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Effects of Climate Change on Human Behaviour: A People Perspective

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ABSTRACT

Aim: Climate change effects are not limited to a single sector of life but it has far reaching effects on behaviour and attitudes of a person or community in a holistic manner. With passing time, climate change is showing its unpleasant consequences in one form or another. Human behaviour has a significant importance in altering and modifying the atrocities of climate change.
Methodology: In this research paper, Tehsil Gagra of District Buner Pakistan was selected to analyze the human behaviour as an independent variable and climate change effects on local people lives as a dependent variable. Out of 3 Union Councils (UC), 2 were randomly selected and from both the UCs 370 respondents were taken as a total sample size. Data was collected from the local respondents through interviews, & collected data was analyzed through medium of central dispersion, univariate and bivariate statistical techniques. Chi-Square test was used to find the association between the targeted dependent and independent variables.
Findings: Findings of the data collected showed that there was found a significant relationship ($P<0.05$) between increased apprehensions and community practical measures towards climate change, rural people settlement has increased pressure on natural resources, increased agro-forestry and awareness among the locals with the climate change effects on human lives. Moreover, there was also found a high negative significant relationship ($P>0.05$) between government has taken sufficient actions to avert the climate change, and government has the proper system to cope with hazardous situation, with climate change effects on human lives.
Conclusion: As regards to the findings, it is suggested that there is need of awareness among the local population about the climate change and a felt need of increase the coordination between the local and international community to give a framework to mitigate the losses in the aftermath of climate change by prioritizing the issue of climate change on urgent basis.
KEYWORDS: Climate Change, Behavioural Change, Change in community, Government response, Pakistan

1. INTRODUCTION

In the past, the role of man was ignored in the contribution to the climate change. Along with that, the climate change phenomenon was considered as vogue and having no belief on the processes related to climate change. With time, scientists' community presented their views and opinions and at later time, having the agreed consensus that anthropogenic activities and involvement of man in the natural balanced systems has added to the climate change and disrupted the natural stability of ecological processes respectively. Research shows that with change in natural processes, it is affecting the behaviour and especially health of the societies and communities. With advancement in social and psychological sciences, it is predicted that climate change has shown its effects on the human behaviour. Such effects are not limited to the shocks, severe weather events and epidemic diseases. But it has a range of impacts on the socio-economic conditions and demographic patterns (McMachiel et al., 2006).
Behaviour of the humans is correlated with climate change. The recent trends in global climate change is the through activities of human including the releasing of the harmful gases and pollutants from the industries, automobiles and furnaces. Such gases are depleting the protective layer of ozone which scan the ultra-violet rays coming from the sun. On the other side, because of the effects of climate change, human behaviour is also changing with respect to norms, attitudes and social customs. Cultural and psychological problems like tension and stress is also negatively affect the human behaviour (Swim et al., 2011). Climate change affects the social customs, attitudes and norms of a society. Human influence has been the dominant reason behind the observed warming of climate since the mid-20th century. Bondage of customs and traditions link the people with each other. Recent surge in the world temperature and the level of susceptibility to climate change is influencing the bonds of society which emerged in the early age of the human civilization and is considered the foundation stone for a strong relations among people. Study conducted in this regard shows that rise in temperature creates

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emotional responses in the form of increase aggression which shape the behaviour of human. It is also worth mentioning that with temperature increase and other stresses, it is predicted that changes in the behaviour of the person's character is imminent and the waves of violence is also expected to increase with time. Increased aggression and violent behaviour leads to conflict and wars (Solanki, 2016).

Climate Change is affecting the society strong cultural bonds because of which people are living in different parts of the world having their own culture and traditions. Culture is the highest and an outstanding feature through which communities and societies are recognized in the international world and have the distinctive features from other systems of culture. Cultural values give people identity, cohesion and response mechanism in times of need. However, the current changes in climatic patterns are altering the cultural bonds threatening lives and livings of the communities. Studies suggest that culture plays an important role to mediate fluctuations in the setting and changes in societies, and explain the adaptation mechanism to climate change and clarify shortcomings in current policies adapted by authoritiesto every dimension of global climate change is facilitated by culture(Whitmarsh, 2009).

