



COURSERA  
IBM APPLIED DATA SCIENCE  
CAPSTONE PROJECT

# Harnessing the power of Foursquare API and Folium to make business decisions

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# Introduction

When making business decisions, it may prove to be a good idea to benchmark your idea against a similar product / service in another city. By making such comparisons one can get a better idea if your business idea is viable.

Foursquare API provides data about venues (which include restaurants, shops, places of education, amusement centers, train stations, and many more) across the world.

This data provides longitudes and latitudes of each venue which can be used to map the venues on an interactive leaflet map using Folium.

This article explains how the power of Foursquare API and Folium has been used to compare the proportion of plant based restaurants in Sandton with those in Toronto. The results can be used to guide an entrepreneur in his decision to open a plant based restaurant in Sandton.

## Problem statement

### BACKGROUND

An omnivorous diet may have negative impacts on a person's health, on the environment and on animal welfare. More people are switching to vegan, vegetarian or plant-based diets that may be healthier, more sustainable, and more ethical.

### THE HISTORY OF VEGAN AND VEGETARIAN DIETS

Vegans don't eat anything that comes from or includes an animal, i.e. meat, eggs, milk, cheese, mayonnaise, honey, whey or gelatin. According to [www.time.com](http://www.time.com) in their article "A brief history of veganism", veganism can be traced back to ancient Indian and eastern Mediterranean societies. Vegetarianism (slightly less strict than veganism - they generally exclude

meat from their diets) is first mentioned by the well-known Greek philosopher and mathematician Pythagoras around 500 BCE. Vegetarianism was advocated by followers of Buddhism and Hinduism.

In November 1944, a British woodworker named Donald Watson created the term “vegan” to describe people who, apart from not eating meat, also don’t eat dairy and eggs. By 2005, there were at least 250 000 vegans in Britain and 2 million in the U.S. The figure for the UK has since increased to around 542 000.

The vegan lifestyle is strongly advocated by young people: About 42% of vegans are between 15 and 34 years old, whereas only 14% are over 65. According to a systematic review of how consumers shift to plant-based diets published on the website of The Vegan Society, vegan consumers are more likely to be female, highly educated, from the middle or upper-middle social class, have a high IQ, and rate high on physical and spiritual well-being.

## VEGAN / VEGETARIAN RESTAURANTS

Due to the increased popularity of vegan and vegetarian lifestyles, it makes perfectly sense that a new wave of vegan restaurants has sprung up across the globe to satisfy the appetite for plant based foods.

According to Italian chain restaurant Zizzi, businesses respond when consumers want something. This chain has rolled out extensive vegan menus. *“That was a big undertaking for a non-vegan restaurant and it’s all been driven by people saying they want it. The business savvy follows the money, which is why [the restaurant chains] are investing in developing vegan offerings. They know money comes in when they do it.” (Bronte, G. 2017)*

## THE CLIENT

An entrepreneur is contemplating opening a vegan restaurant in Sandton, South Africa. He is unsure if vegan eating is a fad that will quickly blow over, or if it is something that will become increasingly popular. He wants to

benchmark it with an international metropolis that is as multicultural as Sandton.

## **Sandton**

Due to the urban decay of downtown Johannesburg, many corporate offices moved to Sandton, a suburb close to Johannesburg, during the 1990s. Sandton has since become the financial district of South Africa. It boasts several large shopping centers as well as various 5-star hotels. It also has some of the finest restaurants.

## **Toronto**

Toronto, Canada, is a multicultural metropolis with an amazing culinary scene. It offers you a trip around the world every time you go to eat out. Not only will you find Chinese, Korean, Italian, Portuguese and Indian cuisine, there are also many vegan and vegetarian restaurants. This is a perfect city to benchmark the restaurants of Sandton against.

## **QUESTIONS THAT NEED TO BE ANSWERED**

With regards to plant based restaurants, how does Sandton, South Africa compare to Toronto, Canada?

Are the ratios of plant based restaurants versus other restaurants similar in the two cities?

Will it be worthwhile to open a new vegan restaurant in Sandton?

## **The data**

Data from restaurants within a 8km radius from the center of Sandton and within the same radius from the center of Toronto was downloaded from Foursquare API.

The dataset contains the names, addresses, city, postal code, state, country, latitude, longitude, distance from city center and restaurant category (e.g.

Chinese, Indian, Italian, etc.). For a list of some of the categories of restaurants that can be obtained using Foursquare API, please see Table 1.

