



CSE Investigation
Business of Adulteration of Honey

Media release
Dec 02, 2020

THE HONEY TRAP



Why this investigation?

- We were **alerted** that beekeepers from North India (and other parts) were in deep distress
 - **Business** had turned **unprofitable**
 - **Prices** of raw honey had **crashed** like never before

- But why? We asked. After all,
 - **Sale of honey is booming** due to the threat of **Covid-19**
 - The Union government has a **massive programme** for beekeepers—some **Rs 500 crore** is being spent to build their livelihoods





We travelled; got some clues...

- **Heard a *grim story* repetitively from beekeepers**
 - Were getting good rates till 2014-15; then prices started to fall
 - From Rs 150 per kg to Rs 60-70 per kg
- **Small and large traders confirmed the *price crash*, but were less open about reasons**
 - One mentioned: *“We have heard that honey is mixed with **sugar syrup**, and this syrup made from rice and other crops can pass all laboratory tests. Companies are mixing this sugar syrup with a **little honey** and making **huge profits**.”*
 - Other divulged that he heard **Chinese companies** had come with their technology and had set up factories in Jaspur in Uttarakhand, Dhampur in Bijnor, UP, and Batala in Punjab; Another from Rampur confirmed this
- **There was something going on; but what?**
 - These businesses, even if tracked down would say they were producing sugar syrup for selling to confectionary and other industries. **Legitimate businesses!**



Part 1

Adulteration business

**The business of adulteration
is devious and evolving**





Honey is the most adulterated food in the world

The globally accepted definition of honey by the Food and Agriculture Organization's (FAO's) Codex Alimentarius Commission is:

“(it) is the natural sweet substance produced by honeybees from the nectar of plants or from the secretions of living parts of the plants or excretions of plant sucking insects on the living parts of the plants, that bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honey comb to ripen and mature”.

If honey is adulterated with sugar it is not honey





The business of adulteration has constantly evolved to beat laboratory tests

- **Globally, the first test added was for C4 sugar syrups**
 - From plants like corn and sugarcane (C4 photosynthetic pathway); this could then be detected by lab
- **So adulteration business evolved to beat laboratory tests**
 - Sugar from another category of plants used - rice or beetroot (C3 photosynthetic pathway)
- **Laboratories came up with:**
 - Isotope tests to detect adulteration (C4 first and then C3 sugars)
 - Special Marker for Rice Syrup (**SMR**) and Trace Marker for Rice Syrup (**TMR**) – for rice syrup (C3)
 - **Foreign oligosaccharides** – to detect starch-based sugars, like rice syrup (C3) and corn (C4)

So now the game is to beat the tests that can detect C3/C4 by adding a modified sugar syrup that can bypass and go undetected

Honey fraud is a big concern across the world

HONEYGATE

The adulteration of honey is a global phenomenon—**its trail goes everywhere.** Countries are struggling to stay ahead of the evil designs of companies who are engaged in the ever-evolving business of honey fraud

Canada

The Canadian Food Inspection Agency, launched an enhanced honey authentication surveillance in 2018-2019. **240 samples were collected** and analysed using both the Isotope Ratio Analysis and NMR. It found some **27 per cent of the samples—imported honey brands—unsatisfactory** on one or the other test. Based on this, the agency claimed inspection had stopped close to 13,000 kg of adulterated honey from entering the country.

USA

The world's biggest honey market—it produces much below what it consumes—and so exporters line up to sell here. In 2017, domestic production only met 25 per cent of total US honey consumption. In 2009-2010, it was found that Chinese exporters were transshipping their products through other countries, including India, to hide the origin of honey. **The food scandal called honey-laundering was busted.** More recently there is concern about quality and adulteration of imported honey. In May 2020, the US House Committee on Homeland Security directed the Customs and Border Protection Agency to use the best technology available, include the purchase and use of NMR equipment, and also to develop a comparison database of honey.

European Union

In 2015, the European Commission started a coordinated monitoring plan to study the prevalence of adulterated honeys in the European market (2,264 samples). **In this study, roughly 40 per cent of the samples (893),** which were compliant with standards were sent for further examinations with LC-IRMS, a method that couples high-performance liquid chromatography with isotope ratio mass spectrometry. Analysis showed "foreign" sugar had been added in roughly 20 per cent of the sample tested and that these sugars had remained undetected in the previous tests. It recommended that not only should a European honey reference database be created but also complementary tests should be used for analysing quality and integrity of honey.

Australia and New Zealand

In October 2018, scientists at Macquarie University tested 100 samples of honey—Australian and from other countries—which they bought from local supermarkets. **One in five samples were found to be adulterated—mainly with sugar syrups**—including domestic honey. The study pointed out that the country only tests 5 per cent of the samples and only those that are imported and only for C4 sugar. **This came just after another scandal** had broken out that involved Australia's largest honey brand—Capilano—when it was found that of the 28 samples of mixed blossom honey that were tested, half were found to be adulterated. The tests were done in Germany using NMR technology for detection of sugar syrup in the honey. Capilano denied any wrongdoing; attacking the tests. However, there was widespread support for the need for new testing methods, like NMR and it was revealed that the Australian Bee Industry Council (which includes Capilano) had written to the government asking for NMR tests to be introduced. Other brands accused of selling fake honey withdrew their bottles from the shelves. In New Zealand, NMR is increasingly becoming popular because of export of their high-value honey to EU customers. It is also being used to detect false C4 test positives such as in case of Manuka honey.



Changing standards; issuing directions: something is afoot

2010: CSE lab found antibiotic residues in honey

2014: FSSAI amends honey standards to include antibiotic residue limits

2017: FSSAI drafts standards for honey, which includes tests to detect cane and rice sugar (C3 and C4 sugars)

2018: FSSAI notifies standards with some minor changes

2019: FSSAI reverses decision to test key parameters such as SMR, TMR and Foreign oligosaccharides that would have allowed detection of rice sugar and other adulteration in honey

December 2019 & June 2020: FSSAI informs state food commissioners that sugar syrups are being used for adulteration. Asks for regular inspections

February 2020: Ministry of Commerce makes it mandatory for honey exports to be screened using NMR technology to detect sugar syrups. EIC (Export Inspection Council) sets up laboratory for this check

May 2020: FSSAI says it has been informed about adulteration of honey using golden syrup, invert sugar syrup and rice syrup. It asks importers to register with it and to inform of the usage of imported products

July 2020: FSSAI reinstates key parameters, but not one additional test TMR to detect rice syrup. Issues 2020 Standard.



