1-15 DECEMBER, 2020

DownToEarth

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INVESTIGATION

IT'S NOT HONEY

DANGEROUS
Almost all honey tested was found to be adulterated with sugar syrup

DELIBERATE
Chinese companies have designed sugar syrup that can bypass standard tests

DEVASTATING
Our health and livelihood of beekeepers are at risk

THE HO

INVESTIGATION INTO THE BUSIN

Lab tests find that almost all honey we consume is adulterated with sugar syrup

Indian standards for honey purity cannot 'catch' this kind of adulteration

We tracked down 'all-pass' sugar syrup from China and India

Chinese companies advertise that they have sugar syrups that can bypass Indian tests for honey

We sent honey of 13 brands for advanced tests to Germany

We spiked honey with sugar syrup and it still passed the tests

NEY TRAP

ESS OF ADULTERATION OF HONEY

Amit Khurana,
Arnab Pratim Dutta
and Sonal Dhingra

The same samples that passed in India failed adulteration tests in Germany

It is also bad for the livelihood of beekeepers who are going out of business

Without bees we will lose our agro productivity; we lose life

Adulteration of this nature's goodness with sugar is very bad for our health

THIS STORY begins in the mustard fields of north India where beekeepers are getting ready for the next honey season. When the yellow flowers are in bloom, the bees suck the nectar and bring us goodness in the form of honey, which we then consume because of its many beneficial properties. We were alerted that beekeepers from this region and other parts of the country were in deep distress—they had reached the point where their business had turned unprofitable in the past few years. Prices of raw honey had crashed like never before.

But why? We asked. After all, the sale of honey is booming—the threat of COVID-19 infection has made people consume more because of its anti-microbial and anti-inflammatory properties. Drinking a glass of water with honey and lime has become the practice for millions of households.

Also, we know the Union government has a massive programme for beekeepers—some ₹500 crore is being spent to build their livelihoods; giving money in the hands of honey producers. What then is making beekeepers lose heart in their business?

When *Down To Earth* travelled to these states, we heard a grim story repetitively. "We were getting good rates for our honey till 2014-15 and then they started to fall. From ₹150 per kg, now the rate is close to ₹60-70 per kg," beekeeper after beekeeper told us. Ram Gopal, a beekeeper from Bharatpur, a major region for raw honey production in Rajasthan, said, "I have doubled my hives, but today my income is less than what I used to get five years ago. I am planning to give it up." Amarnath Bhanwar Singh from Gango village in Saharanpur, Uttar Pradesh (UP), said: "I have abandoned beekeeping because of low profit margins." Sanjay Negi, who is both a beekeeper and trader based in Rampur, UP, said, "Beekeepers could survive only if they got a minimum price of ₹120 per kg. But the current price is simply not remunerative".

SOME CLUES

What are we missing? We wondered. We then approached small and large traders to understand what was happening with the market. They confirmed the price crash, but they were less open about the reasons. "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." But we don't know who does this. We have heard Chinese companies have helped set up sugar syrup factories in India. One prominent trader from Saharanpur, speaking on condition of anonymity, 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 trader from Rampur confirmed this, but would not divulge anything more. There was something going on; but what? These businesses, even if they could be tracked down, would say they were producing sugar syrup for selling to confectionary and other industries. All these are legitimate businesses and all above board. This was where our trail hit a block. The story almost ended here...

How can a beekeeper survive? We spend ₹90-100 to produce 1 kg of raw honey. But the prices of raw honey have fallen to ₹60 per kg. No wonder more and more beekeepers are leaving the profession

RAM GOPAL SINGH
Beekeeper
Bharatpur, Rajasthan

Since 2015, the only story you will hear from beekeepers is that they are facing big losses. Prices have been falling and our expenses have risen dramatically. In the last four years, I have suffered a loss of more than ₹20 lakh

OM PRAKASH
Beekeeper/trader,
Bharatpur, Rajasthan

The health of the consumers and the livelihood of beekeepers are affected because traders are illegally adding syrup to honey. If there are no beekeepers and bees who will pollinate the fields? This is the biggest threat to agriculture and to food security

MOHD AZIM ANSARI
Beekeeper/trainer,
Saharanpur, Uttar Pradesh

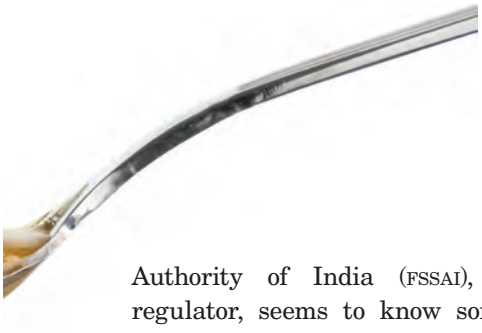
Adulteration business

As tests became more advanced and could detect adulteration, the industry has evolved and found new adulterants

- Honey is the most adulterated food in the world
- The business of adulteration has constantly evolved to beat laboratory tests
- Honey fraud is a big concern across the world
- In India, government knows (but is not telling) that something is seriously wrong
- Standards for honey purity have been revised again and again
- Government has mandated additional and advanced tests for honey that will be exported

THE GLOBALLY accepted definition of honey given 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. So, is the honey we consume adulterated with sugar?

The Food Safety and Standards



Authority of India (FSSAI), our food regulator, seems to know something is amiss. In the past few years, it has amended its standards for quality of honey twice and has issued directives to the industry. And each time, the amendment was to "catch" adulteration by one kind of sugar or another. FSSAI even ordered for regulation on the import of sugar syrup as it suspected it was used for adulteration. 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.

Honey is the most adulterated substance in the world—this is well-known in food circles. What is also known is that every time food regulators get close to checking the cause of adulteration, new ways are found to circumvent and work around this. Honey fraud is a well heeled enterprise. Honeygate is a global story (*see map* "Honeygate", *p*24).

MANY STEPS FORWARD AND A GIANT LEAP BACKWARD

For a good 60 years, quality standards for honey remained static. Nothing changed till December, 2014 when FSSAI added antibiotic limits to standards for honey. This happened after Centre for Science and Environment (CSE), a New Delhi-based non-profit, published its 2010 report on antibiotic residues in honey. This report was based on CSE's laboratory tests of popular honey brands that found residues of antibiotics in honey bottles. CSE also pointed out that there were no standards for antibiotic limits in honey that would be sold for domestic consumption—unlike what existed for export.

In 2010, FSSAI issued an advisory to clarify that pesticide and antibiotic residues were not allowed in honey. In 2014, the honey standard was amended to include tolerance limits for antibiotics—how much or how little the residue must be in honey to pass quality standard. Now beekeepers and honey producers were forced to ensure they did not use antibiotics for disease control. Or would do so, with careful management. These limits were brought in as there is growing concern about how bacteria-causing infections in our bodies are becoming resistant to antibiotics.

The 2014 standards seem to have spooked the honey processing industry. It needed to find ways to work around these limits—and what better than to add some sugar syrup into the product to "dilute" it. It could be "simple and effective".

We don't know if this happened. But we do know that in 2017, FSSAI issued a draft notification with substantial changes in the honey standard for public comments. In this draft notification, the food regulator, for the first time, included tests to detect sugar made from cane, rice, and other crops like beetroot. The tests were to check adulteration by "foreign" sugars in honey. This draft was issued to catch up with the business of adulteration that had grown and was being detected across the world.

Globally, the first test that was added was for C4 sugar syrups—this comes from plants like corn and sugarcane, which use a photosynthetic pathway called C4. This analytical method was developed by scientists to differentiate the "sugar" in honey from the "sugar" that would come from C4 plants. The 2017 draft included this test.

But globally adulteration business evolved with the sole objective to beat laboratory tests—this meant replacing the type of sugar that could be used for adulteration. To this end, another category of plants was used, this time that used photosynthetic pathway called C3. These plants are rice or beetroot. So, then laboratories came up with isotope tests to detect this adulteration and also Special Marker for Rice Syrup (SMR), Trace Marker for Rice Syrup (TMR), and foreign oligosaccharides, which help detect adulteration from starch-based sugars, like rice syrup.

Playing around with benchmarks

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

	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) Δδ13C Max (Maximum difference between all measured δ13C values); per mil (4)	No Provision	± 2.1	± 2.1	± 2.1
(b)Δδ13CFru – Glu (The difference in 13C/12C ratio between fructose and glucose); per mil (4)	No Provision	± 1.0	± 1.0	± 1.0
(c) Δδ13C Protein – Honey (The difference in 13C/ 12C between honey and its associated protein extract); per mil (4)	No Provision	≥ – 1.0	≥ – 1.0	≥ – 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 —13C values of fructose, glucose, and sucrose in honey, and calculating the differences (Δδ13C) 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-acetylfuran-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.

The 2017 draft notification included isotope tests and SMR, TMR and foreign oligosaccharides.

The 2018 final standards notified these parameters. It could be said that India had adopted complex testing protocols to ensure that honey—the product we love to consume—would remain healthy and wholesome.