Table 1 A list of some of the restaurants' categories and their ID codes

<b>African Restaurant</b>
4bf58dd8d48988d1c8941735
<b>American Restaurant</b>
4bf58dd8d48988d14e941735
<b>New American Restaurant</b>
4bf58dd8d48988d157941735
<b>Asian Restaurant</b>
4bf58dd8d48988d142941735
<b>Chinese Restaurant</b>
4bf58dd8d48988d145941735
<b>Sushi Restaurant</b>
4bf58dd8d48988d1d2941735
<b>Thai Restaurant</b>
4bf58dd8d48988d149941735
<b>Fast Food Restaurant</b>
4bf58dd8d48988d16e941735
<b>Indian Restaurant</b>
4bf58dd8d48988d10f941735
<b>Italian Restaurant</b>
4bf58dd8d48988d110941735
<b>Mediterranean Restaurant</b>
4bf58dd8d48988d1c0941735
<b>Portuguese Restaurant</b>
4def73e84765ae376e57713a
<b>Vegetarian / Vegan Restaurant</b>
4bf58dd8d48988d1d3941735

In Figure 1 an example of the data obtained from Foursquare is given.

	id	name	categories	referralId	hasPerk	address	crossStreet	lat	lng	labeledLatLngs	distance	postalCode	cc	city	state	country	formattedAddress	
0	6050a765243da158f633049	Ocean Magic Seafood Restaurant	Asian Restaurant	1624434515	False	Cnr Rivonia Blvd, Shop GA3 Oriental City	9th Ave	-26.056591	28.060204	[[{"label": "display", "lat": -26.056591, "lng": 28.060204}]]	1781	2191	ZA	Sandton	IGauteng	INingizimu Afrika	[Cnr Rivonia Blvd, Shop GA3 Oriental City (9th & 10th Ave), Sandton, 2191]	
1	4ea06d422c5b9f2b3449dd	The Elm Tree Restaurant	Restaurant	1624434515	False	The Syrene Hotel	28 Wessel Rd, btwn 10th & 11th Ave	-26.052791	28.061892	[[{"label": "display", "lat": -26.052791, "lng": 28.061892}]]	2199	2128	ZA	Rivonia	Johannesburg	INingizimu Afrika	[The Syrene Hotel (28 Wessel Rd, btwn 10th & 11th Ave), Sandton, 2191]	
2	4cc95fa45c7b6c9a23ee4366	Thyme On Nicol Restaurant	Deli / Bodega	1624434515	False	William Nicol Dr	at Republic Rd	-26.089544	28.027193	[[{"label": "display", "lat": -26.089544, "lng": 28.027193}]]	3153	2196	ZA	Sandton	IGauteng	INingizimu Afrika	[William Nicol Dr (at Republic Rd), Sandton, 2191]	
3	60b3b1efbc414b5b703bba7	Yuehua Restaurant	Chinese Restaurant	1624434515	False	Rivonia Central		NaN	-26.056688	28.060489	[[{"label": "display", "lat": -26.056688, "lng": 28.060489}]]	1793	2191	ZA	Sandton	IGauteng	INingizimu Afrika	[Rivonia Central, Sandton, 2191]
4	4bd9dac13904a59366e6439e	Maximilien Restaurant	French Restaurant	1624434515	False	Da Vinci Hotel & Suites, Maude St.		NaN	-26.107529	28.053211	[[{"label": "display", "lat": -26.107529, "lng": 28.053211}]]	4404	NaN	ZA	Sandton	IGauteng	INingizimu Afrika	[Da Vinci Hotel & Suites, Maude St., Sandton]

Figure 1 Example of restaurant data obtained from Foursquare



Most of the columns contain text as values, with the exception of lat (latitude), long (longitude) and distance, that contain numerical values that calculations can be done on.

The latitudes and longitudes is used to create maps of the two cities that indicate the different types of restaurants in each.