Playing around with benchmarks

How key parameters to check honey quality have changed in recent years

In India FSSAI Standards for honey purity have been revised again and again

One major change in the latest July 2020 notification: TMR excluded

	Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011	Draft notification: Food Safety and Standards (Food Products Standards and Food Additives) Amendment Regulation, December 2017	Food Safety and Standards (Food Products Standards and Food Additives) Ninth Amendment Regulations, (July, 2018)	Food Products Standards and Food Additives, Amendment Regulations, (July, 2020)
Fructose-glucose ratio	Not less than 0.95% by mass	0.95-1.20	0.95-1.50	0.95-1.50
Hydroxy methyl furfural (HMF), mg/kg, Max ⁽¹⁾	80	80	80	80
Diastase activity, Schade units, Min ⁽²⁾	No Provision	8	3	3
C4 Sugar, per cent. by mass, Max ⁽³⁾	No Provision	7.0	7.0	7.0
(a) $\Delta\delta^{13}C$ Max (Maximum difference between all measured $\delta^{13}C$ values); per mil ⁽⁴⁾	No Provision	± 2.1	± 2.1	± 2.1
(b) $\Delta\delta^{13}C_{Fru} - Glu$ (The difference in $^{13}C/^{12}C$ ratio between fructose and glucose); per mil ⁽⁴⁾	No Provision	± 1.0	± 1.0	± 1.0
(c) $\Delta\delta^{13}C$ Protein – Honey (The difference in $^{13}C/^{12}C$ between honey and its associated protein extract); per mil ⁽⁴⁾	No Provision	$\geq - 1.0$	$\geq - 1.0$	$\geq - 1.0$
Pollen count/g, Min	No Provision	50,000	25,000	5,000
Specific Marker for Rice Syrup (SMR) ⁽⁵⁾	No Provision	Negative	Negative	Absent*
Trace Marker for Rice Syrup (TMR) ⁽⁶⁾	No Provision	Negative	Negative	No Provision
Foreign oligosaccharides ⁽⁷⁾	No Provision	Nil	0.1 (Max per cent)	0.7 (max per cent peak)
Proline, mg/kg, Min. ⁽⁸⁾	No Provision	200	180	180

* Honey standard operationalised

NOTE: (1) Hydroxymethylfurfural (HMF) is absent in fresh honey and increases during processing and/or ageing of the product; thus, it provides an indication of overheating and storage in poor conditions. According to Codex, HMF after processing and/or blending shall not be more than 40 mg/kg, except from countries or regions with tropical ambient temperatures, where the HMF content shall not be more than 80 mg/kg; (2) Diastase is an enzyme naturally present in honey and is an indicator of the quality of honey. Heating the honey degrades the enzyme, which is why honey standards state minimum values. According to the Codex and EU standards, the diastase activity must not be less than 8 for processed honey, with exception given to honey with low enzyme content wherein this minimum value is set at 3. In India, this has been reduced from 8 to 3 in the last few years for all types of honey, including processed; (3) C4 sugar: Elemental Analysis-Stable isotope ratio mass spectrometry (EA-IRMS) was accepted as an official method by Association of Official Analytical Chemistry (AOAC); (4) C3 sugar: By applying liquid chromatography (LC)-IRMS for the determination of the ^{13}C values of fructose, glucose, and sucrose in honey, and calculating the differences ($\Delta\delta^{13}C$) between these values, both the adulteration with C4 and C3 sugars can be detected; (5) Specific marker for rice syrup (SMR) and (6) Trace marker for rice syrup: rice syrup is difficult to detect by isotopic ratio analysis because it is derived from C3 plants. 2-acetylfruran-3-glucopyranoside (AFGP) is a specific compound in rice syrup that can be used as a marker for the detection of honey adulteration. (7) Oligosaccharides: are not normally present in authentic honeys at high concentrations and are therefore indicative of the presence of exogenous sugars. Spiking experiments have revealed that adulteration with rice syrup (C3 plant) could be detected using the per cent area of the oligosaccharide peak parameter. It is possible to detect adulteration with rice syrup at concentrations > 3% using the oligosaccharide per cent peak area parameter which was > 0.7% at this level of adulteration; (8) Proline: free amino acid used as an indication of quality in honey. Most of the proline in honey originates from the secretion of honeybees.



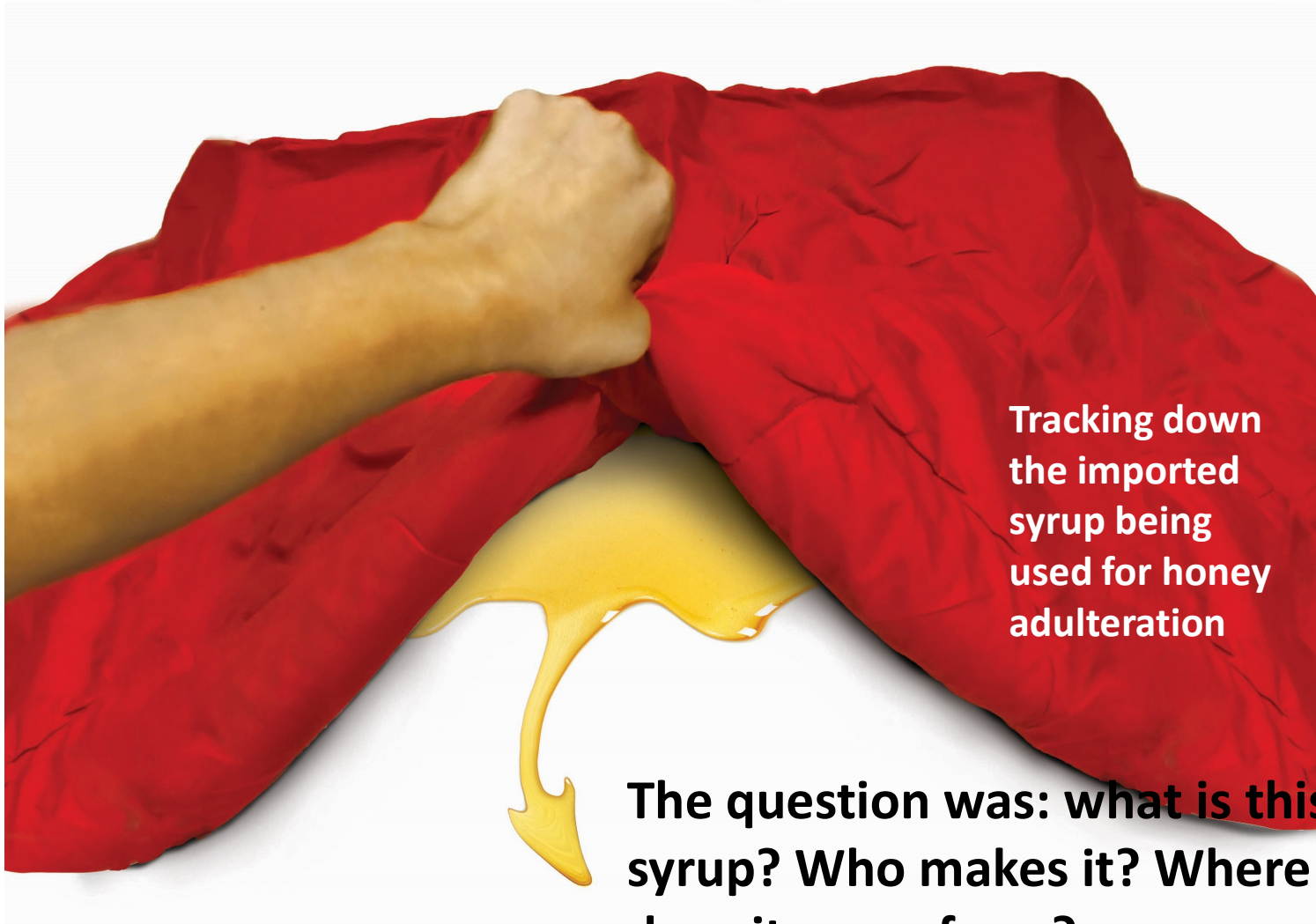
In India, government knows (but is not telling) that something is seriously wrong