Then in October 2019—with no apparent reasoning—FSSAI issued a directive for revision of the parameter of pollen count and deletion of SMR, TMR and foreign oligosaccharides. Given that these parameters had been included specifically to check adulteration from rice syrup, it is still not clear what prompted FSSAI to dilute its own standard. And by July 1 2020, the standard was revised again and certain parameters were restored (*see* "Fast changing standards").

BUT TWO BIG CHANGES WERE MADE IN THE 2018 STANDARD

First, the TMR test was dropped; this when combined with SMR, has a better chance to catch adulteration by rice syrups. It is not clear why this was left out.

Second, pollen count was reduced from the original 50,000 in the 2017 draft notification to 25,000 in 2018 to 5,000 in 2020. The issue of counting pollen in honey and to use this as a determinant for quality and adulteration remains controversial (*see* "Counting pollen", *p*25).

The tug and pull on the standards—between 2017 and 2020—reveal how FSSAI is struggling to agree on the quality standard that will check adulteration. What is also clear is that certain parameters are being fiddled with, without publicly available reasoning as to why this is being done.

GOLDEN SYRUP TO NMR

This clearly is not the end of the adulteration story. We say this because India's food regulator has been sending signals that suggest that new kinds of

FAST CHANGING STANDARDS

Honey standards have seen quick revisions suggesting that there is more than what meets the eye

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 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

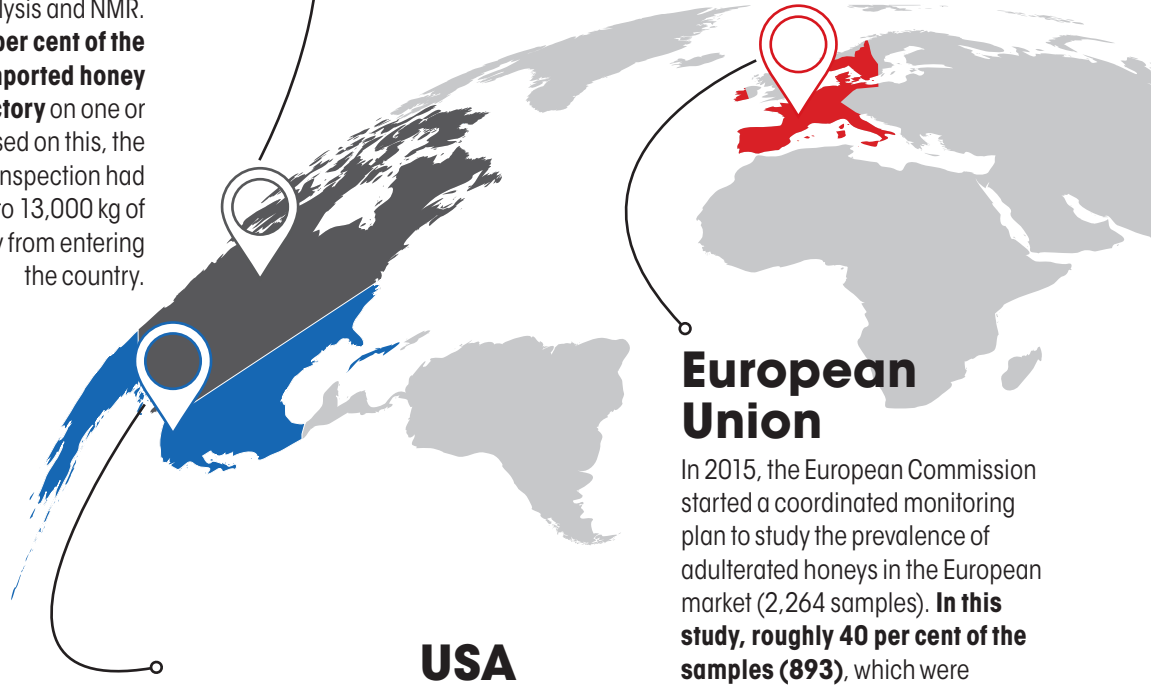
July 2020
FSSAI reinstates key parameters, but not SMR-TMR and foreign oligosaccharides to detect rice syrup. Issues 2020 Standard.

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.



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.

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 where 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.

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 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.

COUNTING POLLEN

FORMER EXECUTIVE Director of National Bee Board Yogeshwar Singh told *Down To Earth* that he had written a letter last November to the Economic Advisory Council's Beekeeping Development Committee, saying that "by reducing pollen count, FSSAI has legalised the practice of adulterating and selling rice syrup and corn syrup as honey. Thus open cheating of the consumer by honey processors has been legalised".

But the government did not agree. In a reply to a question in the Lok Sabha in February this year, the Ministry of Health and Family Welfare said: "FSSAI has informed that revision in pollen count requirement has been made based on the inputs received from the experts from Indian Agricultural Research Institute (IARI) and Central Bee Research and Training Institute (CBRTI) representing the true picture of pollen count in Indian honey."

Laxmi Rao of CBRTI told *Down To Earth* the institution had recommended 5,000 pollen count per gm based on studies in India and abroad in which it was found that pollen content should be minimum 0.01 per cent of the total content of the honey—5,000 per gm.

In fact, as per global practice, pollen is not used to determine quality of the honey. Instead, pollen provides countries the clue to find where the honey originates from. One part of the honey fraud in the western world has been the mislabelling of honey—saying it comes from the US, for instance, when it actually comes from another country. Pollen helps to determine origin—it's like a fingerprint.

Codex Alimentarius Standard recommends that "no pollen or constituent particular to honey may be removed except where this is unavoidable in the removal of foreign inorganic or organic matter. Honey which has been filtered in such a way as to result in the significant removal of pollen shall be designated filtered honey".

Also, pollen count differs between the honey type: whether it comes from mustard or litchi, for instance; or, if the honey is mono-floral or multi-floral. Also, in some cases, adulteration has been done by adding pollen—to disguise the origin of the honey. So, whereas it could be the case that reducing pollen count may aid adulteration; the increase in pollen count in the honey standard may not work to rectify the situation.

Clearly, even if eating honey is simple; the business is not.

adulteration is happening.

In December 2019, and then again in June 2020, FSSAI wrote to state food safety commissioners about the need to step up surveillance, sampling and inspec-tion to check misuse of Golden Syrup/Invert sugar syrup/rice syrup in honey.

On May 20, 2020, FSSAI issued an order on the import of golden syrup, invert sugar syrup and rice syrup. This order says that FSSAI has been informed that "sometimes these syrups are used in the production of honey because it is cheaper in cost and due to similar properties and easy availability". It directed that all importers/food business operators, who are importing golden syrup, invert sugar syrup, rice syrup into India to submit necessary documents with details of the manufacturer with end use to whom the syrups will be supplied.

On September 1, *Down To Earth* filed an application under the Right To Information Act (RTI) with the Imports Division of FSSAI asking for information received from industry to this order 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. Clearly, these are diversionary tactics.

That's not all. On February 26, 2020, the Export Inspection Council (EIC) told all honey exporters that Nuclear Magnetic Resonance Spectroscopy (NMR) testing shall be mandatory for honey meant for export to USA for detection of adulteration and geographical origin/authenticity with effect from August 1, 2020. It has directed that Export Inspection Agency (EIA) officials shall draw samples as per the laid down protocol for inspection and these will be tested in its laboratory in Mumbai, where NMR tests are possible.

Why was this done? And what is NMR? NMR is seen as the gold-standard for testing for adulteration in honey, designed specifically to redflag samples that use modified sugar syrups. Think of NMR as the difference between X-ray and blood test and Magnetic Resonance Imaging (MRI) to detect serious ailments in our body. The technology, similar to MRI, uses imaging to get a full picture of the honey and its constituents. It is then able to identify both the origin of the honey and its authenticity.

In India, brands like Dabur honey and Saffola are now advertising that they use NMR to ensure that their products are pure.

The NMR technology was 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 of breaking this code as well.

Indian government's direction to exporters to do NMR tests shows that they suspect or know that Indian honey has some adulteration, but is not being detected using tests for C3 and C4 sugars. Additional tests are required to be done, which in this case is NMR, to ensure that honey is not adulterated.

So, what is this adulterant that can pass the test for sugar syrup? That was our next question.

Leads to China

Tracking down the imported syrup being used for honey adulteration

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

ON OUR trail to probe adulteration in honey we had two leads. First, beekeepers not getting a fair price for their honey indicated possible adulteration with sugar syrup thus reducing demand for raw honey. Second, government suspected adulteration as it had not only introduced tests to detect sugar syrup from rice or corn, but had asked for tests that would catch sugar syrup, which is undetected by the laid down standards for exported honey.

So, now the next probing question was: what is this syrup? Who makes it? Where does it come from? Our clue came from the May 2020 FSSAI directive that specified that "golden syrup, invert sugar syrup, rice syrup" coming into India needed to be tracked as these could be used to adulterate honey. So, we started to find out about these syrups and thought this would be easy.

But when we checked the export-import database of the Union Ministry of Commerce and Industry, two of the named syrups—rice syrup and golden syrup—could not be found. Each product imported into the country has what is called the harmonised system (HS) code that describes the type of good that is shipped. There were no codes for these syrups. It seemed we had reached another dead end in our investigation.