The categories are used to group similar restaurants together so that a clear picture can be formed of how the two cities' cuisines compare to one another.

	name	country	categories	lat	lng
0	Ocean Magic Seafood Restaurant	iNingizimu Afrika	Asian Restaurant	-26.056591	28.060204
1	The Elm Tree Restaurant	iNingizimu Afrika	Restaurant	-26.052791	28.061692
2	Thyme On Nicol Restaurant	iNingizimu Afrika	Deli / Bodega	-26.089544	28.027193
3	Yuehua Restaurant	iNingizimu Afrika	Chinese Restaurant	-26.056688	28.060489
4	Erawan Thai Restaurant and Bar	iNingizimu Afrika	Thai Restaurant	-26.058651	28.046673

Figure 2 Example of dataset where only the relevant columns were retained

## Method

1. Use Foursquare API to collect data on restaurants in Sandton and in Toronto.
2. Clean the data. Wherever missing values for latitude/ longitude or category appear, these observations are removed. If venues "slip through" that are not restaurants, they are also removed. It is for instance noted that a vegan pharmacy as well as a flower shop was downloaded. These are obviously not restaurants and is therefore removed from the dataset.

4dc79925b0fb5556cd24803d Veganview Dispensary Pharmacy

Figure 3 Example of an item that has to be removed from the dataset

3. Retain only the columns needed for the analysis.

	name	country	categories	lat	lng
0	Ocean Magic Seafood Restaurant	iNingizimu Afrika	Asian Restaurant	-26.056591	28.060204
1	The Elm Tree Restaurant	iNingizimu Afrika	Restaurant	-26.052791	28.061692
2	Thyme On Nicol Restaurant	iNingizimu Afrika	Deli / Bodega	-26.089544	28.027193
3	Yuehua Restaurant	iNingizimu Afrika	Chinese Restaurant	-26.056688	28.060489
4	Erawan Thai Restaurant and Bar	iNingizimu Afrika	Thai Restaurant	-26.058651	28.046673

Figure 4 Example of dataset where only the relevant columns are retained

4. Compare the cuisines with one another to determine if there are similarities and if they differ greatly.
5. Compare the ratios of plant based versus other restaurants for the two cities.
6. Create maps of the two cities using Folium. Folium visualizes data that's been manipulated in Python on an interactive leaflet map. Use different legends to represent different types of restaurants.
7. Make recommendations based on the results obtained.

## Results

The cuisines represented by the Sandton restaurants are provided in Table 2.

Table 2 Cuisines of Sandton restaurants

categories	Freq
African Restaurant	3
Asian Restaurant	3
Chinese Restaurant	3
Eastern European Restaurant	1
French Restaurant	1
Indian Restaurant	5
Italian Restaurant	4
Japanese Restaurant	3
Korean Restaurant	3
Mediterranean Restaurant	1
Modern European Restaurant	1
Restaurant	6
Sushi Restaurant	1
Thai Restaurant	1
Vegetarian / Vegan Restaurant	2

One can see that there are a wide variety of restaurants. Only two of the 40 restaurants are veg\*an restaurants, which gives a proportion of 5.3%.

For easier comparison it was decided to group similar restaurants together, e.g. Chinese, Japanese, Korean, Sushi, Thai and Indian were grouped together under “Asian restaurants”.

The bar chart in Figure 4 shows that Asian restaurants are the most common, followed by “other”, followed by European restaurants. Veg\*an restaurants take 4<sup>th</sup> place.



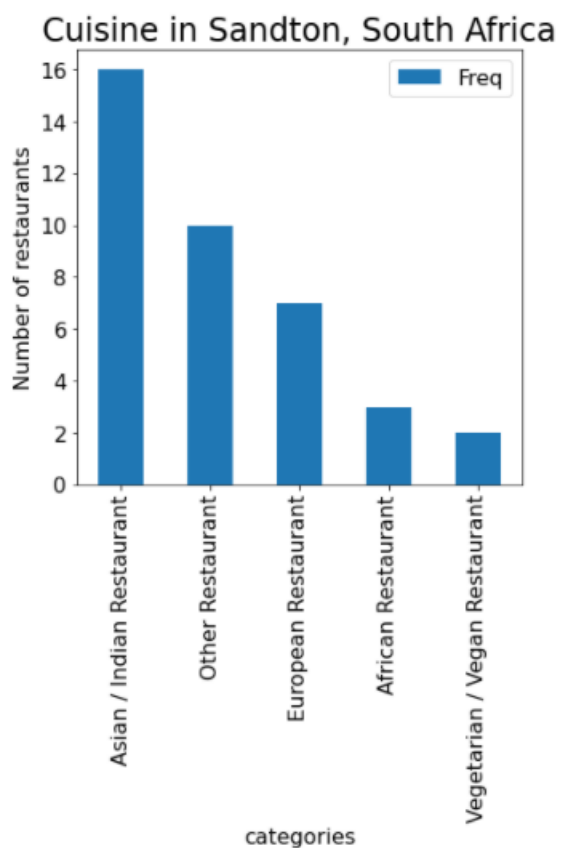


Figure 5 Bar chart: Sandton restaurants

The resulting pie chart for can be seen below.