- **The government (Ministry of Commerce and Industry) has mandated additional advanced tests for honey (NMR) that will be exported**
 - It shows that government suspects or knows that Indian honey has some adulteration, but is not being detected using tests for C3 and C4 sugars
- We filed an application under the Right To Information Act (RTI) with the Imports Division of FSSAI
 - Asked for information received from industry and to understand what further steps are being taken to check the source of adulteration by imported sugar syrup
 - **FSSAI has said it has sent the RTI application to another division, but has not cared to say which one**
- So, **either FSSAI knows** what is going on, and is not telling us—the consumers—**or, it is fishing around** to see if it can find the honey fraud and stop it



Part 2

Leads to China



Tracking down
the imported
syrup being
used for honey
adulteration

**The question was: what is this
syrup? Who makes it? Where
does it come from?**

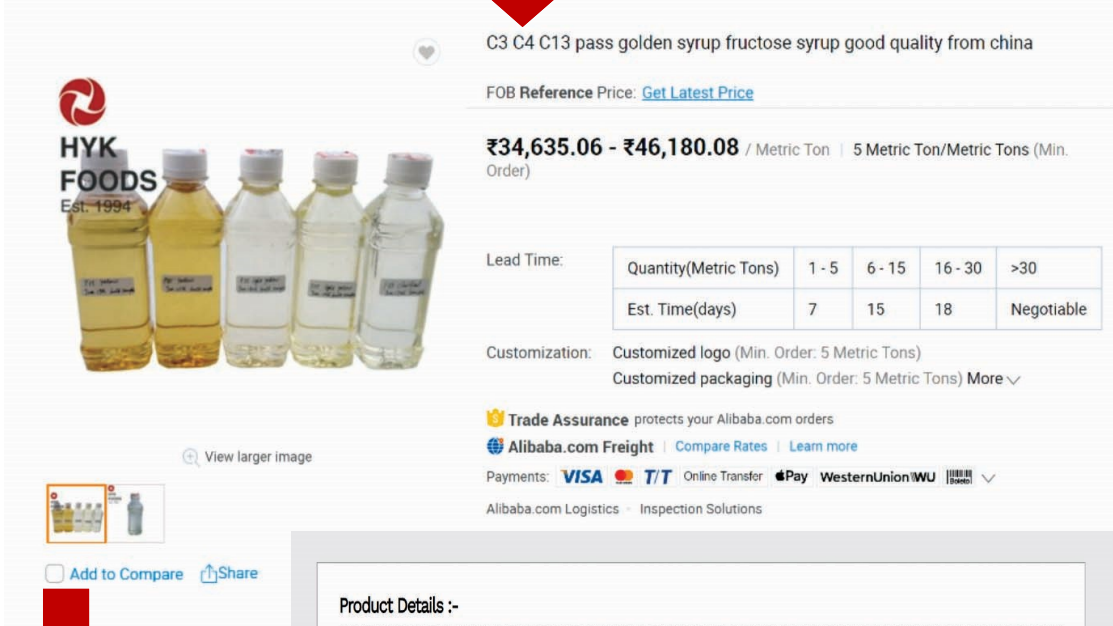
Clues but dead-end

- **FSSAI directive on import of golden syrup, invert sugar syrup and rice syrup used for adulteration is a dead end**
- **But we find Chinese trade portals like Alibaba advertising fructose syrup that can bypass tests C3 and C4**
- **Same Chinese companies that advertise this fructose syrup that can beat C3 and C4 tests also export to India**



Chinese companies are in the lead

Chinese trade portals like Alibaba advertise fructose syrup that can bypass tests



C3 C4 C13 pass golden syrup fructose syrup good quality from china

FOB Reference Price: [Get Latest Price](#)

₹34,635.06 - ₹46,180.08 / Metric Ton | 5 Metric Ton/Metric Tons (Min. Order)

Lead Time:

Quantity(Metric Tons)	1 - 5	6 - 15	16 - 30	>30
Est. Time(days)	7	15	18	Negotiable

Customization: Customized logo (Min. Order: 5 Metric Tons)
Customized packaging (Min. Order: 5 Metric Tons) [More](#) ▾

