

Assessment of nutritional status of Type 2 diabetic patients

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Abstract

A hale and hearty lifestyle and a optimum nutrition plays a key role in maintaining homeostatic functions and averting any chronic or debilitating disease. Various epidemiological and observational investigations force multiplies the fact that nutritional factors and dietary habits play a considerable role in controlling diabetes mellitus. A diet that is rich in fruits and vegetables, green tea, vitamin D and plant derived natural compounds along with specific Mediterranean diets have a long term positive impact on Type 2 diabetes mellitus.

Results concluded that 23.33% patients were obese and 43.33% patients were found at risk of malnutrition. Obesity with diabetes is a major risk for further health complications, therefore assessment of nutritional status is of much importance to prevent further health complications.

Introduction

Type 2 diabetes mellitus (T2DM) has now extended to every nook and corner of the earth, with Asian countries having around 60% of the world's diabetic population which was once considered a disease of developed Western society. Obesity and T2DM have catapulted to be a significant medical problem across ages & genetic combinations.

Diabetes is a major health concern in North America and Middle East. Major culprits for this worldwide health menace are sedentary lifestyle and obesity. As per Treister-Goltzman and Peleg, 2015 "thrifty phenotype" or "fetal origins of disease" states that malnutrition during pregnancy and infancy can lead to more "efficient" metabolic production that facilitates the anabolic processing of energy sources in case of excess calorie intake.

About Type 2 Diabetes

Type 2 diabetes is a disorder causing inefficient use of insulin. Middle-aged people are most affected. It is also known as adult-onset diabetes although it may occur in case of childhood obesity also.

Signs and symptoms include excessive thirst, excessive hunger, frequent urination, blurred vision, tingling or numbness in peripheries, fatigue, delayed wound healing, unusual weight loss. Dark rashes around the neck or armpits may also be seen that is also known as acanthosis nigricans.

Causes include insufficient production of insulin by pancreas or inefficient use of produced insulin by body cells. Many factors cause Type 2 diabetes including genes, weight gain, metabolic syndrome, too much glucose production from liver and improper cell functioning.

After understanding the magnitude of the problem, it was very clear that Type 2 Diabetes Mellitus is a major health concern all over the world, therefore the present research work was aimed to assess nutritional status of Type 2 diabetic patients admitted in Mahatma Gandhi Medical College & Hospital, Jaipur.

Research methodology

It was a perspective observational study, that has been divided into following phases:

1. **Phase 1:** Collection of review of literature: The literature was collected to understand the problem in a thorough manner. It was done from institutional library and from internet like Pubmed, Google scholar, Researchgate and many other web portals that are meant to provide published research articles. These research works were thoroughly studied for better understanding of the type of research work done, their methodology and their results.
2. **Phase 2:** Sample selection: Sample selection was done using purposive sampling technique in which 30 samples were taken who were admitted in Mahatma Gandhi Medical College & Hospital, Jaipur.

Inclusion criteria: Samples who were suffering were Type 2 diabetes and who were willing to participate in the study were taken between the age group of 18-59 years. Only male patients were included.

Exclusion criteria: Unwilling patients who were below 18 and above 59 years of age were not selected for the study.

3. **Phase 3:** Demographic profile of the patients: In this phase, patient's general information was noted from patient's OPD or IPD registration records, or from attendants or by interviewing the patient himself. In this part, information regarding the patient's name, age, place, education, work status, type of activity, economic status, marital status were noted. Information was noted in the following format -

Name -
Age -
Place -
Education -
Working status of the respondent -
Type of activity -
Economic status -
Marital status -
Date of admission -
Date of discharge -
Diagnosis -

4. **Phase 4:** Assessment of nutritional status

4.1 Anthropometric measurements: These were done for weight, height, body mass index (BMI), waist, hip and mid upper arm circumference (MUAC) and waist hip ratio. All anthropometric measurements were taken as per standard methods (Bamji et. al, 2019)

4.2 Biochemical assessment: The biochemical data of the patient was taken, under which reports based on electrolytes reports like Sodium, Potassium, HbA1c, Lipid Profile, liver (LFT) and renal function test (RFT) were observed. Apart from this, blood pressure (BP) charting of the patient was also noted.