We also found that what was called "Invert Sugar Syrup" had an HS code, but when we looked into this, the imports were in small quantity—only about 1,300 metric tonnes (MT) in 2017-18 and 2,500 MT in 2018-19. This was not a significant quantity to indulge in a large-scale adulteration of honey. FSSAI's clue left us with no leads.

We then looked somewhere else. We decided to scan the websites of Chinese sellers. We found that certain Chinese portals such as Alibaba, OkChem, Tradewheel featured syrups that claimed they could pass the honey adulteration tests such as C3, C4, TMR, SMR, oligosaccharides, and in some cases also

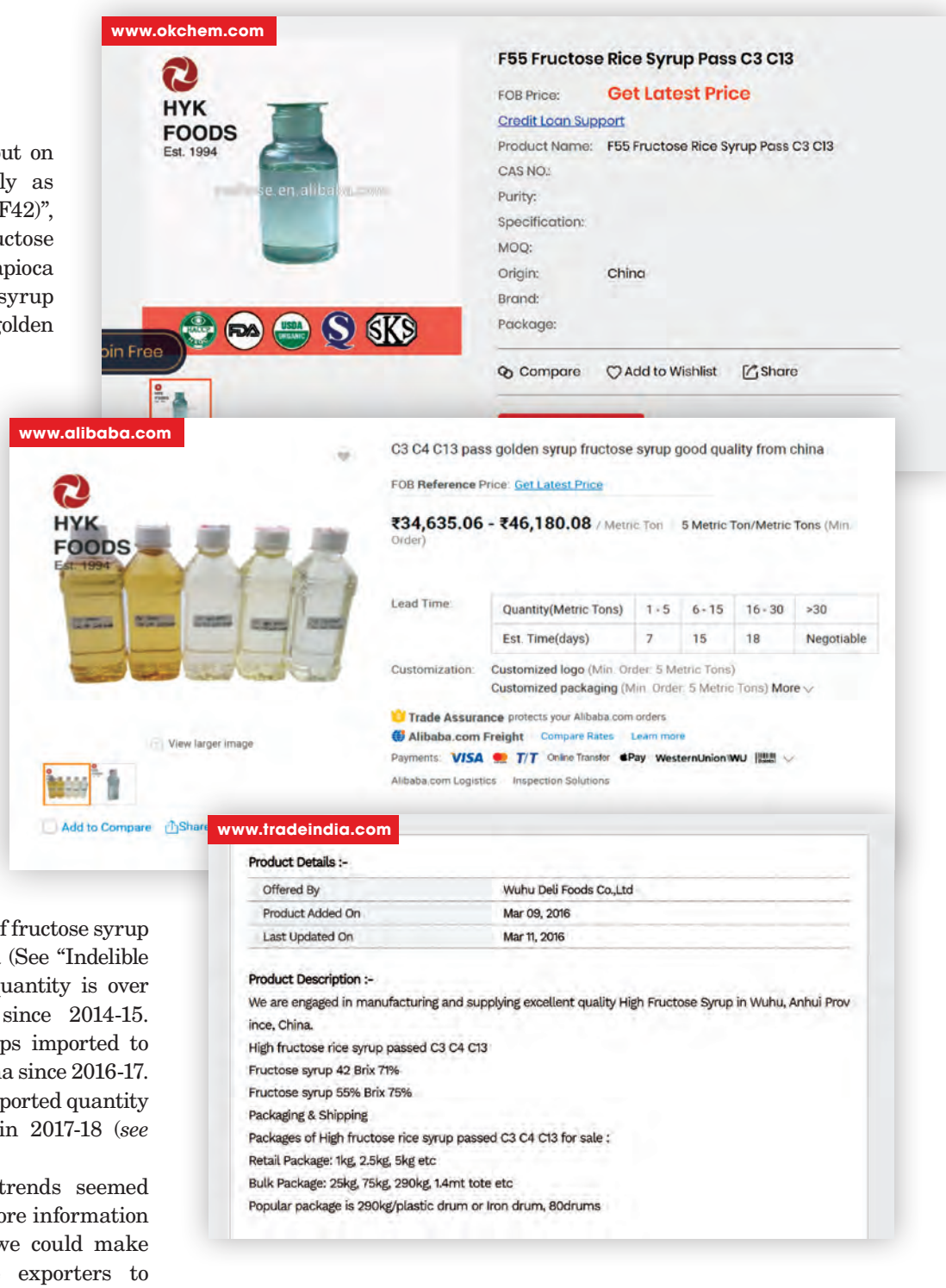
NMR. These syrups were put on display for sale commonly as "Fructose syrup (F55/F42)", "Honey blend syrup", "Fructose Rice Syrup for Honey", "Tapioca fructose syrup", "golden syrup fructose syrup" and "golden fructose glucose syrup".

Repeated use of the terms fructose and glucose in the names of products on these websites prompted us to look at the imports of these from China. The export-import database of the Ministry of Commerce and Industry, Government of India, suggested that since 2014-15, nine other countries regularly exported fructose syrup to India, but China is the only country from where it is imported to India in bulk. So much so that China is driving the trend of fructose syrup quantity imported in India (See "Indelible link", *p*30). The average quantity is over 10,000 MT every year since 2014-15. Similarly, all glucose syrups imported to India are coming from China since 2016-17. There was a spike in the imported quantity to more than 4,300 MT in 2017-18 (*see* "Chinese imports", *p*31).

These statistics and trends seemed unusual, but we needed more information about the sellers and if we could make connections between the exporters to India and the companies selling these adulterants on the websites.

We bought a trade database, on the condition of confidentiality, from a company that compiles data by each imported shipment. It not only provided the details of the Chinese sellers, the prices and major ports where shipments landed, but also helped us understand the names under which syrups are imported to India. We also sought data for golden syrup, rice syrup and invert sugar syrup, which could only be identified by entering key words in description due to lack of HS code.

This trail of the probe fetched us definitive leads. Fructose syrup sellers are the same Chinese companies which, on Alibaba and similar portals, openly sold syrups that could pass the honey



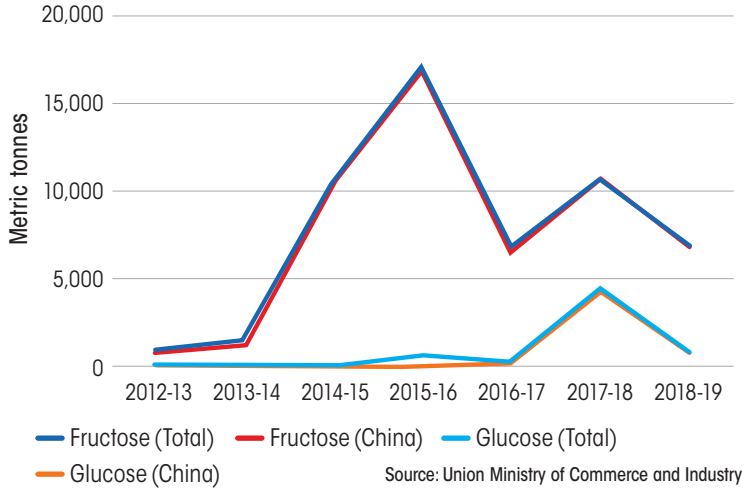
Screenshots of the Chinese portals that sell adulterants (accessed in August, 2020)

adulteration tests. In the last four years, more than 11,000 MT of fructose syrup in India had come from these sellers, which was about 70 per cent of the total quantity imported from China and the stated description was "industrial raw material".

On the face of it, these companies appear to be the legitimate syrup or honey suppliers as they don't say a word about the amazing capability of their syrups to pass adulteration tests on their websites. On the contrary, they display certificates on food safety and standards on their sites. But the connection is made when you find that the same food company—which is exporting to India—is the same respectable food seller, but on online portals like Alibaba, it says that it makes sugar syrup products that will beat all C3/C4 tests.

The problem is at our end—the importers. Here, there is a real dead end to our investigation. Most of the companies listed in the database as importers of this product from China are either trading companies who will further sell to either honey packing business or to other food businesses. Out of 166 fructose syrup shipments from China, 100 were bought by buyers in Punjab (Faridkot, Patiala and Rajpura); about 30 by buyers in Delhi-NCR; and 15 by two buyers in Jaspur and Kashipur (Uttarakhand).

Indelible link Fructose and glucose imports to India from China and rest of the world



Source: Union Ministry of Commerce and Industry

Chinese companies who exported glucose syrup to India are either honey suppliers or claim that they sell glucose syrup as a substitute to honey (*see* "A brief bio of sugar"). If they are supplying pure honey under the HS code of glucose syrup to avoid heavy duties, then it's a different issue. But supplying glucose syrup to blend in honey only increases the gravity of adulteration issue. Major importers are buyers in Nasik, Uttarakhand and Uttar Pradesh.

It is clear that adulterants are not imported as rice syrup, golden syrup or invert sugar syrup. In 2019-20, there were only 10 shipments of rice syrup from the US and only in small quantity (22 MT). Only one seller in China sold it as Golden Syrup under the HS code of fructose—shipped over 2,700 MT in 2017-18 and 2018-19. Golden syrup imported from other countries is either coming for pharmaceutical purposes as reflected by the HS code (in case of Switzerland) or not imported in bulk (in case of the UK).

