

- There is an urgent need to establish modern grain silos in Lebanon

- Risk assessment studies are needed to explore the contamination frequency with aflatoxins and OTA after Beirut port explosion and check their effect on public health

- Traceability systems need to be developed to follow the wheat through the entire food chain (from admission to the level of consumption) and ensure food safety control at every stage to decrease chemical contamination by mycotoxins, specifically, during storage

- Local wheat production and the investment in soft wheat cultivation should be encouraged

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