Cultural values have the capacity to transform the organizational structure within its limits the measures and policy recommendations to climate change, that are harmful to environmental and social values (Nilsson et al., 2004).Cultural values signify the climate change perceptions of the public in the shape of mitigative measures and policies. Studies suggests that measures adapted similar to the culture of the people can give fruitful results (Leiserowitz, 2006). In addition, slow and gradual but continuous change in climatic patterns have disrupted the cycle of human activities. On one side, it has contributed to the ecological imbalances of the natural ecosystem. But, on other side, behaviour of humans especially physical and mental health of the communities are also affecting due to negative outcomes of the climate change and global warming. Research conducted in this regard shows that there is direct relation between the human behaviour and the recent change in climate. Human behaviour is an indicator for the future climate change. All the contributions of the humans in releasing the Greenhouse gases (GHGs) and Chloro-Fluoro-Carbons (CFCs) to the environment clearly shows that behaviour is the main steering factor in climate change. The reason behind this is the human desire for more and more industrialization to dominate the society on the basis of earning more wealth and riches. Contrary to this reality, human behaviour can modify the harmful effects by adaptation strategies and techniques(Mirza, 2003).Some of the studies conducted in America in climate change context shows that climate change is a sensible risk and it has far reaching effects on the health causing an increase in diseases. Such effects are not limited to one continent but it will surpass the nations cause heavy damages (Leiserowitz, 2005).

Moreover, the relationship between the human behaviour and climate change is not limited only to the contribution of harmful gases and pollutants. But climate change is also showing its effects on the behaviour regarding physical and mental health. Increase in the incidences and extent of climate related hazards, severity in the diseases have also increased. Countries that are in the list of developing nations are more vulnerable to weather hazards, where the exposure is high to already exacerbated environmental and land degradation. Along with other factors, overpopulation and urbanization have added considerable stress on the developing countries. On one side, developing countries are in the vicious circle of under-development and poverty, but on other side diseases occurrences in severity and magnitude are doubling their miseries and efforts to impede the impacts of climate change. Recent changes in climatic patterns have compelled the health scientists and meteorologists to propose their recommendations for future considerations devising a relation between the weather and diseases. Planning plays an important role and planners are designing plans in modifying the adaptation mechanism and implementation of the projects to reduce the effects of climate change on the health of the people (Confalonieri et al., 2007).

Furthermore, humans evolved on the planet earth thousands of years ago. It means that there is a relation between the humans and the processes related with the balance of this environment. But as climate change occurring slowly and gradually, it has also affected this relation which persists since ages. In the past, mankind's source of income was subsistence agriculture and hunting and that was the only dependent source. As the world advanced, more and better opportunities came in hand to the humans. But the new trends emerged in the form of climate change and global warming which affected the stability of the relations among the farmers, labourers, industrialists and businessmen. Stresses in the form of inflation, tough competition to acquire more facilities disturbed the balance of the human behaviour. Studies show that increase of stresses and shocks increase the chances of internal conflicts, violence and revolt. Furthermore, climate change poses a threat to the traditional values and taboos which has a great role in strengthening the relations. Experts have of the opinion that the future wars would be fought on the natural resources distribution especially water rather than on nuclear assets(Enviornmental Protection Agency (EPA), 2003).Climate change has affected the nature of the theories that were presented in the past related to human behaviour. The two prominent theories are the Environmentalism, in which environment is the compelling force to modify the activities of human beings and Possibilism is the alternate in which man has the capacity to modify the influence of nature. Now on one side, climate change has disturbed the balance of nature regards to customs, traditions and demographic patterns. But on other side modifying nature of human to the environment has also changed regards to the productivity and

economy (Stern et al.,1999). Taking stock of the situation, as portrayed in the fore-mentioned review, the present study is designed to look into the behavioural alterations at community level under the review of government response with effects of climate change of human life.

