



Research Article

Factors Affecting the Awareness and Adoption Level of Improved Olive Cultivation Practices by the Olive Growers in Pothwar Region of the Punjab, Pakistan

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Abstract | The Government of Pakistan started focusing on the cultivation of olive trees to meet the rising demand for edible oil, save foreign exchange, and improve the farming community's livelihoods. It is a matter of fact that training plays an important role in building the farmer's capacities, raising awareness, and providing them with modern knowledge by enhancing their performance to achieve the ultimate goals. However, farmers struggle to manage the olive crop due to a lack of practical knowledge and training sessions on advanced production techniques. Keeping in view the above-mentioned facts, it was imminent to assess the awareness level and adoption of olive growers of the Pothwar region of Punjab so that they can contribute effectively to the uplift of agriculture as well as their livelihoods. Pothwar region comprises Attock, Chakwal, Jhelum, and Rawalpindi districts. Three districts (Chakwal, Jhelum, and Attock) were purposively selected due to the maximum number of olive growers. The olive growers' list with a minimum of 50 plants was collected from the Department of Agriculture (Extension). A total sample size of 310 farmers was selected through a purposive sampling procedure by using Morgan and Krejcie table as the total population (Olive growers in the targeted research areas) is 1500. Data were collected through a face to face interviews with the help of an interview schedule. The SPSS (Statistical Package for Social Sciences) and MS. Office software were considered for analysis. According to the results, about 51% of the respondents in the study belonged to old age (above 45) and about 53.2% of the respondents were having matric education. Furthermore, results from correlation analysis showed that education, the number of olive trees and motivation to grow olive trees have a highly positive significant relationship with the level of awareness about olive cultivation practices. The systematic promotion of fortnightly and monthly training of olive growers without any discrepancy should be planned under realistic monitoring and evaluation. Agricultural extension department should arrange the training for different progressive farmers' fields to develop an interest in updating their knowledge and analyzing their problems that will bring positive outcomes in olive production of Pakistan.

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Introduction

Agriculture sector shares 19.3% of Gross Domestic Product (GDP) and it is the lifeline of Pakistan's economy. It employs 42.3% of the labor force and supplies raw materials for different value-added sectors (GoP, 2020). The agriculture sector has a significant share of variant crops and their products in the national economy of Pakistan. Major crops of Pakistan are wheat, rice, maize, cotton and sugarcane which contribute around 24% to total agricultural outcomes. Minor crops grown in the country are oilseed, onions, chilies, and lentils which account for 10.80% in agriculture value addition and 2.04% of overall GDP. To feed the rapidly growing population of the country; the need for high-value perishable products like vegetables, edible oil, fruits, meat and dairy products continues to increase with time (GoP, 2020).

In 2019, Pakistan's imports of edible oil were higher than other countries. The share of edible oil increased to a record 3.6 million metric tons. About 91% of palm oil is imported and it continues to be the major imported oil. The total imports of soya beans are at a record 2.2 million metric tons. Cottonseed keeps on being Pakistan's biggest locally produced oilseed and is relied upon to achieve 3.7 million metric tons. The olive (*Olea europaea* L.) is used for its good quality edible oil as well as for the production of pickles. Pakistan currently produces around 1400 tons of olive oil and it is estimated that the production of olive oil would be increased to 1600 tons by 2027 (GoP, 2019). There is a need to develop olive seedlings, however, the greater share of them are expensive and not accessible locally. These must be imported from abroad which makes it costly and improving developing media with fundamental additions can assist with improving general development qualities in olive (Iqbal *et al.*, 2020).

Olea europea has a place with the family *Oleaceae*. The main characteristic of the olive plant is an evergreen tree that reaches a height of up to 50 ft. in stature with a spread of around 30 ft. after harvesting olive tree can be pruned up to 20 ft. height because the production of flowering will be increased on the new branches. The total life span of an olive plant is more than 500 years. About millions of wild olive trees are found in Punjab, Baluchistan and Khyber Pakhtunkhwa provinces of Pakistan. In Pakistan olive

trees has been grown in both arid and semi-arid area but the adaption rate of growth is high in an arid zone where the climate is suitable for growing olive trees or also grown in hilly areas of the country. The oilseed crops are minor like sunflower, mustard, groundnut, canola and rapeseed are favored for extraction of oil but are unable to fulfill the demand for edible oil (Mohsin, 2017).