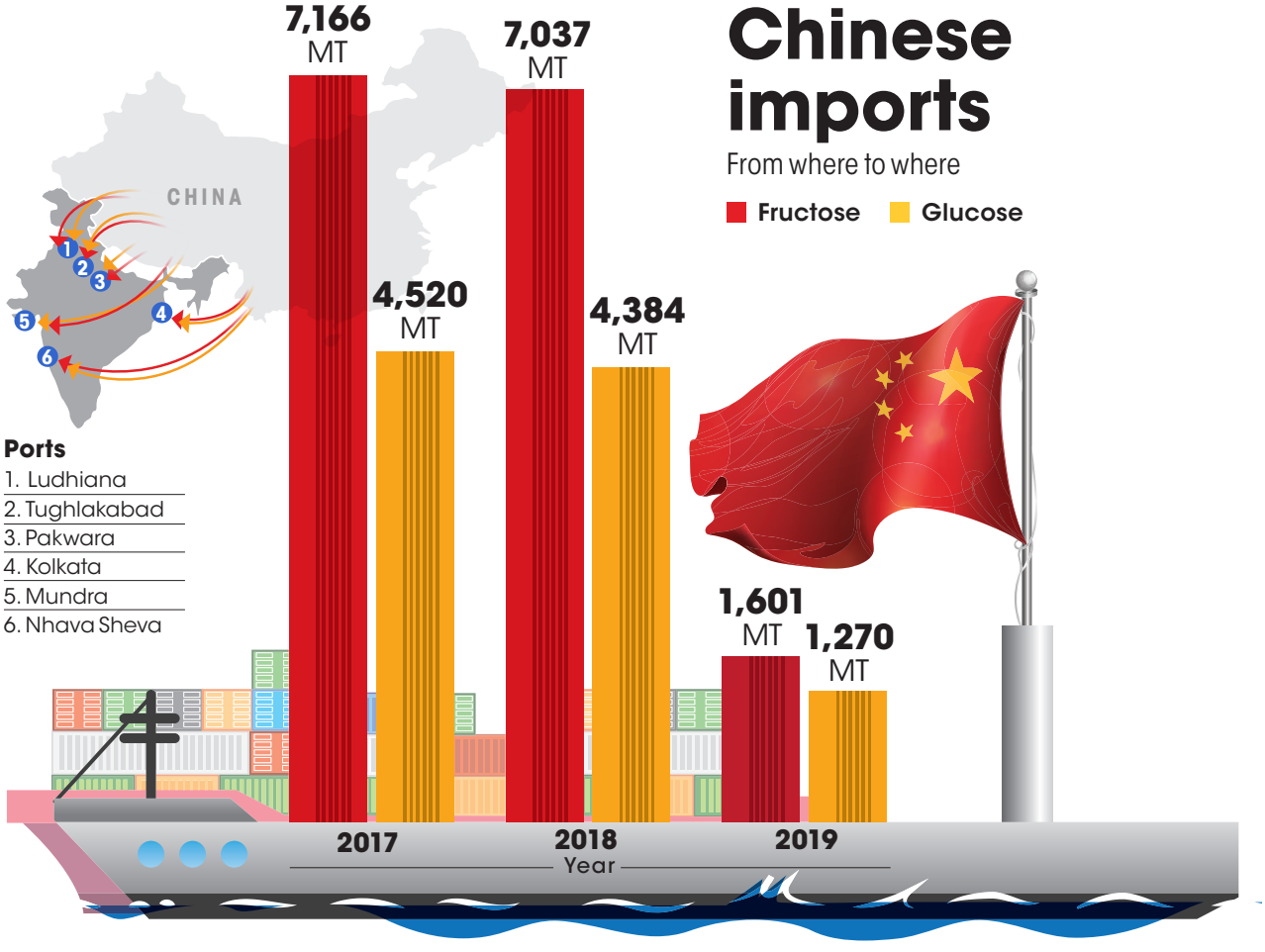
So, why did FSSAI put out what was clearly an erroneous order as it named products not being imported, but missed the ones that were being imported and from the same Chinese companies that claimed that their products could circumvent the C3 and C4 tests. Was it the lack of knowledge or a deliberate misstep?

A BRIEF BIO OF SUGAR

WE KNOW that sucrose, glucose and fructose are all sugars that contain more or less the same calorie per gram. But what differentiate these sugars is what else is in each of them—what is the chemical structure and how our bodies digest and metabolise these. Glucose is simple sugar or a monosaccharide—it's what the body digests fastest. It can be extracted from corn and added to processed foods as dextrose. Fructose is also simple sugar, but it is what is called "fruit sugar" as it is found naturally in fruit, honey, cane and beetroot, to name a few vegetables. It is also easy to digest. Honey has higher fructose, than glucose, but what differentiates it from other "sugars" is that it also has a variety of good enzymes, which break down the sugars—these enzymes come from the plant itself or from the bees. The ratio between fructose and glucose changes based on the origin of the honey—which plant and also if it is multi-floral (many flowers) or mono-floral (one plant/flower). So, one its own, the ratio is not the determinant of adulteration.

Chinese imports

From where to where



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

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
- We received replies 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
- One Chinese company exported syrup as paint pigment to us
- It routed shipment through Hong Kong to bypass custom clearance

ON OCTOBER 22, 2020, a courier arrived by FedEx at our doorstep. It was from Hong Kong, and the package content said it contained plastic pigment emulsion. You may ask: Why would we be interested in plastic pigment emulsion and that too from Hong Kong? As we had established an import aspect to honey adulteration, we wanted to embed ourselves in the business. We would order samples of syrups from China that the company said with confidence could be added to honey and would pass all the stipulated tests.

We contacted two companies in China through e-mails who claimed to be honey producers (see "The China trail", *p*34).

We posed as an Indian honey collection and trading company that wanted to buy these Chinese syrups that could beat all tests. We sent business enquiries to two Chinese companies. The first one was a big FMCG company called Wuhu Deli Foods based in Wuhu, in the rice-growing belt of An Hui, China. According to its website, it was a producer of four products: natural honey, syrups, dry syrups and vegan protein. Wuhu Deli was also one of the exporters of fructose to India.

The other smaller in size company, called CNNFoods, is also located in An Hui. This company claimed that it only sold natural bee products like honey, comb honey, bee wax and propolis.

Our bait for these companies was a rather attractive one. We offered to buy 10 container loads or about 200 tonnes of syrup or adulterant that could pass all Indian testing protocols.

Our requirements were simple. Could your syrup pass the tests set up by the

FSSAI, which includes the tests for C3 and C4 sugars? Apart from these tests, we also wanted to know if the Chinese syrups could pass these additional tests, including a Specific Marker for Rice Syrup (SMR), Trace Marker for Rice Syrup (TMR), and for Foreign oligosaccharides. We also wanted the HMF (5-hydroxymethylfurfural) levels to be low so that it would show that honey has not been heated.

Both the companies got back saying that they could supply us the syrups as per our specified requirements.

Wuhu Deli offered us two syrups one with a fructose content of 48 per cent also called F48, while the other with a fructose level of 55 per cent or F55. Wuhu Deli wrote saying both these syrups could pass our testing requirements. The company wrote that they could ship it to any dry port in India and gave us the rates for inland container deport (ICD) Ludhiana at a CIF (cost insurance and freight) basis. The CIF rates for Ludhiana were quoted as US $805.00/MT for F48 syrups and US $950.00/MT for F55 syrups. In Indian currency, the rate for the F48 syrup was about ₹60 per kg while rate for the F55 variety was about ₹71 per kg ($1=₹75).

The second Chinese company— CNNFoods, which on paper only sold honey—also offered us F48 and F55 syrups that could pass all testing protocols in India. Unlike Wuhu Deli, CNNFoods could ship the syrups to Inland Container Depot at Tughlakabad in Delhi at a much cheaper rate. Their CIF rate for Tughlakabad was US $710/MT for F48, while for F55 it US $790/MT. All these rates were for 200 MT of syrup. That was an astoundingly low price of about ₹53 per kg for the F48 syrup and ₹59 per kg for the F55 variety.

Interestingly, CNNFoods told us that most of their clients mix 50-80 per cent syrup in their honey. We wanted to find out if we could get samples of these two syrups delivered to us in India before we placed the order. Both the companies agreed to ship their samples.

On September 30, 2020, Wuhu Deli confirmed that two samples of 500 ml each has been sent through FedEx bearing Airway Bill number 77166635xxxx. The invoice for the consignment was very secretive of the contents and didn't mention what kind of syrup had been shipped. It simply said "Syrup" with no hint whether it was made from rice or any other starchy ingredient. The certificate of

TURN TO PAGE 36>>

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.