Trade Assurance protects your Alibaba.com orders

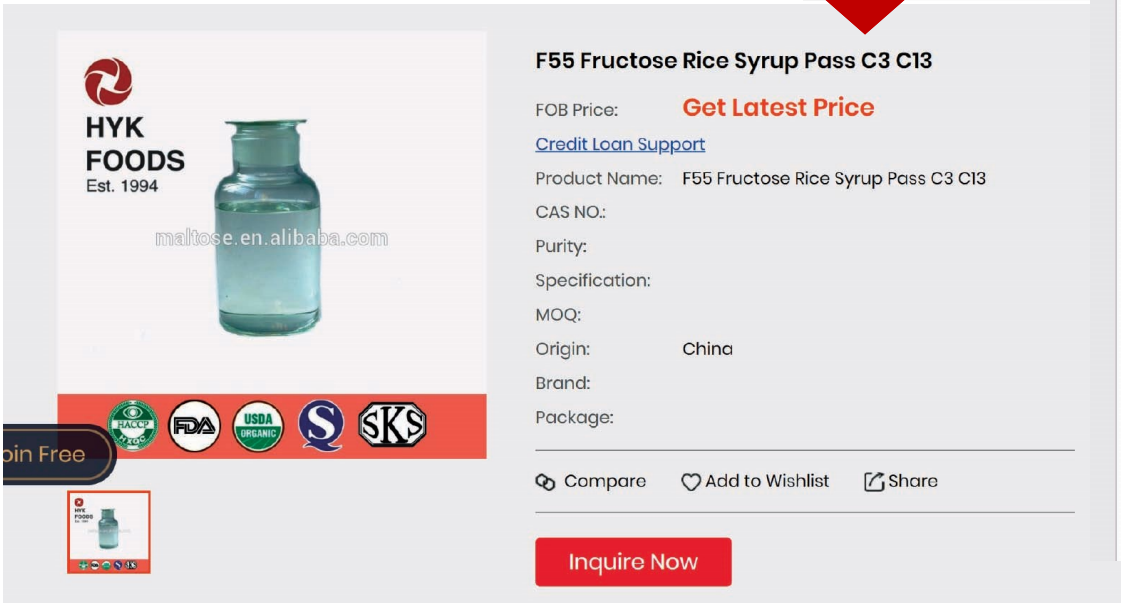
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HYK FOODS
Est. 1994

[maltose.en.alibaba.com](#)

F55 Fructose Rice Syrup Pass C3 C13

FOB Price: **Get Latest Price**

[Credit Loan Support](#)

Product Name: F55 Fructose Rice Syrup Pass C3 C13

CAS NO.:

Purity:

Specification:

MOQ:

Origin: China

Brand:

Package:

[Compare](#) [Add to Wishlist](#) [Share](#)

[Inquire Now](#)

[Join Free](#)

Product Details :-

Offered By	Wuhu Deli Foods Co.,Ltd
Product Added On	Mar 09, 2016
Last Updated On	Mar 11, 2016

Product Description :-

We are engaged in manufacturing and supplying excellent quality High Fructose Syrup in Wuhu, Anhui Province, China.

High fructose rice syrup passed C3 C4 C13

Fructose syrup 42 Brix 71%

Fructose syrup 55% Brix 75%

Packaging & Shipping

Packages of High fructose rice syrup passed C3 C4 C13 for sale :

Retail Package: 1kg, 2.5kg, 5kg etc

Bulk Package: 25kg, 75kg, 290kg, 1.4mt tote etc

Popular package is 290kg/plastic drum or Iron drum, 80drums



We track down the import database to get answers

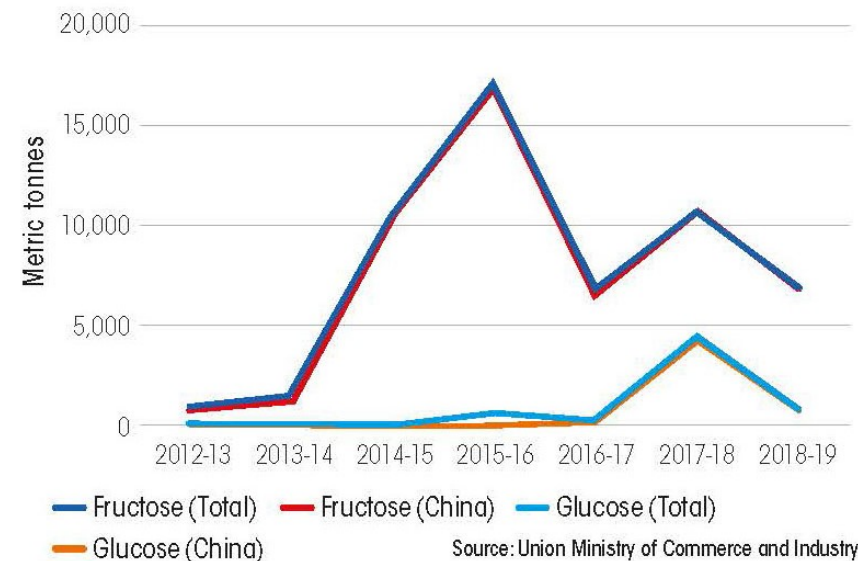
- In the export import database of the Union Ministry of Commerce and Industry, two of the FSSAI named syrups —**rice syrup and golden syrup**— could not be found (**no separate HS codes**)
- “**Invert sugar**”, the third one – had an HS code **but limited shipments**
- Repeated use of the terms fructose and glucose on Chinese websites prompted us to look at the imports of these from China

We found:

- **China is driving the trend of fructose syrup and glucose quantity imported in India**
- **The average quantity of fructose is over 10,000 MT every year since 2014-15**