The foremost purpose of the extension department is to condense the gap between the farmer and the researchers and also improve the capacity or productivity to encourage an exchange of agricultural advances among the farmers. The important role of agricultural extension is to promote the adoption of innovation and technologies and extension education helps to improve learning behavior and knowledge management and also improvement of human behavior (Jamilah *et al.*, 2010). Extension education plays an important role to improve the knowledge skills and attitudes of people through proper communication and education. The major responsibility of the extension department is to uplift all the necessary information about the production technology of crops or new innovative technology which will improve their agricultural production (Sinkaiye, 2005).

The participation of farmers in different agricultural activities arranged by the extension department is very helpful to understand the issues they faced and new methods of communication are very helpful for the farmers to analyze their related problems (Allahyari, 2009). Sustainability in social, human, financial and authoritative ought to be achieved by understanding approaches that give access to data that will be distinguished or carefully examined (Hosseini *et al.*, 2009).

Many researchers had made efforts to document a brief meaning and concept of adoption. Among the various concepts and definitions documented, the concept denoted by Rogers (1983) was considered more brief and relevant. Rogers reported that diffusion is a process by which technology is disseminated through a specific medium over a period amongst the members of a social system. Furthermore, adoption was described as the use of any type of new technology by the farmers at a specific given period.

Feder *et al.* (1984) said that there are a lot of differences

between discrete adoption and aggregate adoption. According to their studies, discrete adoption was the degree of use of innovation in a very long time especially when the farmers must sound aware of the innovation and its potential. The authors additionally explained the concept of aggregate adoption that adoption is the process of the extent of technology within a region. Chaudhary (1999) observed that there are four independent variables like as social interaction, education, size of landholding and field knowledge sources were absolutely and significantly compared with the adoption level of farmers regarding advanced practices of moth bean cultivation, the other variables like family type and size of the family were non-related with the adoption level of farmers.

Bhatti (2011) reported that there are about 60% technological gap was found in approved mustard production technology as per the response of the farmers of all levels as small, medium, and high investment farmers are similar. Choudhary (1999) found that 70% of moth bean growers held in the average adoption group and 16.67% of respondents were in the low adoption. While only 13.37% of the respondents were high adopters.

Thirtle and Ruttan (1987) said that aggregate adoption obtained the extent of innovation within a community. Following a careful review of similarities and dissimilarities between the above-cited definitions, it had been seen as important to implement any kind of study related to adoption. Moreover, when effecting an adoption research study, it is necessary to take an understanding of the circumstance that there are separable (fertilizer, improve seed and herbicide, etc.) and inseparable (mechanization and irrigation, etc.) technologies. The main purpose of training is to increase the awareness of the people so that their knowledge of the people can be increased. Now it is up to the people to adopt or reject this research or knowledge. Also, adoption is a very difficult and tedious process. With time, as the population has increased, the need for food has also increased. Due to this, access to modern technology and technical knowledge for the common farmers has been a major challenge due to the lack of training which causes a low adoption rate.

Sarda and Khurana (1993) reported that around 10% of the reception gap among the rice crops. Besides, the adoption gap was higher by 14% among little farmers,

40% among medium farmers, and 50% among enormous farmers who were developing rice in a huge zone. Besides, around 54% innovation gap was found among mustard farmers (Singh *et al.*, 2011).

The main objective of the study is to examine the factors affecting the awareness and adoption level of improved olive cultivation practices by the olive growers.

Materials and Methods

The present study is based in the Pothwar region of Punjab Pakistan. Three districts (Chakwal, Attock and Jhelum) were purposively selected due to the maximum number of farmers of olive growers. The olive growers having an olive farm with a minimum of 50 plants constituted the population for the study. The study was conducted in 2019 at the College of Agriculture, University of Sargodha. The list of olive growers was collected from the Department of Agriculture Extension. A sample size of 310 respondents was selected by using (Krejcie and Morgan, 1970) table as the total population (Olive growers in the targeted research areas was 1500).