21 Sep
to lisa@foodssell.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

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.

lisa@foodssell.com 22 Sep
to me

Dear

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 Develo
District, Wuhu,

Transaction details — 24 September 2020 at 7:06:23 p.m. IST | Transaction ID: 2XP87162WW

Payment sent to [illegible]
Payment status: Completed
Payment type: Goods and Services

Gross amount
-$ 60.50 USD

Shipping address
Gautam Budh Nagar
Uttar Pradesh
101308
India
Unconfirmed

Gross amount	-$ 60.50 USD
PayPal fee	$ 0.00 USD
Net amount	-$ 60.50 USD

Currency conversion
Conversion from: ₹ 4,675.57 INR | Conversion to: $ 60.50 USD | Exchange rate: 0.012939600709604

Contact info
The recipient of this payment is verified and is located outside of the US.
foodssell@aliyun.com

...t sent to — foodssell@aliyun.com

...details — Funding Type: Debit Card
Funding Source: -₹ 4,675.57 INR – MASTER CARD ending in x-0126
This transaction will appear on your bill as PAYPAL *FOODSSELL

...lp?
...e Resolution Centre for help with this ...nsaction, to settle a dispute or to open a claim.

September 24, 2020

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

christy@cnnfoods.com 24 Sep
to me

Dear

As this is our first coopertion, 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 conbination ratios? We can provide you any Fructose content (any FG) you require.

Best regards,

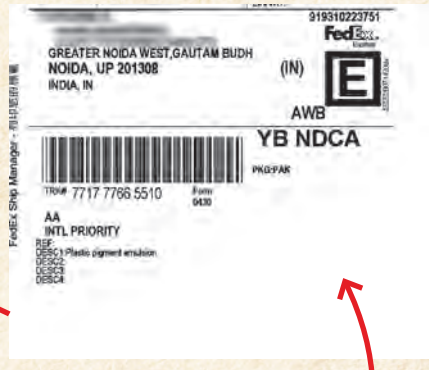
Christy Kai

September 24, 2020

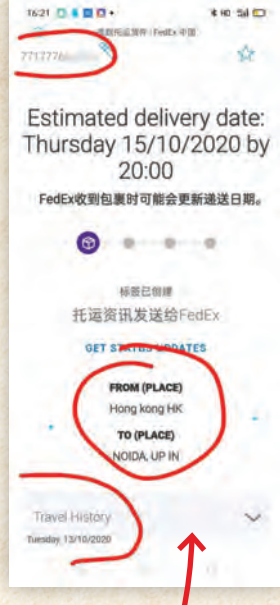
Meanwhile, **Wuhu Deli agreed to ship the samples** through FedEx or DHL provided **we bear the cost of US$ 60.50 for it.** We transferred the amount through Paypal to Wuhu Deli same day.

October 22
We received the samples.

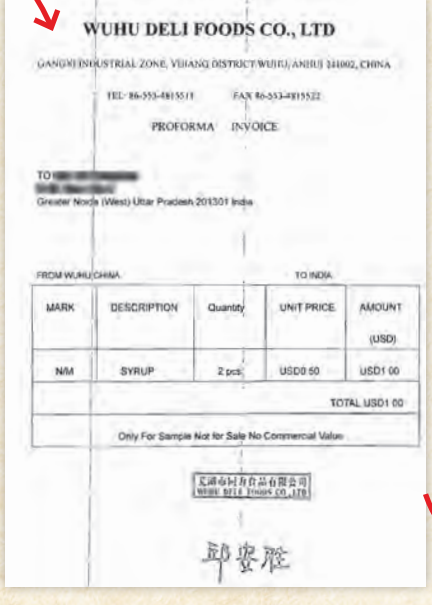
October 20
CNNFoods sent us the **commercial invoice and material data safety sheet of the samples.** Instead of honey or syrup, the samples had been shipped as Plastic Pigment Emulsion.



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

GANGMI INDUSTRIAL ZONE, WUHU DISTRICT WUHU, ANHUI 241002, CHINA

TEL: 86-553-4815519 FAX 86-553-4815522

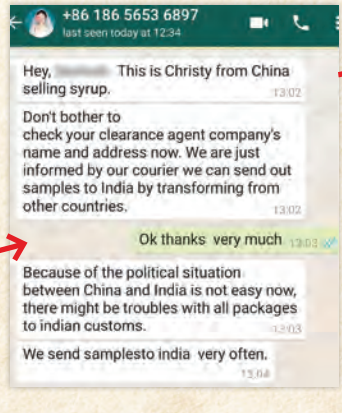
PROFORMA INVOICE

TO
Greater Noida (West) Uttar Pradesh 201301 India

FROM WUHU CHINA TO INDIA

MARK	DESCRIPTION	Quantity	UNIT PRICE	AMOUNT (USD)
N/M	SYRUP	2 pcs	USD0 50	USD1 00
			TOTAL	USD1 00
Only For Sample Not for Sale No Commercial Value				

邱安胜



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.

CHINESE WHISPER

What is this Chinese technology that can "modify" sugar so that it is not detected?

CHINESE FIRMS claim that their syrups will make honey circumvent the advanced adulteration tests. How is it done? Industry circles talk about "resin technology" that is used to do this. But what is this technology all about?

Use of resin technology—a separation technique based on ion-exchange and adsorbents—is well-known in fruit juices. But its use in honey sector is relatively a new phenomenon, which is known to be led by the Chinese resin manufacturers. It is typically sold to help remove harmful substances. Sunresin, a pioneer in China, sells Seplite, a resin for bee honey purification and claims to help remove antibiotics, pesticides, fungicides and HMF (hydroxy-methylfurfural), an indicator of honey quality. The company website also claims resin technology will improve colour and extend the shelf life of honey.

But such resin-filtered honey is not considered honey by governments, experts and bee keepers. A 2018 EU Commission report of the technical round table on honey authentication identified resin treatment/ultrafiltration (followed by blending) as one of major types of frauds in the honey sector and noted that "synthetic resins are illegally used to remove substances (antibiotics, pesticides, etc) from honey". A European Parliament resolution of March 2018 on prospects and challenges for the EU apiculture sector calls on the Commission to ban the distribution of resin-filtered honey as soon as possible, since such honey contains nothing whatsoever of biological value. It goes on to say that the 2002 chloramphenicol problem in honey was resolved by companies exporting honey from China not by complying with the rules but by using resin filters. Apimondia—the International Federation of Beekeepers' Associations—in its January 2020 statement on honey fraud, noted that use of ion-exchange resins violate the Codex Standard of 1981 and the European Honey Council Directive 2001/110/EC (2001).

Clearly, such ultra-filtration renders the end product ineligible to be called as honey. It masks the geographic and botanical origin of the honey which not only helps in blending with desired honey and syrups but also makes it difficult to spot the problem. But does ultra-filtration also allow for sugar syrup to pass the laboratory test? If so, how?

This is still not known. How does technology make plant-based sugars—from rice or sugarcane—hide their characteristics so that they can go undetected? Nobody knows. Or is willing to tell. Not yet.

analysis for F48 sample that was mailed to us by the company had noted that the syrup was light in colour, odourless and sweet to taste, with dextrose plus fructose content of 97.50 per cent with 48 per cent being the fructose content.

While this sample reached Delhi, we were unable to take delivery of the sample because it came as cargo, which required an elaborate process to clear it past customs. FedEx informed us that since the India-China conflict, the government of India does not allow the courier company to clear packages and requires a customs agent to do so. Because we are not a food processing company and we do not have the requisite FSSAI licenses and import certificates, we did not attempt clear the samples on our own. This sample is still in the custody of FedEx to best of our knowledge.

But what about the second company, CNNFoods which only had natural bee products in their portfolio? This company desperate to sell us their product took a different route. They suggested that they would send their product through Hong Kong, as there was greater scrutiny of Indian customs on products coming from China. On October 13, 2020, the CNNFoods shipped the samples from Hong Kong and 10 days later, the packet containing "paint pigment emulsion" arrived at our doorsteps.

The packet, of course, did not contain the item mentioned on the courier label. Instead it contained three plastic vials of F48 and F55. The F48 sample had a claimed fructose-glucose ratio of 0.95 while the F55 had a claimed ratio of 1.20.

The iron curtain of the honeygate had been breached. We now know how the honey fraud operates and we can tell you that these legitimate companies from China—with massive business interests and seemingly all over board—are engaged in selling sugar syrups that they confirm can beat all tests and they even tell you that their clients mix as much as 80 per cent syrup and pass it as honey.

Indian passage for adulteration

Manufacturing of adulterant syrups has begun closer home

- We tracked down a factory in Jaspur, Uttarakhand that manufactures syrup to adulterate honey
- We learnt that the code word for it is 'all pass' syrup
- We made contact and procured a sample of this 'all pass' syrup
- It will pass all stipulated tests for honey purity, said the owner

JASPUR IS a small municipality on the foothills of Himalayas in Uttarakhand's Uddham Singh Nagar district. A handful of agro-processing units had propped up in recent years in this agriculture-dominant region. Nothing out of place about that. But the beekeepers we spoke to earlier to find the root of their problem—dipping honey prices because of adulteration—had mentioned Jaspur in many conversations.

We had also found leads in the import database pointing to Jaspur. There were names of companies and their owners, who had imported fructose syrup from China. These were all legitimate food processing businesses. But were these

companies making the modified syrup in India now? So we decided to chase up the leads we got from the database and dialled some numbers.

Beekeepers had already told us that the syrup that is used to adulterate honey is referred to as "all pass" syrup—leaving it to nobody's imagination that this syrup is one that would pass all Indian tests. We called the owner of one of these companies (*Down To Earth* has the details of the company and owner) and hit the jackpot.