Indelible link

Fructose and glucose Imports to India from China and rest of the world



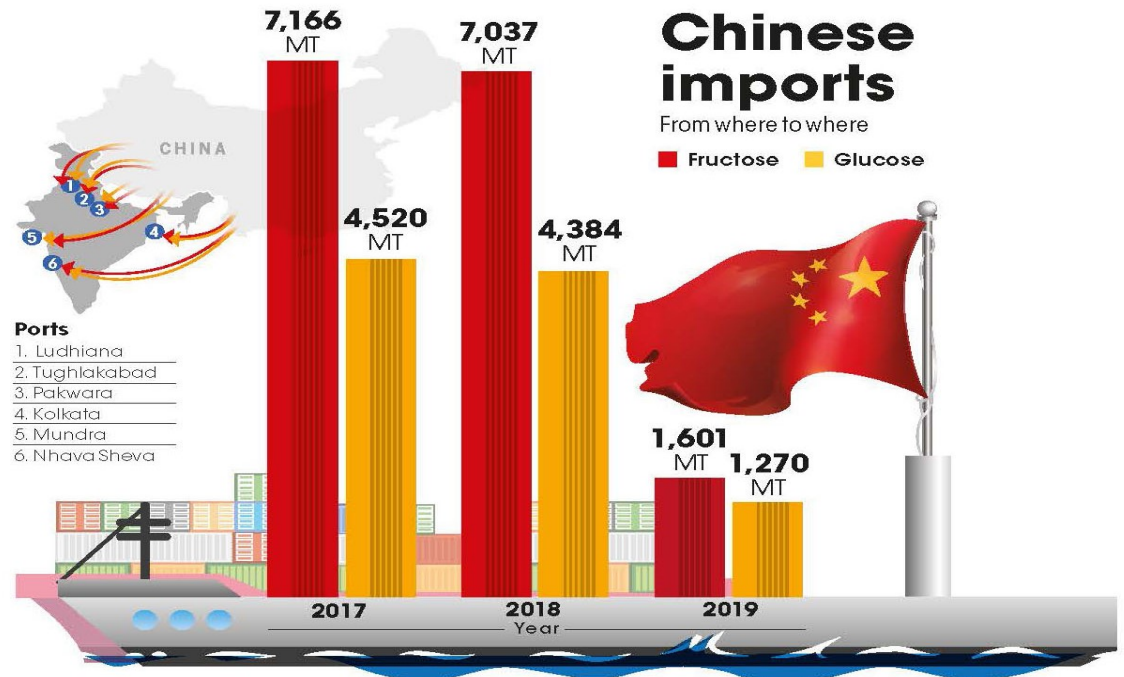


Same Chinese companies that advertise this fructose syrup that can beat C3 and C4 tests also export to India

From a trade base, we found:

- In the last four years, more than 11,000 MT of fructose syrup had come from these sellers (~70 per cent of the total from China) as ‘industrial raw material’
- Buyers were from Punjab (Faridkot, Patiala and Rajpura); Delhi NCR; Jaspur and Kashipur (Uttarakhand).

On the face of it, these companies appear to be the legitimate syrup or honey suppliers (don’t mention about passing adulteration tests on their websites)



	FRUCTOSE	GLUCOSE
2017	<p>Major sellers Wuhu Runquin daily necessities, Wuhu Haoyikuai Import and Export (HYK foods), Wuhu Deli</p> <p>Ports/No. of shipments Kolkata 27, Ludhiana 30, Pakwara 7 Nhava Sheva 11, Tughlakabad 2</p>	<p>Major sellers Hunan Huisheng, Anhui Baihe Foodstuff Co. Ltd., Anhui Shunxin</p> <p>Ports/No. of shipments Nhava Sheva 10, Tughlakabad 27 Pakwara 1, Mundra 1</p>
2018	<p>Major sellers Wuhu Runquin daily necessities, Wuhu Haoyikuai Import and Export (HYK foods), Wuhu Deli</p> <p>Ports/No. of shipments Kolkata 20, Ludhiana 35, Nhava Sheva 7 Tughlakabad 2, Pakwara 7</p>	<p>Major sellers Anhui Shunxin, Hefei Dangbao Import and Export, Anhui Baihe Foodstuff Co. Ltd.,</p> <p>Ports/No. of shipments Nhava Sheva 19, Pakwara 29</p>
2019	<p>Major seller Anhui Yuan Sen</p> <p>Ports/No. of shipments Kolkata 4, Ludhiana 2, Tughlakabad 4 Pakwara 3, Mundra 2</p>	<p>Major seller Wuhu Deli</p> <p>Ports/No. of shipments Pakwara 5, Mundra 1, Nhava Sheva 2</p>



Part 3

How we broke honeygate

**An undercover operation to
contact Chinese sellers of sugar
syrup brought to light the shady
business**





- **We sent emails to Chinese companies soliciting syrups that could pass tests in India**
- **These are the same Chinese companies that export fructose syrup to India**
- **Replies received that syrups are available and can be sent to India**
- **Chinese companies inform us that even if 50-80 per cent of the honey is adulterated with syrup it would pass all stipulated tests**
- **Chinese company export syrup as paint pigment**
- **Company routes sample through Hong Kong to bypass custom clearance**

The China trail

A record of our correspondence in soliciting syrups that can pass Indian tests

September 21, 2020

We wrote to two Chinese companies Wuhu Deli Foods Co. Ltd and CNNFoods—both based in An Hui Province—asking for syrup/rice syrup that could pass Indian honey testing protocols.

September 22 Wuhu Deli replied their produce met our requirements and specified the rates for F48 and F55.

The company also wanted to know which Indian port it would ship the produce.

Dear [redacted]

Pls check the current quotation as below:
1.F48 C3,C4,SMR,TMR, Oligosaccharides passed HMF less than 20 ;FOB WUHU USD\$ 725.00/MT;
2.F55 C3,C4,SMR,TMR, Oligosaccharides passed HMF less than 20 ;FOB WUHU USD\$ 770.00/MT;
Pls notice that the above quotation is based on 10 containers quantity,if you ned CIF price, pls advise which port is nearby you.
Any other needs pls feel free to contact with us.
Best wishes,
Lisa

Vice General Manager

Wuhu Deli Foods Co.,Ltd.
p: +86 553 4815511 m: +86 18755353636
f: +86 553 4815
a: Gangxi Develc District, Wuhu

September 24, 2020

The other company—CNNFoods—replied saying that they could supply us fructose syrup of any fructose glucose ratio (FG).

Dear [redacted]

As this is our first cooperation, we offer you our best prices with 10 fcls as below:
...QUALITY: C3, C4, SMR, TMR, Oligosaccharides pass, HMF 20max
F48(FG 0.95min) : USD 620/mt FOB China
F55(FG 1.2min) : USD 700/mt FOB China

What do you mean combination ratios? We can provide you any Fructose content (any FG) you require.

Best regards,
Christy Kai

21 Sep
to lisa@foodsell.com

Dear Mam,
We are looking for syrup that will pass honey requirements as per FSSAI. This includes C3, C4, SMR, TMR, Oligosaccharides, with HMF max 20. We would like to know F48 and F55 rates. I will also be grateful if you could advice me on the combination ratios. Thanks for your prompt reply.

With regards

Transaction details
24 September 2020 at 7:06:23 p.m. IST | Transaction ID: Z39F75Z2W8032393

Payment sent to 银联® | Gross amount
Payment status: Completed | -\$ 60.50 USD
Payment type: Goods and Services

Shipping address
Gangxi Develc District, Wuhu

Your payment
Gross amount -149.50 USD
Paypal fee 8.00 USD
Net amount -149.50 USD

Contact info
WUHU DELI FOODS CO., LTD
The recipient of this payment is verified and is located outside of the US.
foodsell@foodsell.com

Send to details
Funding Type: Debit Card
Funding Source: -149.50 USD - MASTER CARD ending in *-0126
This transaction will appear on your bill as PAYPAL *FOODSELL

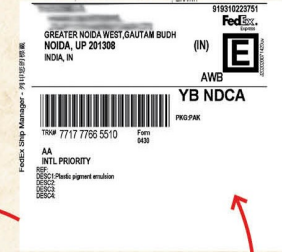
September 24, 2020

Meanwhile, Wuhu Deli agreed to ship the samples through FedEx or DHL provided we bear the cost of US\$ 60.50 for it. We transferred the amount through Paypal to Wuhu Deli same day.