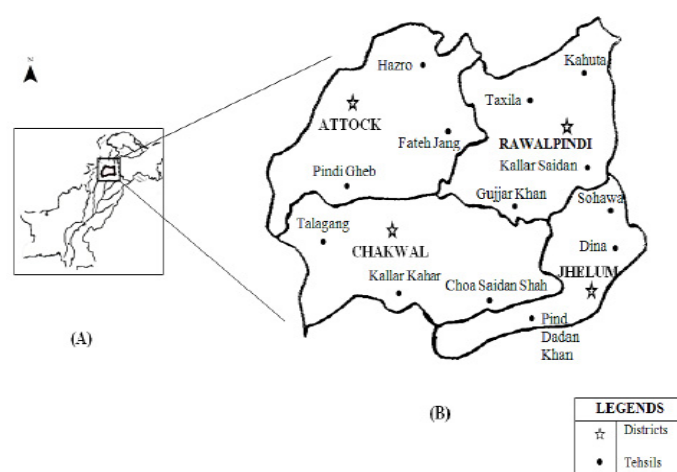


Figure 1: The map of Pothohar region.

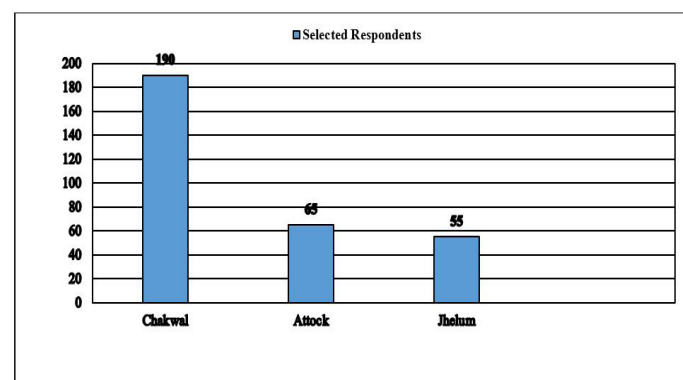


Figure 2: Distribution of sample from selected districts.

Instrument and data collection

There are different methods utilized for information assortment. Data may be collected through many steps in which face to face method is the most reliable technique. This method helps the interviewer to get data in a real-life situation or respondents feel free to give answers (Radhakrishna, 2007). After studying the targeted area, a well-structured interview schedule was developed based on research objectives. To determine whether the research tool is reliable or not, it was pre-tested on 30 respondents and the value obtained for Cronbach Alpha was 0.84 indicating that the research tool is reliable. The validity of the interview schedule was also measured and deeply checked by the members of the Supervisory Committee. The farmers were interviewed at their farms and home on a fixed schedule.

Adoption gap

The adoption gap is the difference between the level of awareness and the adoption level by the olive farmers in their field concerning rice cultivation practices (Uday et al., 2017).

The adoption gap will be calculated through:

$$AG = (Level\ of\ awareness - Level\ of\ adoption) \times 100$$

Chi-square test statistics

A chi-square measurement is one approach to show an association between two downright factors. In measurements, there are two kinds of factors: mathematical (countable) factors and non-mathematical (unmitigated) factors. Chi-square test is addressed by X^2 . It was presented by Karl Pearson in the year 1900. He decided the level of freedom in sociological investigations. The accompanying equation is used for the Chi-square test.

$$x^2 = \sum \frac{(fo - fe)^2}{fe}$$

x^2 = The test statistics; Σ = The sum of; fo = observed frequency; fe = expected frequency.

Analysis

Various descriptive and inferential statistical techniques i.e. percentage, mean, cross-tabulation, Chi-square and multiple regression analysis were applied for getting meaningful results by using Statistical Packages for the Social Sciences (SPSS).

Results and Discussion

Age is a significant factor that assumes a crucial part in the improvement of positive perspectives and appropriation performance of the respondent (Talib, 2012). The data concerning this aspect is given in Table 1.

Table 1: Distribution of respondents according to their age.

Age (years)	Frequency	Percentage
Young (15 to 29)	40	12.9
Middle (Above 30-45)	112	36.1
Old (Above 45)	158	51.0
Total	310	100.0

The data in Table 1 depicts that about 51% of the respondents in the study belong to old age (above 45). While 36.1% of the respondents were middle (above 30- 45). Furthermore, only 12.9% of the respondents were young (15-29).