4.3 Clinical examination: In this part of the study, patient's clinical signs and symptoms were observed and recorded including weakness, nausea, vomiting, diarrhea, constipation, shoulder and back pain, fatigue, etc. Format was as following -

Weakness -

Anorexia -

Wasting -

Anemia -

Loss of appetite and taste changes -

Fatigue -

Nausea / vomiting -

Frequent urination -

Excessive thirst -

Excessive hunger -

4.4 Dietary recall: To know the patient's nutrient intake, patient's 24 hour dietary recall was recorded. It is done for three consecutive days including 2 working days and 1 holiday to find out their actual food intake pattern. Nutrient intake was calculated from the data on food intake. Empty calories intake was noted by Food Frequency Questionnaire, in which daily consumption of sugar, oil, cold drinks, pickles and alcohol was recorded.

Format for 24 Hours Home Recall

Time	Menu	Household measures	Calories	Protein	CHO	Fat	Fiber

Empty calorie intake through food frequency

Food items	Daily	Weekly	Fortnightly	Monthly	Total empty calorie intake
Oil					
Sugar					
Cold drink/ Sherbat					
Juice					
Pickles/ Fried foods / Junk food					
Alcohol					
Total					

4.5 Statistical analysis: Patient's mean values with percentage were mentioned in the Results part.

4.6 Nutritional diagnosis: On the basis of data gathered patient's nutritional diagnosis was derived and data was interpreted in Results and discussion part as final findings in form of Obese, Overweight, Underweight, Malnourished and Normal.

Results and discussion

Results & discussion section has been divided into following parts as per the data collected from 30 patients for ease of elaboration and a better understanding.

1. Demographic profile
2. Nutritional status assessment

2.1 Anthropometric measurements

2.2 Biochemical investigations

2.3 Clinical examination

2.4 Nutrient intake

3. Nutritional diagnosis

1. Demographic profile:

Demographic profile of patients: Patients demographic profile was recorded in terms of age, place, educational status, activity pattern, occupation, marital status, economic status & clinical diagnosis as shown in table 1:

Sample patients	Age	Place	Education	Working status	Type of activity	Economic status	Marital status	Diagnosis
1	30/M	Hisar	Metric	Working	Heavy	Middle	Married	DM2/ Hypothyroidism
2	60/M	Jaipur	Metric	Working	Moderate	Middle	Married	DM2/ SOB
3	60/M	Alwar	Metric	Working	Sedentary	Middle	Married	DM2 /Ascites
4	45/M	Jhunjhunu	Metric	Working	Heavy	Middle	Married	DM2/ Parkinson's
5	37/F	Churu	Metric	Working	Moderate	Middle	Married	DM2/SOB
6	35/F	Sadulpur	Metric	Working	Heavy	Middle	Married	DM2/ HTN
7	40/F	Kota	Metric	Working	Moderate	Middle	Married	DM2/ Hypothyroidism
8	75/M	Jaipur	Primary	Non working	Moderate	Middle	Married	DM2
9	45/M	Hisar	Graduate	Working	Moderate	Middle	Married	DM2/HTN
10	49/F	Udaipur	Graduate	Working	Moderate	Middle	Married	DM2/Ca breast