2. MATERIALS AND METHODS

Research methodology comprised of various components and these included universe of the study, sampling, data collection, conceptual framework and data analysis respectively. Tehsil Gagra, one of the 6 Tehsils of the District Buner, was the universe of the study. Tehsil Gagra was selected because of its geographical location and the recent climatic changes faced by the local people. Tehsil Gagra, one of the six Tehsils of District Buner was purposely selected. Out of 3 Union Councils (UCs), only 2 UCs namely Shalbandi and Rega were randomly selected. Further, from each UC, one village was selected namelyAmnawar from UC Shalbandi, and Takhtaband from UC Rega, on the basis of simple random sampling method.The total population of the village Amnawar and Takhtaband stand,al-(H.H) 7367 and 2775(H.H) respectively, and by adding both the total number of the household stood at 10,142 by using the Proportionate sample formula. A sample size of 370 determined as per criteria of Sekeran (2003), was selected. The total sample size was distributed through proportional villages' allocation method as shown below in Table 1.

$ni = \frac{n \times N}{N}$ ……..Eq (1) (Chowdhrury+Kamal, 1996)

Table 1: Sample Size (n) Showing Distribution of Population and Respective Sample Size

Serial No.	Name of the Village	Population Size (N)	Sample Size (n)
1	**Amnawar**	7367	269
2	**Takhtaband**	2775	101
	Grand Total	**10,142**	**370**

Primary data was collected from the respondents through interview schedule involving the community members. Conceptual framework has given the idea about the variables used in the research and the data was collected about these variables in the field. In the current research, climate change effects on human life was declared as dependent variable and human behaviour as an independent variable as shown below in Table (2).

Table 2: Conceptual Framework

Independent Variable	Dependent Variable
Behavior	Climate Change Effects on Human Life

Statistical techniques such as chi-square test analysis was used to analyze the data. Descriptive statistics were used to concise the detailed information obtained from primary and secondary sources. Percentage and average was used for analysis of the data at the universal level. In addition, bivariate analysis was also be carried out to measure the level of association between independent and dependent variables through cross tabulation.x^2-test statistic was applied to adjudge the level of significance of the relationship, x^2 test was determined through the application of the following formula.

$$(x^2) = x^2 = \sum_{j=i}^{j}\sum_{j=i}^{k}\frac{(oij - eij)2}{eij}$$

3. RESULTS AND DISCUSSIONS

3.1 Change in Community Behaviour and Government Response in Views of Local Respondents

Climate change effects are not limited to a single sector of life but it has far reaching effects on behaviour and attitudes of a person or community in a holistic manner. With passing time, climate change is showing its unpleasant consequences in the form of increased temperature, abrupt melting of glaciers and change in weather and seasonal shift, Similarly, as the impacts of climate change deteriorating our lives, so the local community perception is also undergoes modification in behavioural patterns. Government bodies have a significant role in averting and mitigating the impacts of climate change and raise the perception level by means of creating awareness among the people.

Table (3) shows that 98.9% of the respondents express their views that community apprehensions about climate change has increased, 0.1% of the respondent was in disagreement and 0.3% respondents were treating climate

change apprehension in a neutral way. It could be disclosed from these finding that people has a wider understanding of the variation of weather shifts and subsequent effects on human ways of life. Study carried out by (Farooqi et al., 2005) has also concluded that in Pakistan comparing the Southern and Northern part, provides an evidence that as the impacts of climate change have increased, Southern parts of the country will have to face the effects in the form of increased frequency of droughts due to less rainfall. On the other side, Northern part of the country will have to face more precipitation and melting of the glaciers. These findings have increased the perception level of people that climate change is a real threat to their lives with a distorting effects. An assessment has been conducted by the (Centre for Science & Policy, 2000), which also indicated that with increase in risks of climate people have also realized these risks which have threatened and changed the behaviour of communities. Local community are now taking practical actions to avert the negative impacts of climate change.

Almost 50.8% of the respondents were of the view that now local community has stood in response to the climate effects. 24.3% of the respondents were in contradiction with the statement and 24.9% of the respondents were recorded the local community action in a neutral manner. This could be ascertain from these results that people has respondend to climate change as a threat to the very extisance. Community people realizing the effects of climate change has taken action in diversifying their livelihoods and economies through a better methods of enhancing the capacity of local people. Sustained efforts in this regard need the support of government and private sector (Ministry of Finance, 2017).