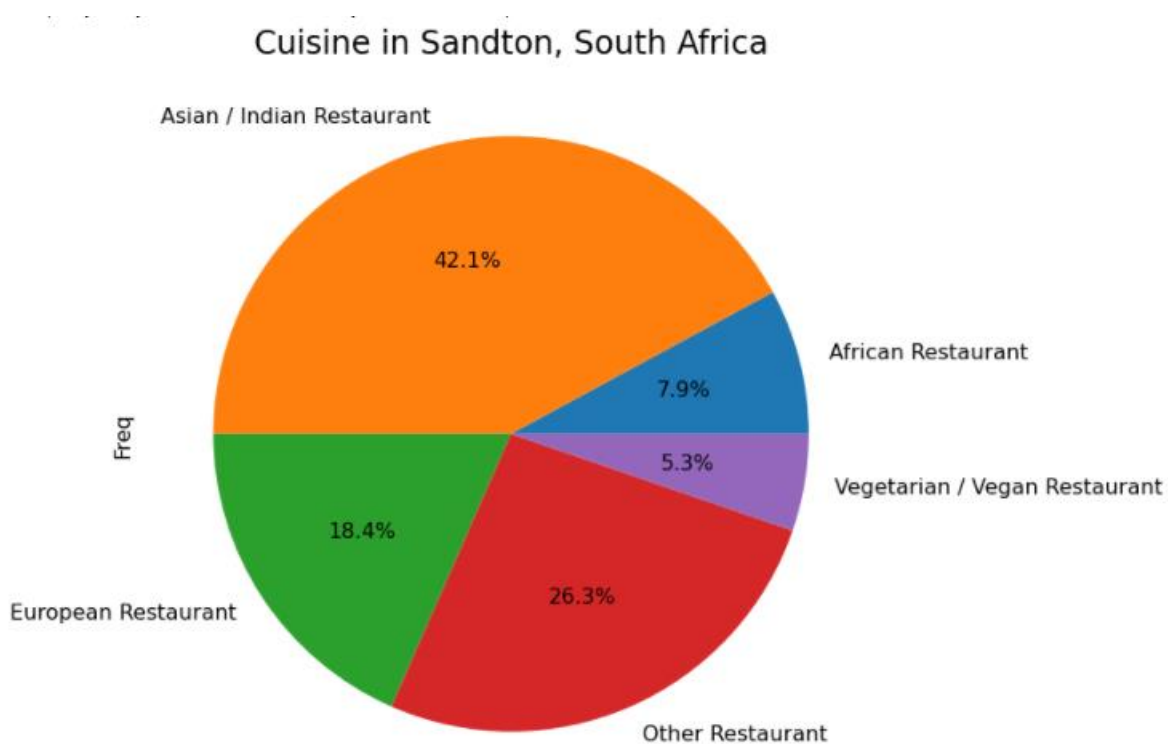
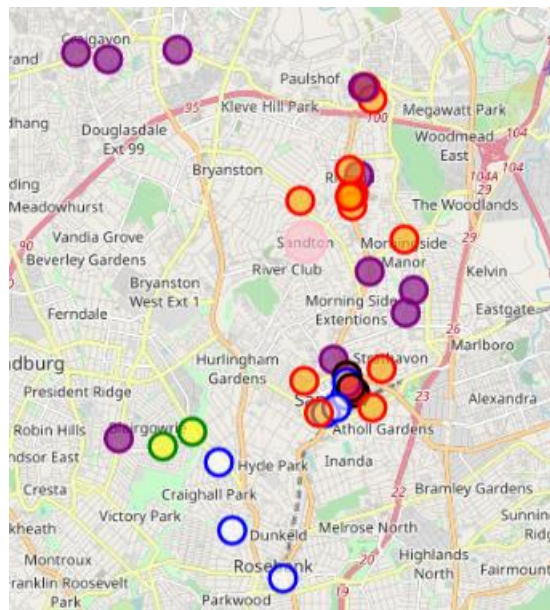


Figure 6 Pie chart: Sandton restaurants

A map of the restaurants in Sandton is shown in Figure 6.