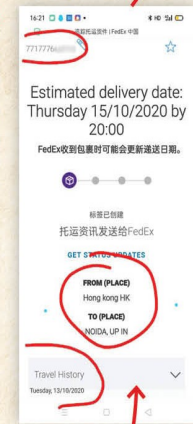


October 22
We received the samples.

October 20
CNNFoods sent us the commercial invoice and material data safety sheet of the samples. Instead of honey or syrup, the samples had been shipped as Plastic Pigment Emulsion.



October 13
CNNFoods sent us the samples (Fedex AWB 7717776XXXXX). The port of origin was shown as Hong Kong.



September 30

Wuhu Deli sent us the samples through FedEx. We received the invoice. But next day FedEx informed us that we needed a clearing agent to clear the samples at our end as it had come as cargo. We asked FedEx to cancel the shipment.

WUHU DELI FOODS CO., LTD
PROFORMA INVOICE

MARK	DESCRIPTION	Quantity	UNIT PRICE	AMOUNT
NM	SYRUP	2 pcs	USD0 50	USD1 00
TOTAL				USD1 00

Hey, [redacted] This is Christy from China selling syrup.

Don't bother to check your clearance agent company's name and address now. We are just informed by our courier we can send out samples to India by transforming from other countries.

Ok, thanks very much

Because of the political situation between China and India is not easy now, there might be troubles with all packages to indian customs.

We send samplesto india very often.

October 8
CNNFoods in a message on Whatsapp informed us that they would courier the samples from another country to save us the trouble of getting a clearing agent.



Part 4

Indian passage for adulteration

**Manufacturing of adulterant
syrops has begun closer home**





Chinese technology now in India

- We hear that Chinese companies have sold technology for bypass syrup to India
- We track down factory that manufactures syrup to adulterate honey to Jaspur in Uttarakhand
- We learn that that the code word is “**all pass**” syrup
- We make contact and procure a sample of this “all pass syrup”
- It will pass all stipulated tests for honey purity says the owner





Part 5

When we spiked honey with Chinese and Indian 'all-pass' syrups

**If the samples passed the tests
for purity, it would show that
such syrups worked**





We spiked honey with Chinese and Indian all-pass syrups

- **We adulterated samples of pure honey**
- **Mixed Chinese and Indian all pass syrups at 25%, 50% and 75%**
- **Sent samples to laboratory**
 - Same Indian laboratory (CALF of NDDB) where honey samples were tested for key adulteration parameters set by FSSAI
- **Adulterated samples with 25% and 50% sugar syrup passed the test of purity**
- **We confirm that sugar syrups exist that can bypass the 2020 FSSAI standard for honey**



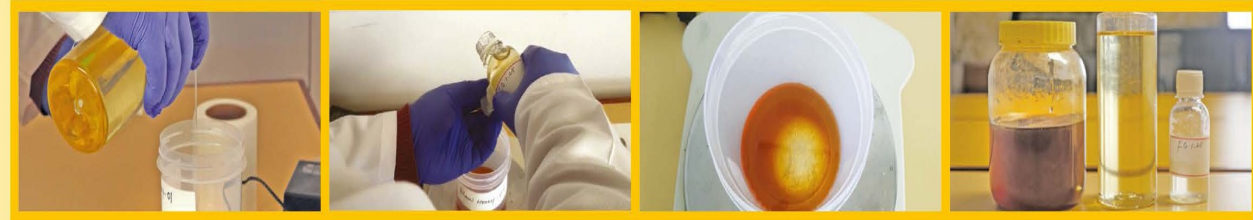
Raw honey sourced directly from a beekeeper in Bharatpur from the nectar of *ber* plant sucked up by bees in Jaisalmer

Scientists from CSE's Environmental Monitoring Lab "mixed" the syrup and honey using scientific tools and procedures

75% spiked sample failed; it was clear others passed because the adulterant could not be detected

Lab results of deliberately adulterated honey

Samples with adulteration up to 50 per cent pass Indian tests



	Honey	Adulterated with	Ratio: Honey Syrup (g)	13C Isotope Analysis (C4/C3-Sugars)	Foreign oligo-saccharides
1	Raw honey	Indian "all pass" syrup	75:25	Passed	Passed
2	Raw honey	Indian "all pass" syrup	50:50	Passed	Passed
3	Raw honey	Chinese syrup	75:25	Passed	Passed
4	Raw honey	Chinese syrup	25:75	Failed	Passed
5	Processed branded honey	Chinese syrup	75:25	Passed	Passed
6	Processed branded honey	Chinese syrup	50:50	Passed	Passed
Control sample	Raw honey			Passed	Passed

For complete test report, please visit www.cseindia.org





Part 6

Laboratory tests of honey we consume





13 top and smaller honey brands were selected; samples sent to Indian and German lab

Samples	Lab	Tests
8 processed honey	CALF, NDDB*	Adulteration, quality (FSSAI 2020)
5 samples (4 raw+1 processed)	CALF, NDDB	Adulteration, quality (FSSAI 2020)
13 samples (same batch) 4 samples (2 each of different batch of 2 brands)	German lab [^]	Advanced testing: NMR profiling, TMR
5 samples of major brands (for reconfirmation – which failed on NMR in the first round)	German lab	Advanced testing: NMR profiling, TMR

*Centre for Analysis and Learning in Livestock and Food, National Dairy Development Board, Gujarat, India; ^ A renowned food testing laboratory in Germany; samples sent through Indian counterpart; name not disclosed as per the agreement with lab; if required all details could be shared with government agencies; Export Inspection Council (EIC) near Mumbai that had the equipment to test for NMR was not open for us to send samples.

Laboratory tests

- **We select 13 top and smaller honey brands**
- **We first send samples of 8 top brands to NDDDB state of the art laboratory for tests (August 2020)**
- **All honey tested passed the laboratory tests for Indian standards (except Apis Himalaya). Laboratory does not find adulteration of C3 and C4 sugar in these brands**
- **We then bought five smaller brands and sent to same laboratory**
- **Most of the smaller brands fail the laboratory tests for Indian standards**
- **Adulterated with C4 sugar in most cases**

Incomplete story

- By then we had tracked down the modified syrups; we knew there was more to this story
- **We then sent samples are sent to top laboratory in Germany**
- **And the picture changes**
- **Many passed samples fail on Trace Marker for Rice (TMR)**
- **Almost all samples fail on NMR. Laboratory says indicates adulterated/addition of sugar syrup**



What is NMR?