According to the Government of Punjab, youth (15-35) comprises 60% of the population. This demographic shows that the potential of the young age group could be harvested by connecting them with the agriculture profession. However, certain factors exist which hinder the participation and interest of youth in the agriculture sector, therefore it is necessary to attract youth to agriculture but making it more attractive and providing incentives.

Education assumes a significant part in the advancement of individual character, improves their skills, knowledge, expertise and it additionally assumes a vital function in the development of countries. The respondents were asked for some information about their education level.

Table 2: Distribution of respondents according to their educational level.

Education	Frequency	Percentage
Up to Primary	55	17.7
Matric	162	52.3
Intermediate	31	10.0
Graduate and above	62	20.0
Total	310	100.0

The results of Table 2 reveal that about 52.3% of

respondents possess matric level education, about 17.7% of the respondents were up to the primary. The farmers having a high adopted rate of olive cultivation was belonging to educated and also encouraged other farmers to generate income from barred lands. Furthermore, 20% of the respondents were at graduation and above level and 10% of the respondents were educated at an intermediate level. Education is one of the important factors in the development of personality improving knowledge and also capacity building. Therefore, agricultural development experts and extension service providers must consider the education level of the farming community while launching a project/program and carrying out extension activities in the field.

The results in Table 3 show that 56.5% of the olive growers belonged to small landholding up to 6 acres. The small landholding farmers take much interest in growing olive plants motivated by the department of agricultural extension and also give subsidies on the olive plants and irrigation system. whereas, about 29.7% of the respondents had land > 6-12 acres who were medium farmers. The farmers who have above 12 acres under olive cultivation were 13.9%.

Table 3: Distribution of the respondents according to their family landholding.

Family land holding (Acres)	Frequency	Percentage
Up to 6	175	56.4
>6-12	92	29.7
Above 12	43	13.9
Total	310	100.0

Table 4: Distribution of the respondents according to their size of land holding under olive cultivation.

Size of land under olive cultivation (acres)	Frequency	Percentage
Up to 6	189	61.0
>6-12	103	33.2
Above 12	18	5.8
Total	310	100.0

The data in Table 4 reveals that the cultivation of olives is mostly adopted by small farmers. About 61% of the respondents have utilized up to 6% of acres for olive plantations. Furthermore, 33.2% of the respondents have planted an olive orchard on 12 acres. About 5.8% of the respondents cultivated olive plantations

above 12 acres. This implies that small farmers are showing their interest in the cultivation of olives on their land. This might be due to the incentives given by the government to the farmers through the project to motivate them to produce olives. These farmers have adopted new olive cultivation practices to boost their production.

Table 5: Distribution of the respondents according to the number of years of growing olive.

Olive growing experience (years)	Frequency	Percentage
Up to 4	181	58.4
> 4 - 8	112	36.1
Above 8	17	5.5
Total	310	100.0

Table 6: Distribution of the respondents according to their adoption gap of olive recommended cultivation practices.

Olive cultivation practices	Awareness level		Adoption level		Adoption gap %
	Mean	St. D.	Mean	St. D.	
Land preparation	2.24	0.754	1.89	0.704	35
Planting time	2.22	0.657	2.01	0.715	21
Olive tree cultivation with covering crops	1.93	0.709	1.62	0.766	31
Planting geometry	2.08	0.675	1.85	0.592	23
Pruning	1.88	0.688	1.59	0.655	29
Irrigation requirement	1.99	0.809	1.55	0.714	44
Fertilizer requirement	1.83	0.706	1.51	0.665	32
Chemical Control	1.87	0.744	1.46	0.586	41
Cultural Control	2.05	0.629	1.76	0.697	29
Harvesting and post harvesting	2.32	0.619	1.73	0.509	59

Scale: 1= Low; 2= Medium; 3= High; N=310

About 58.4% of the respondents have up to 4 years of olive experience (Table 5), which is very low because the awareness level and importance of olive plantation are not enough to motivate the farmers to grow olive orchards. In the present situation, the need for edible oil is increasing day by day by the increasing population Pakistan imports edible oil from other countries by sending a huge amount of money. The government should take steps to motivate the farmers to adopt olive plantations on cultivated and non-cultivated lands. Therefore, about 36.1% of the respondents have 8 years of olive growing experience

and about 5.5% of the olive growers have experience of greater than 8 years.