11	49/M	Ajmer	Metric	Working	Moderate	Middle	Married	Dm2/ HTN/SOB
12	38/F	Jhunjhunu	Graduate	Working	Moderate	Middle	Married	DM2/HTN
13	69/M	Sadulpur	Metric	Working	Moderate	Middle	Married	DM2/Hypothyroidism
14	32/M	Jaipur	Metric	Working	Moderate	Middle	Married	DM2/HTN
15	39/M	Jhunjhunu	Graduate	Working	Moderate	Middle	Married	DM2/HYPOTHYROIDISM/CHRONIC Diarrhoea
16	59/M	Sikar	Metric	Working	Moderate	Middle	Married	DM2/SOB
17	24/M	Banswara	Graduate	Student	Moderate	Middle	Unmarried	DM2
18	44/M	Hisar	Graduate	Working	Moderate	Middle	Married	DM2/Hypothyroidism
19	64/M	Rohtak	Graduate	Working	Moderate	Middle	Married	DM2/HTN
20	72/M	Chandigarh	Metric	Working	Moderate	Middle	Married	DM2/HTN
21	53/M	Jodhpur	Metric	Working	Moderate	Middle	Married	DM2/DIARRHOEA/SOB
22	45/M	Ajmer	Metric	Working	Moderate	Middle	Married	DM2/HYPOTHYROIDISM
23	49/M	Ajmer	Metric	Working	Moderate	Middle	Married	DM2/Hypothyroidism
24	64/M	Dausa	Metric	Working	Moderate	Middle	Married	DM2/HYPOTHYROIDISM
25	34/M	Jaipur	Metric	Working	Moderate	Middle	Married	DM2/SOB/PARKINSON'S
26	54/M	Churu	Metric	Working	Moderate	Middle	Married	DM2/HTN
27	68/M	Sikar	Metric	Working	Moderate	Middle	Married	DM2/SOB
28	59/M	Jaipur	Metric	Working	Moderate	Middle	Married	DM2/Fever
29	69/M	Karauli	Metric	Working	Moderate	Middle	Married	DM2/PIVD
30	54/M	Pali	Metric	Working	Moderate	Middle	Married	DM2/Hypothyroidism/SOB

Table 1: Demographic profile of patients

Data collected has been interpreted as shown in table 2.

Variable	Parameter	No. of patients	%
Age	20-30	1	3.33
	30-50	14	46.66
	50-70	11	36.66
	Above 70	4	13.3
Marital status	Married	29	96.7
	Unmarried	1	3.33
Type of activity	Moderate	25	83.33
	Sedentary	5	16.66
Economic status	MIG	30	100

	LIG	0	0
	HIG	0	0
Educational status	Metric	23	76.66
	Graduate	7	23.33
	Primary	1	3.33
Occupational status	Working	28	93.33
	Non working	2	6.66

Table 2: Data interpretation of demographic profile of type 2 diabetic patients

Patient's demographic profile showed that 3.33% patients were in the age group of 20-30, 46.66% patients were in the age group of 30-50, 36.66 % of patients were observed in the age group of 50-70 and 13.3% patients were found >70 years of age. Majority (96.7%) of the patients were married. Only 3.33% of patients were unmarried. Activity pattern of majority (83.33%) of patients was found in the category of 'moderate activity' while 16.66% patients were sedentary active. Economic status showed that 100% of patients were from the middle income group. Majority of the patients were from Rajasthan specially Jaipur but some of the patients were from Chandigarh, Rohtak and Hisar also. By occupation, 93.33% patients were working while 6.66% patients were non working, one of them was student. Educational status showed that 76.66% patients were metric pass, 23.33% patients were graduate. All patients were male.

2. Nutritional status assessment:

2.1 Anthropometric measurements

Sample patients	Height (cm)	Weight (kg)	BMI (kgm ²)	MUAC (cm)	Waist circum (cm)	Hip circum (cm)	WHR (cm)
1	165	60	22	20	70	75	0.93
2	165	60	22	20	70	75	0.93
3	165	65	23.8	21	72	76	0.94
4	170	69	23.8	23.8	78	80	0.97
5	160	68	26.56	22.4	75	79	0.94
6	170	72	24.9	25.4	82	84	0.97
7	165	69	25.3	24.8	76	79	0.96
8	175	80	26.6	25	74	78	0.94
9	175	70	23.3	24	73	75	0.79
10	175	90	30	29	78	80	0.97
11	175	70	23.3	24	72	75	0.96
12	165	65	23.8	20	70	73	0.95
13	170	75	25.9	22	73	75	0.97
14	170	70	24.2	23	71	74	0.95
15	170	58	20	20	65	69	0.94
16	167	68	24.4	22.8	68	70	0.97
17	168	69	24.4	22.8	68	70	0.97
18	170	67	23.1	22.8	69	72	0.95
19	160	55	21.4	22.8	69	72	0.95
20	165	59	21.6	22.8	69	72	0.95