- **NMR** is seen as the **gold-standard** for testing for adulteration in honey
 - Think of NMR as the difference between X-ray and blood test and **Magnetic Resonance Imaging (MRI)**
 - The technology uses imaging to get a full picture of the honey and its constituents
 - Identifies the **origin** of the honey and its **authenticity**

- Developed by a German company and **now governments** are using it to **check origin** and **adulteration** in honey
 - It is also clear that very soon **even this technology will get obsolete** as the adulteration business will find new ways



Honey is adulterated

Advanced tests which can detect modified sugar syrups confirm this

- Samples sourced from retail stores from Delhi and major online stores b/w Aug-Nov 2020
- Overall 22 samples sent to the German lab for advanced testing
- Two additional samples each of Dabur and Saffola also sent (different batches); they advertise their products are NMR tested

Lab	Brand	Tests from Indian lab					Tests from German lab		Interpretation as provided by the German lab	
		C4	$\Delta\delta^{13}C$ p-h	$\Delta\delta^{13}C$ Fru - Glu	$\Delta\delta^{13}C$ Max.	Foreign oligosaccharides	SMR	TMR		NMR
FSSAI specification		Max. 7%	≥ -1.0	± 1.0	± 2.1	0.7	Absent* (MRPL-1 mg/kg)	LoQ 15 ppb (w)		
		1	2	3	4	5	6	7	8	
01	Dabur Honey	Pass 0.0	Pass 0.1	Pass (-)0.1	Pass (-)1.1	Pass ND	Pass Absent	FAIL 25	FAIL	TMR: Unauthorised addition of rice syrup was detected NMR: Indicates adulteration/addition of sugar syrup
01A	Dabur Honey	-	-	-	-	-	-	Pass 15	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar
01B	Dabur Honey	-	-	-	-	-	-	Pass 15	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar
02	Patanjali Honey	Pass 0.0	Pass 0.3	Pass (-)0.9	Pass 1.0	Pass ND	Pass Absent	FAIL 33	FAIL	TMR: Unauthorised addition of rice syrup was detected NMR: Indicates adulteration/addition of sugar syrup
02A	Patanjali Honey	-	-	-	-	-	-	FAIL 39	FAIL	TMR: Unauthorised addition of rice syrup was detected NMR: Indicates adulteration/addition of sugar syrup
03	Apis-Himalaya Honey	Pass 4.6	Pass (-)0.9	Pass 0.1	Pass 1.7	FAIL 4.9	FAIL PRESENT	FAIL 27	FAIL	TMR: Unauthorised addition of rice syrup was detected NMR: Indicates adulteration/addition of sugar syrup
04	Baidyanath Honey	Pass 4.6	Pass (-)0.8	Pass 0.2	Pass 2.1	Pass ND	Pass Absent	Pass ND	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
04A	Baidyanath Honey	-	-	-	-	-	-	FAIL 41	FAIL	TMR: Unauthorised addition of rice syrup was detected NMR: Indicates adulteration/addition of sugar syrup
05	Zandu Pure Honey	Pass 2.7	Pass (-)0.5	Pass 0.0	Pass 1.3	Pass ND	Pass Absent	Pass ND	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
05A	Zandu Pure Honey	-	-	-	-	-	-	Pass	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
06	Nature's Nectar Honey	Pass 5.4	Pass (-)0.9	Pass (-)0.2	Pass 2.0	Pass ND	Pass Absent	Pass ND	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
06A	Nature's Nectar Honey	-	-	-	-	-	-	Pass ND	Pass	TMR: Unauthorised addition of rice syrup was not detected NMR: Does not indicate adulteration/addition of sugar syrup





- If sample fails on any of the parameters then it fails the adulteration test.
- Isotope testing: for C4/C3 sugars
- SMR-TMR: for rice syrup
- Foreign oligosaccharides: for starch based sugars – e.g. rice (C3), corn (C4)
- NMR: advanced testing for modified syrups

Lab	Brand	Tests from Indian lab						Tests from German lab		Interpretation as provided by the German lab
		C4	$\Delta\delta^{13}C_{p-h}$	$\Delta\delta^{13}C_{Fru-Glu}$	$\Delta\delta^{13}C_{Max.}$	Foreign oligosaccharides	SMR	TMR	NMR	
		Max. 7%	≥ -1.0	± 1.0	± 2.1	0.7	Absent* (MRPL-1 mg/kg)	LoQ 15 ppb (w)		
	1	2	3	4	5	6	7	8		
07	Hitkari Honey	Pass 1.0	Pass (-)0.2	Pass 0.6	Pass (-)0.5	Pass ND	Pass Absent	FAIL 19	FAIL	TMR: Unauthorised addition of rice syrup was detected NMR: Indicates adulteration/addition of sugar syrup
08	Saffola Honey	Pass 1.8	Pass (-)0.3	Pass 0.2	Pass 2.0	Pass ND	Pass Absent	Pass ND	Pass	TMR: Unauthorised addition of rice syrup was not detected NMR: Does not indicate adulteration/addition of sugar syrup
08A	Saffola Honey	-	-	-	-	-	-	Pass ND	Pass	TMR: Unauthorised addition of rice syrup was not detected NMR: Does not indicate adulteration/addition of sugar syrup
08B	Saffola Honey	-	-	-	-	-	-	Pass ND	Pass	TMR: Unauthorised addition of rice syrup was not detected NMR: Does not indicate adulteration/addition of sugar syrup
09	Markfed Sohna Honey	Pass 5.2	Pass (-)0.8	Pass (-)0.1	Pass 1.0	Pass ND	Pass Absent	Pass ND	Pass	TMR: Unauthorised addition of rice syrup was not detected NMR: Does not indicate adulteration/addition of sugar syrup
10	Dadev Honey	FAIL 20.2	FAIL -3.4	FAIL 5.1	FAIL 5.7	Pass ND	Pass Absent	Pass ND	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
11	Indigenous Honey	Pass 0.1	Pass 0.0	Pass (-)0.4	Pass (-)0.9	Pass ND	Pass Absent	Pass ND	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
11A	Indigenous Honey	-	-	-	-	-	-	Pass	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
12	Hi Honey	FAIL 26.6	FAIL -3.8	Pass 0.6	FAIL 10.5	Pass ND	Pass Absent	Pass ND	FAIL	TMR: Unauthorised addition of rice syrup was not detected NMR: Indicates adulteration/addition of sugar syrup
13	Societe Naturelle Honey	FAIL 8.1	FAIL -1.3	Pass (-)0.1	Pass 1.2	Pass ND	Pass Absent	Pass ND	Pass	TMR: Unauthorised addition of rice syrup was not detected NMR: Does not indicate adulteration/addition of sugar syrup