Legend:

- Vegan / Vegetarian
- Asian
- Other
- European
- African



*Figure 7 Map of restaurants in Sandton*

The cuisines represented by the Toronto restaurants are provided in Table 3.

Table 3 Cuisines of Totonto restaurants

categories	Freq
American Restaurant	4
Asian Restaurant	1
Caribbean Restaurant	2
Chinese Restaurant	8
Dim Sum Restaurant	3
Indian Restaurant	2
Italian Restaurant	3
Korean Restaurant	3
New American Restaurant	4
Restaurant	6
Sushi Restaurant	1
Szechuan Restaurant	1
Thai Restaurant	2
Theme Restaurant	1
Vegetarian / Vegan Restaurant	20
Vietnamese Restaurant	1

Twenty out of the 62 restaurants are veg\*an restaurants, which gives a proportion of 32.3%.

After grouping similar restaurants together, the following bar chart and pie chart were obtained.

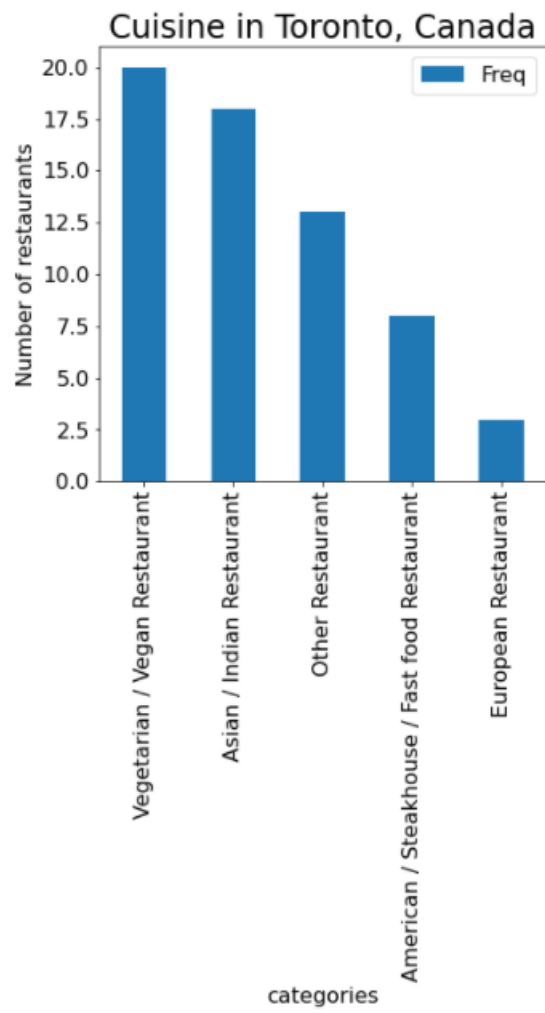
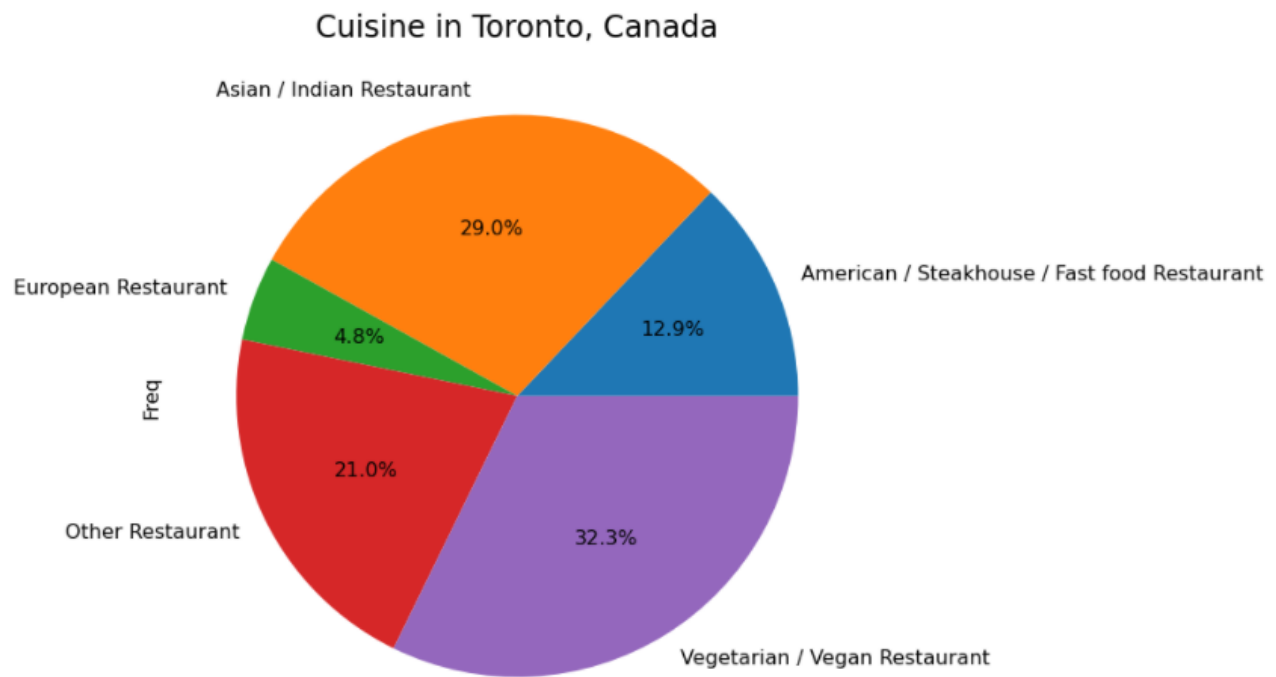