After some cajoling, he told us that he did indeed make such "all pass" syrups and that we could buy it from him. An appointment was fixed for October 23, 2020.

We travelled to Jaspur. We said we needed low-cost magical syrup that could pass the C3 and C4 sugar tests. We learnt that the factory made syrups from rice and the basket of products was impressive—it included sorbitol, liquid glucose, invert sugar, rice proteins and finally (but not publicly said) high fructose syrups that could pass off as honey. We asked for 50 tonnes of F48 or F55 syrups, but what we wanted first was a sample that we could send to the laboratory and check if it passed the test for C3 and C4 sugars.

We were given a free sample of this "all pass" syrup, and told that when we place our order, we will be billed for honey. This was clever as it would mean that if caught, the company would simply brush off the allegations saying that we were sold honey and not "all pass" syrup—there was nothing like this in the official manifest.

The clincher was the price and, of course, our conversation. We got the syrup for ₹68 per kg, slightly higher than what we were quoted on the phone (₹65 per kg). But we were assured that when we placed bulk orders, this price would be negotiated and brought down substantially.

We returned to Delhi with sample of this syrup. The company assured us that this would pass all tests, but not NMR.

It is said that there are at least half a dozen such factories across Uttar Pradesh, Uttarakhand and Punjab that are making these "all pass" syrups. It is still not clear what technology is used to make these modified syrups—that remains an exclusive Chinese whisper.

But what is clear is that Indian beekeepers will not be able to compete in this syrup business. Their minimum cost of production is over ₹100 per kg; if even 50 per cent of the honey we consume is substituted with syrup, it will devastate the honey business, forget our health.

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 adulterated samples of pure honey
- Mixed Chinese and Indian 'all pass' syrups at 25%, 50% and 75%
- Sent samples to laboratory
- 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

NOW WE had the sample of the Chinese and Indian "all pass" syrups. The question was if the syrups would indeed pass the laboratory tests as claimed by the companies. We took raw honey and also honey that had passed tests in the Indian laboratory and "spiked" these bottles with syrup and sent it to the laboratory.

If the samples with the added sugar syrup passed the test, the experiment would confirm that honey could be adulterated and yet pass the stipulated purity tests for C3, C4 sugar.

The toughest job was to procure what would be raw honey, without any adulteration. We wanted to get this directly from the source —so we travelled to Bharatpur in Rajasthan. There we met Om Prakash a 42-year-old beekeeper with about 1,400 bee boxes and also a storage facility to keep raw honey. Prakash told us that he knew about the adulteration of honey with sugary syrups and that he was also a victim. Prices had crashed and he was unable to run his business. He then gave us a bottle of raw and unprocessed honey, which he said had come from the nectar of *ber* plant (*Ziziphus mauritania*), sucked up by bees in Jaisalmer.

We then brought the sample to Delhi and scientists from CSE's Environmental Monitoring Lab "mixed" the syrup in the raw honey and branded honey. In this way, raw and unadulterated honey was systematically mixed with Chinese and Indian syrups in different proportion using

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

scientific tools and procedures. In total, we made 6 compositions using the two types of honey and three types of syrup.

We mixed the Indian and Chinese syrup in raw honey in different proportions—25 and 50 per cent. We wanted to see how much adulteration would pass the test and so we mixed one sample with 75 per cent of the Chinese syrup. In the branded honey, we spiked with 25 and 50 per cent Chinese syrup.

We then sent bottles of these "adulterated" honey samples to Gujarat-based laboratory, Centre for Analysis and Learning in livestock and Food (CALF) of the National Dairy Development Board. We also sent the raw honey as a control sample.

The results confirmed our worst fears:

All the samples (except one, which we had spiked with 75 per cent) passed. The samples passed the C3 test; they passed the C4 test; and even passed the tests for foreign oligosaccharides.

This showed that Indian and Chinese syrup were effective in hiding foreign sugars. And adulteration as high as 50 per cent went undetected. In other words, there is no longer a mystery here. Chinese companies and now Indian companies have the technology to modify sugar syrups so that they can be masked in the tests. We know also that up to 50 per cent can easily pass. Perhaps even more.

The fact that the 75 per cent adulterated sample failed, told us also that the laboratory had done the analytical testing with full care and professional integrity. It was not the laboratory that had passed the sample; but the honey had been passed because the adulterant could not be detected.

The mastery has to be marveled. But this sophisticated method of adulteration has massive impact on our health—instead of nature's wonder, honey, we are consuming sugar—50 per cent or more of the honey could be sugar. This is bad for our health. No question about it.

LABORATORY TESTS OF HONEY WE CONSUME

HONEY WHICH PASSED INDIAN STANDARDS FAILED WHEN TESTED USING EQUIPMENT THAT CAN DETECT MODIFIED SUGAR SYRUP

- 13 top and smaller honey brands were selected
- Most of the top brands passed the laboratory tests for Indian standards
- Laboratory in India didn't find adulteration of C3 and C4 sugar in these brands
- However, most of the smaller brands failed the laboratory tests for Indian standards
- Adulteration with C4 sugar is most common
- But when all samples were sent to a top laboratory in Germany, the picture changed
- Many samples passed in India failed on the Trace Marker for Rice (TMR) test
- Almost all samples failed on Nuclear Magnetic Resonance Spectroscopy (NMR) test. Laboratory said, "indicates adulteration/addition of sugar syrup"
- Of the 13 brands only three brands passed
- Of the 22 samples only five samples passed test. Rest were adulterated

IT WAS now critical to understand the nature and extent of adulteration of honey sold to us and that we consumed.

So, in August 2020 we collected eight brands of processed honey that are typically available in the retail shops and commonly advertised. These samples were collected from stores in Delhi. These samples were sent for laboratory test to the Centre for Analysis and Learning in Livestock and Food (CALF) at National Dairy Development Board (NDDB) in Gujarat—which has a state of art facility for testing honey for all parameters set by FSSAI. The samples were to be tested as per the 2020 honey quality standards—to check for C4, C3 sugars, foreign oligosaccharides, specific rice marker (SMR).

The testing of honey for its purity is not a simple business. The laboratory uses different methods to check for adulteration. But what is clear is that if the sample fails on any of the parameters then it fails the adulteration test (see "Testing methodology...", *p*44).

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TESTING METHODOLOGY FOR SUGARS IN HONEY

ISOTOPE TESTING (all three delta tests—max, p-h, fru-glu) is done to calculate C4 and C3 sugars. The method used is isotope ratio mass spectrometry (IRMS) to determine the sugar—but with small variation. For C4 sugar analysis, laboratories do elemental analysis (EA) and for C3 sugar they use liquid chromatography (LC). But it is the "nature" of the sugar type that only C4 sugar can be quantified as carbon 12,13 ratios of corn is available and used. FSSAI 2020 standard for checking the purity of honey is based on isotope testing.

Test for foreign oligosaccharides check for starch-based sugars (that is, polysaccharides from rice, wheat, corn). This is about starch-based sugar, which can be from corn or rice. Therefore, if a sample fails on foreign oligosaccharides, it would mean adulteration by either C3 or C4 sugar, but starch-based sugar. Therefore, cane sugar or beet sugar, which are not starch-based, would not be detected in this test.

Then there are two markers for identifying rice syrup adulteration. There are tests for Specific Marker for Rice (SMR) i.e. 2-AFGP and Trace Marker for Rice (TMR) conducted to check for the presence of the markers in the sample. If these are found then would mean the sample is adulterated with rice syrup (C3 sugar).

The nature of sugar is complex and there is interaction between the different sugar types so this is why it is important to take the results together. It is accepted that if a sample fails on any of the above tests then it shows it is adulterated by either C3 or C4 sugar. However, if the sample fails on SMR and TMR, then we do know that the source of the sugar is rice syrup.

THE RESULTS CAME IN

All the samples passed the C4 sugar test; and test for C3 sugar. Only one brand—Apis Himalaya Honey—failed the test on foreign oligosaccharides and SMR—indicating possible adulteration with rice syrup.

As per these tests, which would meet the standards set by FSSAI, it could be said that there is no significant adulteration in the honey we consume.

We decided to get additional brands tested—this time we bought five more brands—smaller and more niche. These were sent to the same lab for testing on the same parameters.

This time the results were more varied. In three of the five honey samples there was evidence of adulteration.

Therefore, what was clear that there were stark differences in the honey that we tested.

The big companies with large brand values and market share (except for Apis Himalaya Honey) all passed the tests for C3 and C4 sugar.

Three of the smaller honey brands, namely Dadev, Hi Honey and Societe Naturelle failed on the C4 test and also on the isotope testing. However, they passed on the foreign oligosaccharides and specific marker for rice (SMR). This indicates that the samples were indeed adulterated, but may not be with rice syrup or C3 plant syrups but with simple cane sugar. Dadev and Hi Honey had 20 and 27 per cent C4 sugar—when the limit is 7 per cent.

The samples of Dadev, Indigenous, Hi Honey and Societe Naturelle are labelled as raw (unprocessed) honey, which makes it all the more worrying to see that three of the four were found adulterated with addition of sugar syrup.