Although majority i.e. 50.8% of the respondents considered that local community are taking action to prevent the adversities of climate change, however, 24.3% of the community responses also holds place. The reason may be lack of access to the resources, poverty and lack of awareness and sense to the calamities of recent climate change. The climate change, if taken in a holistic mode, could only be averted by an organized agency like government. Government role in mitigating the impacts of climate change by taking practical actions cannot be ignored. Governmnet has resources and capacities at the national, provincial and local level. Creating sustainability in ecosystem provides opportunity to lessen the impacts on natural processes and the relationship between the human and the environment (Centre for Science & Policy, 2000).

Table 3 has exhibited that 67.5% of the respondents were of the view that government did not take actions to prevent check on the climate in order to create harmony in the natural ecosystem. Majority of the responses showed that people had less satisafction level from the government regards to actions to prevent climate effects on the ecosystem. Government role was found to be placed as a dynamic notion, if could not successfully avert the drastic ramifications of climate change. These findings were in conclusion to the study conducted by (Khan, 2016), who pointed out that local people have feelings of insecurity to climate change effects. Further, elaborating the government role in climate change mitigation, there is lack of planning and an agenda at the local level to prevent the effects of climate change on the ecosystem.

Some 30.3% of the respondents were in agreement with the statement that government has taken his role in adversing the impacts of climate change. It is apparent from these results that people had some level of information pertaining to certain recommendations over climate change initiatives. The reason behind in agreement with the statement is the formulation of national climate change policy by the government recently which indicates a high role of the government among the local community an ensuring the safety of the natural processes in the ecosystem (Global Facility for Disaster Risk Reduction, 2016).

Furthermore, government role in reducing effects of climate change through a proper system to cope with hazardous situation was also found. Majority of the respondents, i.e. 50.5% were of the opinion that there is no such proper system with government to cope with the situation. 41.1% of the respondnets said that government has the capacity to cope and 8.1% respondents were in neutral manner. Government role with amalgamation of institutional capacities could not be ruled out, as climate change has been declared a national calamity and its mitigation effects at the individual level is unwise to bring any useful results. Cameroon government role suggested that there is lack of capacity to cope with the adverse effects of climate change. Government institional framework is an early stage to make decisions and planning towards climate change. Malfunctioning of the institutions is also a factor to cope with the hazardous situation (Brown & Bele, 2010). Lack of climate change adaptation measures in livelihoods sector and economy by the government has further worsen the situation. Preparedness level of the local community is very low on the behalf of the government. Lack of funds and coordination between the government and donors has created an atmosphere of distrust among the local people (Ashry, 2009).

Behaviour of the community people about the effects of climate change can be judged by migration of the people from settled to rural areas or from rural to settled areas. This fact has been analyzed by the current research in which 77.1% of the respondents were of the view that people have constantly settled in the rural area thus increasing pressure on the natural resources especially on limited agriculture practised in the study area. However, 18.6% of the respondents shared their opinions contrary to the statement and 4.3% of the respondents had neutral responses. It is emanated from these results that climate change has not only put pressure on the avalible resources but also triggered the process of internal migration. These changes have drastically affected

the avaliable resources and the routine life pattern of people including their patterns of livelhood. Climate change and migration has a deep linkage with each other. According to (The Diplomat, 2017), Pakistan is one of the country which is facing the impacts of climate change, but the local people of the study area still not in position to leave the rural areas. The reason behind not leaving the rural areas may be strong social bonds and local community dependency on agriculture. According to (Thomas Reuters, 2017), rural areas provide a better chance for poor people to practise various livelihoods usually agriculture, livestock rearing, poultry farming and cutting of trees to earn their living. But the negative aspect of such practice is the deforestation by the inhabitants of the community. Economy of a country depends on the stability of the natural processes. However, climate change has affected the growth of economies and stability of the GDP in the developed and developing nations. Industries installation provides an opportunity for the developing nations to get an advantage from the raw material and processed in the industries to achieve development. Better economic output needs installation of huge industries to achieve the target of stable economy.