21	164	62	23.8	21.8	66	69	0.95
22	169	78	27.3	21.1	66	69	0.95
23	170	63	21.7	21.1	66	69	0.95
24	168	65	23	21.1	66	69	0.95
25	158	66	26.5	21	65	67	0.97
26	162	59	22.5	22	65	66	0.98
27	166	67	24.3	22	65	66	0.98
28	176	57	19	22.4	63	65	0.96
29	170	67	23.1	22.4	63	64	0.98
30	160	55	21.4	22.4	63	65	0.96

Table 3: Anthropometric data of patients

Anthropomorphic data includes information related to human body size and shape. Anthropomorphic measurements includes height, weight, BMI (body mass index) . Above table 3 was showing that mean height of patients was 167.6 cm, while mean weight was 66.6 kg. Body mass index of 10 out of 30 patients was in the range of normal category, while 43.33 % patients were found in the category of at risk. BMI in the range of obesity was found in 23.33 % patients as shown in table 4.

Ranges	No. of patients	%
Normal A	10	33.33
At risk of obesity	13	43.33
Obese	7	23.33

Table 4: Classification of patients as per BMI

2.2 Biochemical investigations

Sample	HBA1C	Haemoglobin	Creatinine	Blood in urine	Glucose in urine
1	11.3	14	0.8	Negative	Negative
2	12	13	0.6	Negative	Negative
3	10.5	14	0.6	Negative	Negative
4	14	15	0.8	Negative	Negative
5	10.5	13	1	Negative	Negative
6	13	12	0.9	Negative	Negative
7	11	13.8	1.2	Negative	Negative
8	13	16	0.9	Negative	Negative
9	13.6	16	0.8	Negative	Negative
10	13.6	15	0.8	Negative	Negative
11	11.3	14	0.8	Negative	Negative
12	11.9	9	0.7	Negative	Negative
13	11	11.3	1.2	Negative	Negative
14	15	5.7	0.7	Negative	Negative
15	13.4	14.1	0.8	Negative	Negative
16	12.6	13.6	0.6	Negative	Negative

17	13.4	13.8	0.8	Negative	Negative
18	13.5	14.4	0.4	Negative	Negative
19	10	12.2	0.8	Negative	Negative
20	14.8	12	0.7	Negative	Negative
21	13	12.5	0.7	Negative	Negative
22	13.6	16.1	0.7	Negative	Negative
23	12.8	11	0.9	Negative	Negative
24	15	14.2	1	Negative	Negative
25	12.4	13	1.3	Negative	Negative
26	13.5	10.2	0.8	Negative	Negative
27	13	9	0.5	Negative	Negative
28	13.6	13.1	0.8	Negative	Negative
29	13.4	14.1	1.8	Negative	Negative
30	11.8	11.6	1	Negative	Negative

Table 5: Biochemical reports of T2DM patients

Biochemical assessment include measuring a nutrient or it's metabolite in body at any given period of time. Haemoglobin, HbA1C, creatinine levels were found in all patients while that were prescribed by doctors. 93.33% patients were found normal haemoglobin level out of 30 patients, 6.66 % patients were found with low haemoglobin levels. Above table 5 is depicting that mean HbA1C level was 12.2. All patients had higher HbA1C levels (Table 6). With this creatinine levels were also found in the normal range that makes it clear that till now diabetes didn't shown any deteriorating effect on kidneys.