Figure 8 Barchart: Toronto restaurants



*Figure 9 Pie chart: Toronto restaurants*

A map of the different types of restaurants in Toronto, is displayed in Figure 10.

Legend:

- Vegan / Vegetarian
- Asian
- Other
- European
- American

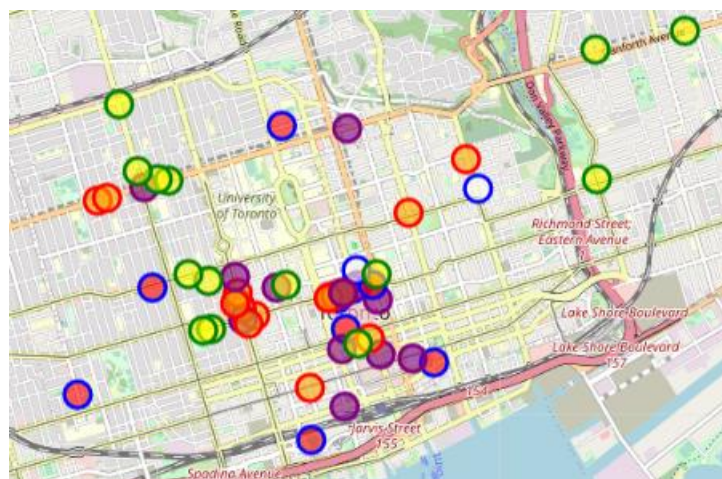


Figure 10 Map of Toronto

Since the author does not have the paid version of Foursquare API, only a sample of restaurants can be downloaded. It is therefore important to use inferential statistics to determine what the probability is that the proportion veg\*an restaurants in Sandton ( $\pi_S$ ) is significantly lower than the proportion in Toronto ( $\pi_T$ ). We will test it at a 1% level of significance.

$H_0: \pi_S = \pi_T$  versus  $H_A: \pi_S < \pi_T$

It is known that the sample proportions are  $p_S = 0.053$  and  $p_T = 0.323$

The  $z$  statistic obtained is -3.163, with a  $p$ -value of 0.002.

Therefore the null hypothesis can be rejected and we conclude that the proportion veg\*an restaurants in Sandton is indeed significantly lower than the proportion in Toronto.

## DISCUSSION

When one compares the proportions of veg\*an restaurants of Toronto with Sandton, one can see that Toronto has a significant higher proportion. As Toronto is one of the world's most vibrant cultural hubs, it is an indication that the veg\*an culture is expanding fast.

## CONCLUSION

It is noted that there are many plant based restaurants in Toronto and that the proportion of veg\*an restaurants indicates that the veg\*an movement is something to take note of. If it were simply a fad, one would expect that



such a great number of plant based restaurants would not have been able to survive.

If one can assume that people living in, and visiting Sandton, are also embracing the veg\*an lifestyle more and more, opening another veg\*an restaurant in Sandton should be a viable business opportunity, since the current proportion of veg\*an restaurants in Sandton is significantly lower than that of Toronto.

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