According to the results in Table 6, about 59% of the adoption gap was found during the harvesting of olive fruits due to the lack of adoption of modern machinery and management of olive fruiting, this is ranked at first position. Irrigation requirement also showed the highest adoption gap of 44%, olive growers having limited sources of adopted different irrigation techniques to irrigate their olive orchard. Uses of different pesticides, insecticides and fungicides on olive trees were very limited which causes about 41% of the high adoption gap and stood at third rank order. Fertilizer requirement also showed high adoption gap of 32% due to high prices of fertilizers and having less knowledge about the management of fertilizer from flowering to harvesting due to fewer awareness pieces of training on fertilizer applications and ranked in the fourth position. Olive tree cultivation with covering crops was ranked at the fifth level having a 31% of medium adoption gap. While as, 29% of the adoption gap was found in the pruning of olive trees because respondents had limited information about the advantages of pruning and also on which stages pruning was conducted and stood at six rank level. Cultural control showed a medium level of adoption of 29% by the olive growers and stood at the seventh rank order. About low level of adoption gap was found in planting time and planting geometry with 21 and 23 percentages and also was ranked at the eighth and ninth rank level. At last, about 35% of low levels of adoption belonged to land preparation.

It is well understood that the method of harvesting olives had a significant effect on their quality, especially for consumption purposes. As the cultivation of olives is rapidly increasing across different regions of the country, there is a need to focus on the harvest and post-harvest practices. In this regard, more focus is required on this aspect and agricultural extension agents should introduce best practices of harvesting to the farmers and build their capacity.

As olive is primarily grown in rain-fed areas, mechanisms should be developed regarding irrigation of the olive crop. Farmers should be provided with the right information about the requirement and timing of irrigation and necessary measure in case of excessive or less rainfall. In addition to this, the quality of agricultural inputs should be available for

the olive growers for boosting olive production in the region.

To reduce the adoption gap, the agricultural extension should spearhead the task by designing and implementing farmer-centered campaigns on the latest production technology of olive crops. Audio-Video materials and ICTs should be used to familiarize the growers with the latest technologies and practices and also extension agents should be incentivized to do the said tasks.

Table 7: Relationship among demographic characteristics of the respondents and their awareness and adoption of recommended olive cultivation practices.

Demographic characteristics	Chi.-square (P-value)	
	Awareness	Adoption
Age	16.430* (0.012)	12.856* (0.045)
Education	54.219** (0.000)	42.80** (0.000)
Major source of income	2.657NS (0.448)	2.508NS (0.474)
Farm size	14.381* (0.026)	22.87** (0.001)
Area under olive cultivation	10.67NS (0.099)	21.15** (0.002)
Number of olive trees	49.28** (0.000)	40.35** (0.000)
Year of olive growing experience	13.27* (0.039)	30.52** (0.000)
Motivated to grow olive trees	25.86** (0.000)	17.27** (0.008)
Type of tenure	1.459NS (0.692)	3.285NS (0.350)

NS: Non-significant ($P > 0.05$); *: Significant ($P < 0.05$); **: Highly significant ($P < 0.01$).

The data in Table 7 represent the chi-square test according to the results in this figure education, the number of olive trees and motivation to grow olive trees have a highly positive significant relationship with the level of awareness about olive cultivation practices. On the other hand, age, farm size and years of olive growing experience have a positive significant relationship with the level of awareness about recommended olive cultivation practices. While the area under olive cultivation and type of tenure is a non-significant relationship between the level of awareness about recommended olive cultivation practices. Education is an important factor regarding

the awareness level, according to the results old-age farmers are highly motivated to get information through different media about olive growing practices and also have a high adoption rate of new agricultural practices regarding olives. Farmers with large landholdings were showing high interest to update their information through different sources. Farmers who belong to a different source of income also show minor interest in taking information regarding olive cultivation practices.

Results in Table 7 show that education, farm size, and area under olive cultivation. Olive growing experiences and motivation to grow olive trees have a highly positive significant relationship with the level of adoption of recommended olive cultivation practices. A major source of income and type of tenure have non-significant associations between the adoption rate of recommended olive practices. It might likewise suggest that olive farmers with huge landholdings are bound to receive prescribed practices like drip irrigation systems more than little farmers. large farmers are financially strong to adopt innovation regarding olive production and protection practices.