Parameters	Variables	No. of patients	%
Haemoglobin	Normal	28	93.33
	Low	2	6.66
	High	0	0
Hba1c	High	30	100
Creatinine	Normal	28	93.33
	High	2	6.66

Table 6: Interpretation of data obtained for biochemical parameters

2.3 Clinical examination

Sample Patient	Weakness	Anorexia	Wasting	Anemia	Loss of appetite	Fatigue	Nausea	Frequent urination	Excessive thirst	Excessive hunger
1	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes
3	No	Yes	Yes	No	Yes	Yes	No	No	No	Yes
4	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	No
5	Yes	Yes	No	No	No	No	Yes	Yes	No	Yes
6	Yes	No	Yes	No	No	No	No	No	No	No
7	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes
8	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes
9	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes

10	No	Yes	No	No	No	No	Yes	Yes	No	No
11	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes
12	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes
13	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
14	No	Yes	Yes	No	No	No	Yes	Yes	No	Yes
15	Yes	No	No	No	No	No	No	No	Yes	Yes
16	Yes	Yes	Yes	No	No	Yes	No	Yes	No	Yes
17	Yes	Yes	Yes	No	Yes	No	No	Yes	No	No
18	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
19	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes
20	Yes	Yes	Yes	No	No	Yes	No	No	No	Yes
21	Yes	Yes	Yes	No	Yes	No	No	Yes	No	No
22	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes
23	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes
24	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No
25	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes
26	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
27	No	Yes	Yes	No	No	Yes	Yes	No	Yes	No
28	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes
29	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes
30	Yes	No	No	No	Yes	Yes	Yes	No	No	No

Table 7: Clinical signs & symptoms in T2DM patients

Clinical signs and symptoms include weakness, anorexia, wasting, anemia, loss of appetite, fatigue, nausea, frequent urination, excessive thirst and excessive hunger. Above table 7 is presenting the data obtained for clinical signs and symptoms and data has been interpreted in figure 1.

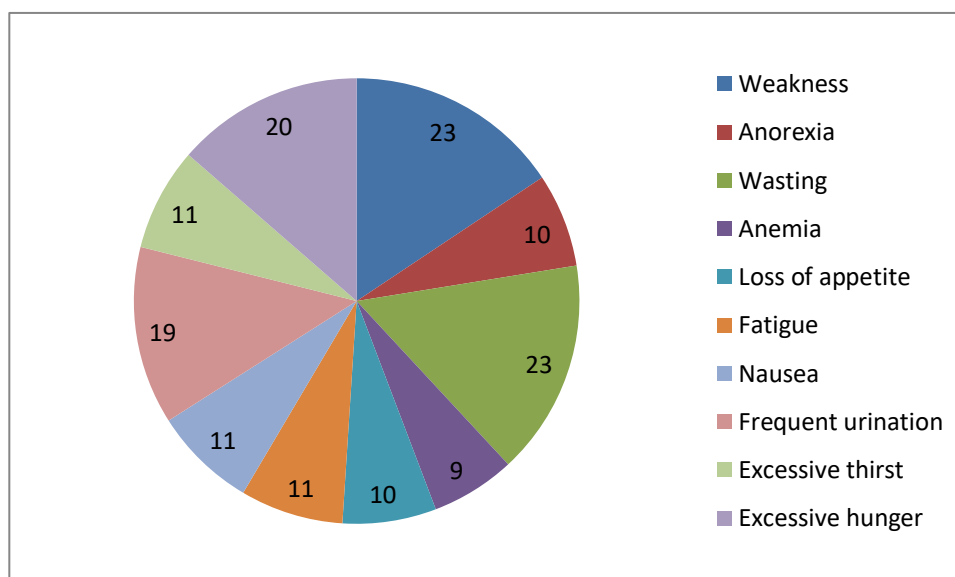


Figure 1: Interpretation of clinical signs & symptoms of T2DM patients

Above figure is showing that 76.6% patients showed symptoms of weakness and wasting. Thirty three percent patients showed anorexia and loss of appetite. Sixty six percent

patients showed symptoms of excess hunger. Symptoms of fatigue, nausea and excessive thirst were observed in 36% patients. Anemia was observed in 30% patients.