Note: '-' indicates samples not tested for this parameter. ND=Not Detected

Column (1): Quantifies C4 sugars

Column (2) to (4): By applying EA/LC-IRMS for the determination of the $\delta^{13}C$, adulteration with both C4 and C3 sugars could be detected

Column (5): Foreign oligosaccharides are starch-based sugars such as from rice, corn, and wheat—can be both C4 and C3 sugars

Column (6) and (7): These are markers for rice syrup, thus identify C3 sugars

Column (8): NMR shows addition of sugar syrup—could be either C4 or C3 plant based

For test report visit website www.cseindia.org





What has emerged

- **Three brands out of 13 brands**, namely Saffola, Markfed Sohna and Nature's Nectar (one sample), passed all tests, including NMR
- **Out of the 22 samples only five bottles passed NMR—77 per cent of the samples failed the NMR test**
- **Three brands, Dadev, Hi Honey and Societe Naturelle**, failed C4 sugar syrup tests indicating that their adulteration was “**basic**” and not with the use of modified sugar syrup.



What do we conclude?

- That much of the honey we consume is adulterated
- The business of adulteration is sophisticated and evolved. It uses sugar syrups that are “modified”
- The syrups are imported from China and are now also manufactured in India. Up to 50 per cent adulteration is certainly possible
- Economics works in favour of the adulterant
 - Rs 60 per kg of syrup vs Rs 120 per kg for raw honey for beekeeper
 - Easier to buy syrup in bulk than work on beekeepers supply chain
- The big-brand honey Indians are consuming has already caught up with the modified sugar syrup business; pass standards set by FSSAI
- The NMR technique is the only way to check for this modified syrup
 - But very soon there will be another adulterant in the market—this time it will even pass the NMR test
- Need to understand the impact on our health of this sugar-laden honey



Part 7

Immunity booster or buster?

What makes honey special and why honey adulterated with sugar is bad

The collage features several honey advertisements:

- Apis Himalaya Honey:** "BOOST YOUR FITNESS! INTRODUCING THE FITNESS HONEY". Benefits listed: 100% PURE HONEY, CINNAMON HELPS REGULATE LIPID PROFILE, GREEN TEA HELPS PROMOTE WEIGHT MANAGEMENT, LEMON HELPS ENHANCE METABOLISM. Includes an image of a woman meditating and a glass of lemon tea.
- Apis Himalaya Honey:** "I ONLY TRUST, TRUE SOURCE CERTIFIED HONEY!". "WHAT ABOUT YOU?". "STAY STRONG". Includes a "TRUE SOURCE CERTIFIED" logo and text: "True source Certification is an Internationally Accepted Standard for Quality Honey".
- Saffola Honey:** "Absolutely Pure, 100% Sure". Includes an image of Saffola Honey jars and the website "tabletkhabet.com Healthcare on ur Fingertips".
- Patanjali Honey:** "नैचुरल हनी का स्वाद, पतंजलि के साथ". Includes an image of Patanjali Honey jars.
- Dabur Honey:** "Hitkary Pure Honey". "We Knew it, Now Experts believe it too !!". "RANKED NO.1 BY CONSUMER VOICE". Includes an image of a Dabur Honey jar and a honey dipper.



The big question for us, the consumers...

- **Does it make a difference if the honey we are consuming is actually sugar?**
- **What are the honey's special properties that differentiate it from sugar? What will it do to our health if we have sugar, instead of honey?**
- **Does it have implications, particularly in this time of covid-19?**



Bad for our health; COVID-19 will be made worse

- **Honey is sugar but a special one, full of nature's goodness**
 - “sugar” of honey is transformed to goodness; honey is then not about the “sugar”, but the enzymes, amino acids, phenolic compounds like flavonoids, minerals and other phytochemicals
 - Has antioxidant, antimicrobial, anti-inflammatory properties
 - Scientifically proven to be good for our immune system and improves our well-being
- **We are consuming more honey to build immunity against the COVID-19 infection**
 - Immunity boosting claims by big honey selling companies; Sales were up by 35% until March; would be much more by now
 - With high level of sugar syrup, we are getting empty calories without benefits, which can lead to weight gain



Overweight people are more at risk to COVID-19; So consuming honey that is sugar will make us more vulnerable; more ill – it's a double jeopardy

- **In the US, CDC has said excess weight may have increased risks of severe covid-19 infection**
 - Risk expanded to larger numbers of people, who may not be declared “obese” but are “overweight”
- **Now link b/w weight and risk to disease is more clear:**
 - The adipose tissue—the fat in our bodies—is biologically active, promotes low intensity chronic inflammation; makes our body more immune suppressed and more vulnerable to coronavirus diseases
 - Problem of abdominal obesity also adds stress to the lungs
- **Studies are suggesting that the epidemic of obesity and Covid-19 can be viewed as a syndemic**
 - Negatively interact with one another to exacerbate the course of diseases, leading to greater complications and severe illness



Way forward We need pure honey

**It is time we
outwitted the
business of
adulteration**





Our ask from government, industry and the consumer

- **First: Need to stop import of syrups and honey from China**
 - Regulation is tough; need to stop all imports. It begins the clean-up – but not enough
- **Second: Need to strengthen enforcement in India public testing so companies are held responsible. Cannot play with our health**
 - Including NMR, however important, will be short-term as Chinese companies will design NMR bypass syrups
 - Test samples; make result public and hold companies responsible. If CSE can do this investigation and tests using NMR, FSSAI certainly can do this and more
 - **Every honey selling company must be required to be able to trace back the origins of the honey – from the beekeeper to the hive.**
- **Third: We consumers must be able to tell adulteration by the taste, the smell and the colour. Our health is in our hands.**
 - Consumer choice for liquid honey shaping business of adulteration; This is why adulterated honey thrives; honey which does not crystallize is no guarantee of a pure honey. **Consumers must demand change – crystallization of honey is not bad, it is honey properties, for instance**



Bees are critical for health of food system

- **Because of adulteration beekeepers are going out of business**
- **Farmers are losing livelihoods**
- **Without beekeepers there will be decline in bees**
- **Bees provide crucial service as pollinators**
- **Without bees we lose productivity of food; we lose life**