NOT THE END (YET)

We were not satisfied that honey sold to us and that we consumed for good health was not adulterated.

Our ongoing investigations were unravelling the following:

- That Chinese companies had sugar syrups that they said would pass the C3/C4 tests; we had not only found the information as advertised on online trading website, but had even contacted these companies and procured samples of this modified sugar syrup.

- We had found an Indian link – company that was able to supply the "all-pass" syrup that would be able to beat the FSSAI mandated tests for purity.

- We had procured samples of the "all-pass" Chinese and Indian syrups and when we "spiked" honey samples with these syrups, these were not detected by the laboratory. So, now we had confirmed that such syrups existed and these could indeed mask the addition of foreign sugar in natural honey.

Therefore, we could not say anymore that honey that had passed the tests is not-adulterated. We needed to confirm this.

To check we decided to get the same samples, of the same batch, tested using what is considered the gold-standard for detecting adulteration through Nuclear Magnetic Resonance Spectroscopy (NMR). The Indian government had already mandated this test for honey that would be exported. Also, big companies like Dabur and Saffola were telling consumers that they were getting their products NMR tested and certified. Our research told us that this was one of the technologies governments across the world were using to detect adulteration—particularly if the sugar syrup could pass the C3/C4 tests.

We looked for laboratories in India that would do this test for us. But there was only one—Export Inspection Council (EIC) near Mumbai that had this equipment and it was not open for us to send samples.

On further investigation we found a

Honey is adulterated

Advanced tests which can detect modified sugar syrups confirm this

Lab		Tests from Indian lab						Tests from German lab		Interpretation as provided by the German lab
Sample no.	Brand	C4	Δδ13C p-h	Δδ13C Fru – Glu	Δδ13C Max.	Foreign oligosac-charides	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

Lab		Tests from Indian lab						Tests from German lab		Interpretation as provided by the German lab
Sample no.	Brand	C4	Δδ13C p-h	Δδ13C Fru – Glu	Δδ13C Max.	Foreign oligosac-charides	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	
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—13C, 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

laboratory in Germany, which has specialised in testing for honey adulteration, including through the use of NMR. We decided to send the samples there. We located the Indian counterpart of the renowned German food testing laboratory and they accepted taking samples—these were then sent to Germany for analysis.

We sent the samples from the same batch of 13 brands that we had got tested in India.

We added to this lot two additional samples of different batches from Dabur and Saffola. We did this because these two brands were advertising that each batch of their product was NMR tested. And so it would be important to get two more samples of different batches tested in their case.

Therefore, we sent 17 samples to Germany in this lot.

As the results came in (please read on to find out more) we also decided to send additional samples from major companies that had failed NMR in the first round. We wanted to give these companies another chance—call it further reconfirmation. These companies were Patanjali, Baidyanath, Zandu, Nature's Nectar and Indigenous.

All in all, we sent 22 samples to the German laboratory.

The German laboratory was told that the origin of the samples was India and that test would need to check for non-EU compliance—in other words, the honey sample would be tested against the less stringent parameters set outside the EU.

All honey samples were tested for the following:

- Trace Marker for Rice (TMR)—this parameter had been dropped in the 2020 standard by FSSAI but was seen to be an important indicator of the presence of rice syrup.
- Nuclear Magnetic Resonance Spectroscopy (NMR)—which would be used to determine adulteration by sugar syrup designed to pass C3/C4 test.

THE RESULTS

What we found was shocking.

- Dabur honey passed tests for C3 and C4 sugar, but failed the NMR tests on all three samples. In one sample it also failed on TMR.
- Patanjali honey passed tests for C3 and C4 sugar, but failed TMR and NMR tests on both samples.
- Apis Himalaya failed the foreign oligo-saccharides and SMR (done in India) and also failed the TMR and NMR tests.
- Baidyanath honey passed tests for C3 and C4 sugar, but failed on NMR. In one sample it also failed on TMR.
- Zandu honey passed tests for C3 and C4 sugar and for TMR but failed on NMR.
- Nature's Nectar passed tests for C3 and C4 sugar. One sample failed NMR and one sample passed NMR.
- Hitkari passed tests for C3 and C4 sugar but failed on TMR and NMR.
- Saffola honey passed tests for C3 and C4 sugar and passed on TMR and NMR.
- Markfed Sohna passed tests for C3 and C4 sugar and passed on TMR and NMR.
- Dadev forest honey failed tests for C4 sugar and failed on NMR. It passed on TMR.
- Indigenous honey passed tests for C3 and C4 sugar and for TMR, but failed on NMR.
- Hi Honey failed tests for C4 and failed on NMR. It passed on TMR.
- Societe Naturelle honey failed tests for C4 and passed on TMR and NMR.

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.**
- **Two brands, Dadev and Hi Honey, failed C4 sugar syrup tests indicating that their adulteration was "basic" and not with the use of modified sugar syrup.**

(*See test results*, "Honey is adulterated", *p*46).

WHAT DO WE CONCLUDE FROM THESE RESULTS?

With these results, the dots we started joining when we were told of the loss of livelihood of beekeepers because of adulteration of honey with sugar syrup had come full circle.

We can now conclude with certainty that much of the honey we consume is adulterated. Of the 13 brands—and these include all the top sellers—only three have products that can be termed as not adulterated.

The business of adulteration is sophisticated. It uses sugar syrups that are "modified" so that these cannot be detected using the laboratory tests that are mandated and done typically to check this adulteration.

The syrups are imported from China and are now also manufactured in India. The companies claim that even if up to 80 per cent of the honey is adulterated using the syrup will go undetected by the laboratory. The tests we got done have confirmed that up to 50 per cent adulteration is certainly possible and it will pass the laboratory scrutiny. Therefore, the quantum of adulteration with sugar syrup in the honey bottle could be 50 per cent or above.

We also know that the economics works in favour of the adulterant—it is cheaper to use (₹60 per kg) as compared to the cost of true honey—₹120 per kg is the cost that beekeepers need to meet basic needs. It is also so much easier—the syrup can be bought in bulk and used in this hot-selling item—as against the supply chain that would need to work with beekeepers who would in turn work with the supply of nectar from seasonal flowers. We know that honey is nature's bounty and that beekeepers go place to place in search for the flowers that the bees then suck and bring us the goodness in the form of honey.

The adulteration business has also evolved, we know. From the addition of simple cane sugar; to more evolved sugars of rice (C3) and now to the modified sugars that can pass tests. The big-brand honey Indians are consuming has already caught up with the modified sugar syrup business. The big brands pass the standards set by FSSAI in 2018 and 2020. The NMR technique is the only way to check for this modified syrup.

And these tests show that 76 per cent of the honey was found adulterated. The German laboratory in its analysis report for the samples that have failed NMR says: "Indicates adulteration/addition of sugar syrup."

But it is also clear that this is not the end of the honey adulteration story; very soon there will be another adulterant in the market—this time it will even pass the NMR test. Therefore, what we need is to understand the impact on our health of this sugar-laden honey and demand that there is change—this is about our bodies, our health and in the time of COVID-19 it is a double-triple jeopardy. This is not acceptable.

Immunity booster or buster?

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

- Honey is sugar but a special one, full of nature's goodness
- We are consuming more honey to build immunity against the COVID-19 infection
- Overweight people are more at risk to COVID-19
- So consuming honey that is sugar will make us more vulnerable; more ill

THE QUESTION for us as consumers is simple: does it make a difference if the honey we are consuming is actually sugar? For this, we need to understand the following. 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?

What we know today also is that honey brands are "selling" their products as immunity boosters, good for us to beat COVID-19. We also know that we are consuming more honey—market analysts Nielsen reported in March 2020, that sales of this goodness product were booming. Honey sales were up by 35 per cent. Since then, it is expected that many more of us are consuming honey because of its goodness, so essential when we know we need protection from the virus.

WHAT MAKES HONEY DIFFERENT

Honey is sugar, but it is special. One tablespoon of honey (21 grams) contains slightly higher calories than sugar. It mainly comprises sugar carbohydrates, which are glucose and fructose.

But the "sugar" of honey is transformed to goodness because of the way the bees collect it from the sweet nectar of plants and how they "manufacture" it in the beehives. Bees consume, digest and regurgitate the nectar and it is this that makes it so beneficial for us. Honey is then not about the "sugar", but the enzymes, amino acids, phenolic compounds like flavonoids, minerals and other phyto-chemicals. It is these that give honey antioxidant, antimicrobial, anti-inflammatory properties. Honey is scientifically proven to be good for our immune system and improves our well-being.

This is why starting your day with honey in warm water is well advised. It provides us the ability to manage the oxidative stress that results from life-style, dietary and environmental strain. This oxidative stress is the reason for

cellular degeneration that results in several chronic ailments such as metabolic and cardiovascular diseases as well as aging. In addition, honey is also known for gut health.

A SUGAR-COATED HOAX

Now, imagine starting your day with a shot of sugar syrup! Even if the honey you are consuming is adulterated with 50 per cent sugar syrup, it means you are getting empty calories without any benefits. It will do you harm. Not good.

Now let's consider this during COVID-19. It is sheer poison. We are not getting what will protect us from the virus, by improving our overall health and immunity. But worse, we are consuming honey with sugar syrup, which puts us in the danger of adding weight and will make us more vulnerable to the virus attack.