2.4 Nutrient intake

Sample Patient	Energy (kcal)	Protein (gm)	CHO (gm)	Fat (gm)
1	1204	52.34	224.4	24.71
2	1296.36	52.45	210.9	23.5
3	1035.96	47	169.3	16.7
4	1204	52.34	224.4	24.71
5	1949.62	51.28	203.8	19.01
6	1204	52.34	224.4	24.71
7	1081	41.98	189.5	11.61
8	828.6	30.21	151.3	14.9
9	1081	41.98	189.5	11.61
10	1035.96	47	169.3	16.7
11	1949.62	51.28	203.8	19.01
12	1074.06	44.89	169	21.9
13	828.6	36.21	151.3	14.9
14	1204	52.34	224.4	24.71
15	1035.96	47	169.3	16.7
16	1081.6	41.98	189.5	11.61
17	1275	40.8	165.2	16.7
18	1949.62	51.28	203.8	19.01
19	1081.6	41.98	189.5	11.61
20	1375	52.1	172.8	13.5
21	1750	58	151.3	16.6
22	1204	52.34	222.4	24.71
23	1035.96	47	169.3	16.9
24	1828.6	36.21	151.6	18.5
25	1204	52.34	224.4	25.71
26	1035.96	47	168.5	25.8
27	1081.6	41.98	189.5	11.61
28	1825	37.5	150.4	36.64
29	1949.62	52.38	203.8	19.01
30	1828.6	36.21	151.3	14.7

Table 8: Nutrient intake of T2DM patients

Above table 8 is showing nutrient intake of type 2 diabetic patients. Nutritional intake included intake of the patients of energy, protein, carbohydrate and fat content. It was found that 33.33 % patients were taking proper diet according to their RDAs. Majority of patients showed nutrient intake more than their requirements specially calorie and fat intake. It contributed to weight gain and uncontrolled diabetes.

3. Nutritional diagnosis:

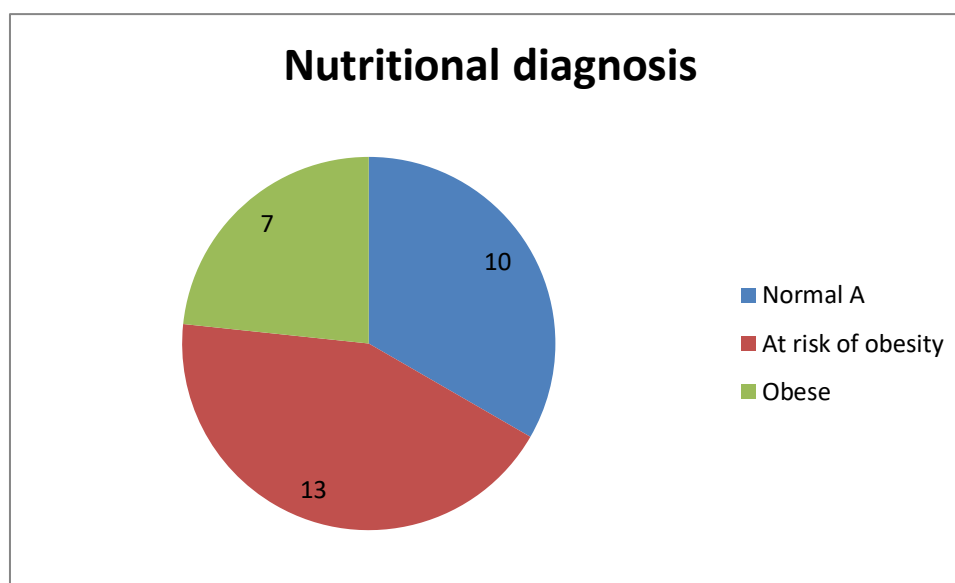


Figure 2: Nutritional diagnosis of type 2 diabetes patients

Above figure is showing that 10 out of 30 patients (33.33%) were normal, 43.33% patients were at the risk of obesity and 23.33% patients were found obese out of 30 patients.

Conclusion

Thus it is concluded that 23.33% patients were obese and 43.33 percent patients were found at risk of malnutrition. It was due to many reasons like weight gain, more BMI, uncontrolled blood sugar, symptoms of excessive hunger, and excess intake of calories and fat. Timely assessment of nutritional diagnosis is very important as it may prove helpful in suitable treatment plan for patients within time so that future diabetes related health complications can be prevented.

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