Table 8: Model summary of multiple regression analysis.

R	R square	Adjusted R square	Std. error of the estimate	F
0.964	0.929	0.925	0.16200	962.896

Table 8 shows the value of R indicates here the measure of the quality of awareness and adoption level of the respondents. It reveals that there is a good level of awareness and adoption regarding recommended olive cultivation practices. The model showed a 0.929% variation (coefficient of determination, R²) explained by the independent variables. The adjusted R² was also capable of identifying that the input

variable was found supportive to clarify the output variable.

The statistical significance tests whether or not the standardized or unstandardized coefficients are equal to 0 so the P-values are observed. The model showed that the coefficients regarding the number of years of olive growing experience were non-significant with $p = .088$ and awareness regarding recommended olive cultivation practices was also statistically significant with $p = 0.000$. However, the rests of the variables were not statistically significant (Table 9). The unstandardized coefficients in the model show how much the dependent variable diverges from the independent variable when the rest of the variables (independent) are constant.

Conclusions and Recommendations

Results depict that most olive farmers are educated and possess more than 12 acres of land. Mostly the respondents are the owner of their land it is because the land is under orchard farming which is not given on the rents. The farmers cannot afford to give rents; a large number of area is a barren land due to no irrigation system they only depend on rainwater. In the Pothwar region, the climatic condition and environment are very suitable for the cultivation of olive plants and farmers are motivated to grow olives if proper support is given to them by the government and agriculture department. The majority of the olive growers required information on various aspects like improved varieties, soil analysis, organic manure and judicious use of fertilizer. Moreover, they also need updated information on irrigation water testing and its judicious application for the olive crop. Results also revealed that olive growers need information on the causes behind the attack of insect pest and diseases and the time of controlling their spread.

Table 9: Multiple regression analysis of factors affecting the adoption of recommended olive cultivation practices.

Dependent variable	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.421	0.089		-4.734	0.000
Number of years of olive growing experience	-0.027	0.016	-.027	-1.709	0.088
Awareness regarding recommended olive cultivation practices	1.206	0.020	.962	60.154	0.000
Training needs regarding scientific olive cultivation practices	-0.054	0.032	-.027	-1.696	0.091
Effectiveness of training received by the olive growers	-0.025	0.014	-.029	-1.768	0.078

*. Significant ($P < 0.05$); **. Highly significant ($P < 0.01$); R Square=0.929.

Regarding harvesting and post-harvesting interventions, olive growers were interested in getting information on the time and methods of picking olive fruit and its marketing opportunities in and outside the country due to lack of proper management a very huge amount of fruits is wasted.

It was revealed that a small percentage of the youth and middle age group is involved in agriculture, particularly in olive production. Therefore, it is recommended that rural youth should be sensitized to grow high-value crops. There is a need to motivate young farmers to do farming and olive production is an opportunity for them. Barani agriculture research institute (BARI), Chakwal should increase their farmer's training and field day workshops in the different agro-ecological zone of the Pothwar region. Government support should be extended to the involvement and investment of the private sector in olive production.

Novelty Statement

Pakistan's import of edible oil is much higher than other developing countries of the region. The demand of edible oil in the country is increasing with the increase of population. We can save out foreign reserves by lowering the import of edible oil and cultivating oil seed crops at local level. Olive is one of the high value oil seed crop grown in Pakistan. However, its production is not upto the international standards. This is due to the low adoption status of olive growers regarding improved olive cultivation practices. This article is unique as it highlighted the major factors responsible for awareness and adoption of Improved Olive Cultivation Practices by the Olive Growers in Pothwar Region of the Punjab.

Author's Contribution

Hassan Raza: Conceived the main idea prepared final draft of manuscript

Muhammad Kashif Afzal: Data analysis and prepared initial draft of manuscript.

Muhammad Luqman: Prepared research instruments.

Tahir Munir Butt: Reviewed the literature.

Muhammad Yaseen: Conceived the major idea of research as principal author and prepared initial draft of manuscript.

Muhammad Umer Mehmood: Field data collection.

Conflict of interest

The authors have declared no conflict of interest.

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