Table 3 further provides the description in which 49% of the respondents were in disagreement with the statement that government has enhanced the industrial growth to achieve better economic output. 43.2% of the respondents had of the opinions that government has enhanced the growth and the remaining 7.8% of the respondents had the neutral thinking. International community has started to working by focusing their energies on the policy formulation at the global, regional and local level to cut short the agents causing climate change. Industrial growth is responsible for the emission of pollutants and other chemicals causing global warming and climate change. The study revealed that majority i.e. 81.6% of the respondents were of the view that international community is playing its role to curb and put check on the sources. However, a negligible number i.e.7.9% had their views in disagreement and 10.5% of the responses were found as uncertain (United Nations Organization,(2005). Reports have suggested that climate change is affecting everyone and each sector either in developed world or in less developed countries. Developed nations to achieve the development have installed industries in a huge number that has contributed to emissions of large amount of harmful substances. In this regard, international community came forward to formulate policies and implement such policies at the ground level in true sense. In Pakistan, acceptance of the National Climate Change Policy is a step in realizing that climate change is a real threat to our lives. Recent reports have pointed out that Pakistan is on the 7th position among the affected nations due to climate change (Dawn News, 2017).

Majority of the respondents i.e. 91.9% were of the opinion that government and international community is planning to implement strategies to reduce the population growth. The remaining respondents were in disagreement to the population policies. These findings suggested that the respondents had the knowledge of the negative effects of increase in population growth in terms of relations to climate change. More populations put more pressure on the resources and mitigating the chances of sustainability with regard to resource utilization. Population is one of the important factor for climate change effects. High population in an area means high exposure of that population to the effects of climate change. Various strategies have been adopted to combat the effects of climate change.

Agro forestry is one of the technique that involves the land utilization in a sustainable way to achieve diverse ecosystem. Out of 370 respondents, 55.4% were in agreement that government is trying to encourage farmers to develop agro-forestry mechanism to combat climate change. However, 22.2% of the respondents were in disagreement and neutral in their responses. Means of attaining any calamity is to be determined by an organized government agency. Maintainability of the ecosystem in the rural areas have different approaches of the rest of the country. Sustainability in rural areas could be addressed by planting more trees i.e. enhance the forest areas, stop deforestation and encourage the practice of agro-forestry. According to (Abbas & Hammad, 2017), agro forestry is a best alternative technique to reduce and absorb the carbon emissions. It helps in the sustainable utilization of the land with control use of the natural resources.

The study disclosed that majority i.e. 80.8% of the respondents were of the view that government has created awareness among the local people about climate change effects. Disagreement to the statement stood at 10.8 % and 8.4% as natural. Raising awareness level and climate change perception has a significant role in mitigating the effects of climate change. One of the major cause in developing countries is the lack of awareness among the population. International community supporting the governments to transfer the technology and funds to increase the level of awareness and change their behaviour towards climate resilient societies (Shahid &Paracha, 2016).

Table 3: Frequency and Percentage Distribution of Local Respondents Regarding Change in Community Behaviour and Government Response

S. No	Statement	Agree	Disagree	Neutral	Total
1	The climate change has increased the apprehensions of community.	366(98.9)	1(0.1)	3(0.3)	370(100.0)
2	Community members are taking practical steps to prevent changes in the climate.	188(50.8)	90(24.3)	92(24.9)	370(100.0)
3	Government has taken sufficient action to put check on the climate in order to keep the harmony in the eco-system.	112(30.3)	250(67.5)	8(2.2)	370(100.0)
4	Government has the proper system through which it can cope from the hazardous situation resulted from climate change.	153(41.4)	187(50.5)	30(8.1)	370(100.0)
5	People are constantly settling in the rural area which has decrease agriculture and forest land.	285(77.1)	69(18.6)	16(4.3)	370(100.0)
6	For better economic output, government enhancing industrial growth for stable economy.	160(43.2)	181(49.0)	29(7.8)	370(100.0)
7	International community has realized to put checks on sources of climate changes.	302(81.6)	29(7.9)	39(10.5)	370(100.0)
8	Governments and international community have implemented policies of family planning in order to reduce the population growth rate.	340(91.9)	3(0.8)	27(7.3)	370(100.0)
9	Government encourages farmers to develop Agro-Forestry to combat climate change.	205(55.4)	83(22.4)	82(22.2)	370(100.0)
10	Government and private sector has created awareness among the local people about climate change.	299(80.8)	40(10.8)	31(8.4)	370(100.0)

Note: Number in the parenthesis shows percentage and number outside the parenthesis shows the frequency.