In the US, the Centers for Disease Control and Prevention (CDC) has said that people with even moderately excess weight may have increased risks of severe COVID-19 infection. This has expanded the risk to larger numbers of people, who may not be declared "obese" but are "overweight"—weight that is greater than what is considered healthy for certain height.

In the initial months of the COVID-19 pandemic, it was not clear why weight was linked to the risk of the disease and its virulence. But as months have gone by, this connection is now clear. One link is with the adipose tissue—the fat in our bodies—that is now understood to be biologically active and promotes low-intensity chronic inflammation in the body, even without infection. This makes our body more immune suppressed and more vulnerable to coronavirus diseases. Then there is the problem of abdominal obesity, which adds stress to the lungs. Studies are suggesting that the epidemic of obesity and COVID-19 can be viewed as a syndemic, as they negatively interact with one another to exacerbate the course of diseases, leading to greater complications and severe illness. Together they create a simultaneous and significant burden on the health system.

In this way, consuming honey laced with sugar, will make us all more likely to fall into the obesity trap—and this when Indians already have a huge burden of obesity on their hands. We also know that obesity is the primary trigger for hypertension, type-2 diabetes and many chronic ailments. India is on the path of becoming an obesity capital of the world—overweight and obesity levels among 15-49-year-old populations have doubled in a decade. In the urban areas, about one-third of the population is overweight and or obese.

This makes it all the more deadly. We are consuming honey—more of it during in these days to fight the COVID-19 infection. But the honey adulterated with sugar will not make us well. It will make us even more vulnerable to COVID-19. It is a double jeopardy.

BEES ARE NEEDED, NOT JUST FOR HONEY...

... but to produce our daily foods

A WORLD without bees would be much a world without food—literally. The fact is bees are important, not just for the honey they give us, but for their "services" as pollinators. As they move from plant to plant, sucking the nectar of flowers, they also spread pollen. Fertility in the ecosystem is dependent on bees. In addition to increasing crop yield through cross pollination, honeybees also increase the biodiversity through pollination and perpetuation of a whole lot of plants in this world, wild or cultivated, in farm fields or forests.

The Food and Agriculture Organization estimates that pollinators affect 35 per cent of the world's crop production, increasing outputs of 87 of the leading food crops worldwide, plus many plant-derived medicines.

In this way, the livelihood of the beekeeper is intertwined with the food we eat. If the beekeeper goes out of business because honey is adulterated, then food will be under threat. Without the bee, we lose much more than the goodness of honey; we lose productivity of our ecosystem itself. We lose life.

We need pure honey

It is time we outwitted the business of adulteration. This requires government to act decisively. It needs industry to be made responsible. It needs consumers to be made aware of the purity of the honey they consume. This demands change

IT IS critical that the business of honey adulteration is stopped at the earliest. It will not only benefit the consumer, but also the beekeeper. It will also go a long way in helping restore and regain agriculture productivity and biodiversity. This is because beekeeping is not just about our honey, it's also about protecting the pollinator bees. But to make this happen, we need aggressive and concerted action—by government, industry and consumers. Nothing less will do.

FIRST: Stop import of syrups and honey from China and do not allow this to come through other countries (syrup laundering)

The much-needed first step is to plug the source and routes of adulteration from China. The Union Ministry of Commerce and Industry should either regulate the imports of all kinds of syrups and honey or stop it completely. Regulation would need

end-use declaration by traders; and links with the honey sector. The ministry should also ascertain that all syrups and honey are imported under the appropriate HS codes and updated database is available publicly. If required, new HS codes could be developed.

However, in our experience, government agencies are completely unable to stop this deviant trade. We have seen how FSSAI has fumbled to check import; it has even got the names of the syrups wrong; it has not been able to check the end users. We also know that this business has a legitimate face—the websites of the Chinese companies do not proclaim their side business of modified syrup. The importers of this syrup will also not say that they are buying syrup that can bypass the lab tests. They will simply say that they are importing fructose or glucose syrup, which has many industrial uses, including honey.

Catching the underbelly of this honey business is tough. So, we would argue that the government stops their imports. It begins the clean-up.

However, we recognise that this will not be enough. Already, the Chinese technology has found roots in India—we discovered one factory that can make this "all pass" syrup. There will be many others ready to replace the Chinese imports. So, we need to do more.

SECOND: Strengthen enforcement in India through tightened standards, testing, but also traceability. Every honey selling company must be required to be able to trace back the origins of the honey—from the beekeeper to the hive.

There is no doubt that the honey industry will argue that they are all within the law—most of the honey samples of the big brands cleared the tests as laid down in India. But they are adulterated as advanced laboratory tests revealed.

To check this, there are three ways:

One, to further tighten standards and testing requirements for honey. To do this, FSSAI would need to include testing for Trace Marker for Rice (TMR) syrup—incidentally this is the parameter FSSAI dropped from the standard between the 2018 and 2020 revisions. It would also need to mandate the use of nuclear magnetic resonance (NMR), which is already being done for honey for export.

However, this approach will have limited results over time. We have seen how the industry has evolved methods of adulteration. Already there is news that Chinese companies have "designed" syrups to beat NMR as well. As soon as NMR gets mandated, it is possible NMR-pass syrups will be used.

Two, and in our view a preferred option, is to test and make data available publicly. FSSAI must be required to buy samples from the market and disclose the results in the public domain and take punitive action against companies selling adulterated honey or those making misleading test-related claims. So, even, if TMR and NMR are not made mandatory, it must be made part of the official testing system—which is public and is done to protect consumer health.

Third, and much more critical, is the food-system approach. To do this, we need a system of traceability and transparency across the honey supply chain. Every honey producer must know their bees—the botanical source of all honey produced along with the geographical location of the apiary should be traceable to the stakeholders, including the consumer. Each entity in the supply chain such as the collector, trader, packer or seller should keep a record of required details which should be open for inspection. This can also happen if each beekeeper is registered and each beehive is numbered, coded and its location can be figured out using the technology. While the companies selling honey should be liable for the traceability of honey sold by them, the government, in

CLUELESS

The data on honey products is weak and so regulation is weak

THE NATIONAL Bee Board (NBB) is responsible for enhancing honey productivity and livelihood of beekeepers in India. It says that the total honey produced in India was 115,000 Metric Tonnes (MT) in 2018-19. On the other hand, the database of the Food and Agriculture Organization (FAO) of the United Nations shows that India produced about 67,500 MT of honey in the same year. The NBB estimates are 1.7 times of those given by FAO. Such a high difference points towards some fundamental problems in collecting and calculating production data.

A look at the historical numbers of NBB also suggest that the numbers saw a much sharper rise from 2013-14 onwards than before. For example, from 62,000 MT in 2007-08 to 72,300 MT in 2012-13, the yearly growth rate was in the range of 0-4.8 per cent. Whereas, from 76,200 MT in 2013-14 to the latest figures for 2018-19, the yearly figures grew in the range of 5.3-11.1 per cent.

The June 2019 report of the Beekeeping Development Committee, chaired by Bibek Debroy, chairperson of the Prime Minister's Economic Council had observed that NBB production data is based on estimates obtained from leading beekeepers in various states which are pooled and expressed.

The report noted that data on honey production is not scientifically collected and needs a systematic approach and that the discrepancy in the NBB and FAO data needs to be scientifically verified. The report mentioned that a better way of estimating honey production would be to find out the number of beekeepers, number of managed bee hives and colonies, number of wild honey bee hives, estimates of feral colonies of domesticated hive bees, actual honey extracted, which will help to get a more accurate estimate of honey production in India.

In the event of no actual figures, it becomes almost impossible to ascertain the scale of adulterated honey in the market, something which is a must to fix the entire issue of honey fraud. It also becomes impossible to design systems of traceability—knowing the bee is as important as consuming the honey.

parallel, should also have its own system to trace all honey produced by beekeepers in the country.

This is where we are the weakest today. We do not even have accurate data on total honey production in the country. This, in spite of the number of governmental agencies that are involved in the bee business (*see* "Clueless").

But this will not work to safeguard our health. We need, not just traceability of the honey produced to the bee, but also a national reference database of pure honey. This would allow for documentation of the chemical and biological properties of different honey types and check for adulteration.

THIRD: We consumers must really "know" our honey; we must be able to tell adulteration by the taste, the smell and the colour. We must demand pure; not refined honey that can be any syrup

It is the preference of the consumer which is shaping-up the business of adulteration. We make a choice for a clear looking liquid honey that does not crystallise. This is why adulterated honey thrives. We must know that a honey which does not crystallise is no guarantee of a pure honey. In fact, crystallisation in honey is a natural phenomena, and the occurrence of which is minimised by processing of honey in factories. Our poorly informed choice helps the industry to freely adulterate with filtered colourless syrups. If we demand a different product, then the honey producing companies will have one less reason to adulterate the honey. Else, it is like a self-goal by all of us—ignorance and trust is not bliss in this case.

We have to demand the change; we have to hold government and industry responsible. Remember there is just too much at stake here. It is about our health, but it is also about the health of our food system—without bees, there will be no agricultural productivity. DTE

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