Source: Field Survey, 2017

3.2 Association between Community Behaviour and Government Response to the Climate Change Effects on the Human Life

Role of the community and government authorities holds an important place to reduce the impacts of climate change on the lives and the associated sectors through introduction of a number of intervention both short and long term. Behaviour is variation to character of an individual based on exposure to various situations within a community. However, sometimes it is necessary to bring change in the behaviour with the circumstances as well. Besides, community behaviour, the government role cannot be ignored in addressing to the threatening situation due to climate change, casting black shadows on the each corner of the life. Government has the resources and the capacities, by utilizing the resources in a better response to the climate change effects can be initialized.

In Table 4, an association was drawn between the independent variable i.e. community behaviour and Government response with the dependent variable i.e. climate change effects on the human lives, by studying the each statement correlated between the two. Increase in community apprehensions among the local people to the effects of climate change has shown a highly significant (P=0.000) relationship. The reason behind this high association is the cognitive reasoning of the local individuals towards the climate change effects and a change in the attitude and behavioural patterns. These findings had similarities to Shove, (2010), that increase in the apprehensions among the communities arise due to the current trends and changes in the hydrological and ecosystem imbalances at the global and local level. Changes at the global level also have reflections on the local community. People are aware of the severities of climate change due to which they treat climate change as a real threat for their lives. As the apprehensions have increased in the local community towards the climate change, community members are taking some of the practical steps to avert the impacts on the basis of their available resources and capacities.

On this basis, a significant (P=0.000) relationship was discovered in taking practical steps by local community with climate change effects on their lives by bringing change in their behavioural patterns to resist the adverse impacts of climate change. These result has the support of Grothmann & Patt, (2005), who carried out a study in Rural Germany and Zimbabwe to analyze the findings of their research on the basis of the local adaptation to the climate change. Findings from both the rural areas have shown that developed regions have more resources and capacities, so they can better manifest themselves in the stressed environment as compared to the less developed or developing countries where there is less availability of the resources and high backwardness.

Role of the government is of utmost importance in a crisis situation with a challenging mode in terms of climate change. Contrary to the above, a non-significant (P=0.165) relationship was detected that Government has taken action to harmonize balance in the ecosystem with the climate change effects on the human life. Government is focusing on the adaptive and mitigative measures to reduce the impacts of climate change. More concentration is on the socio-economic problems and relief after when the climate disasters strike a community as pointed out by(Gore & Robinson, 2009), who has suggested that developed nations have reached to high

stage of development where there is no such issues of socio-economic nature. In developing nations including Pakistan, there is less concentration of government authorities towards the effects of climate change. One of the basic reason is the lack of funding on the part of donors and the resolve to utilize the community level resources in such a challenging environment is also missing. Poverty, unemployment along with the recent surge in the anthropogenic activities like terrorism has complicated the situation to focus on the climate issue. Malfunctioning of the local government institutions and agencies are also responsible to create a system of proper functioning to take actions by creating harmony among the local people to balance the ecosystem.

Like to the above, a non-significant (P=0.170) relationship was observed that government has a proper system through which it can cope with the hazardous situation and climate change effects on the human life. Supporting the findings Gilley, (2012) conducted a research on this aspect says that governments having no proper system to work on the emerging and challenging issue of climate change is hit hard, because of the high exposure of the community to the increasing hazards and an improper functioning of government bodies. In this regard authoritarian environmentalism implemented in China, a public policy approach to achieve the goal of preventing the community and increasing the capacities of the government machinery by joining hands with the people and institutions.

However, a significant (P=0.000) relationship was discovered that people constantly settling in the rural areas are decreasing the agriculture and forest cover with increasing climate change effects on their life. Agriculture and forest activities are practised in the rural areas of the local communities and such areas are the hub of high human population. As the population increases, a burden on the natural resources increases. Rural areas are normally backward lacking of modern facilities. In rural areas, there are less livelihoods means due to which people are restricted to the agriculture sector and forestry to meet their needs and get satisfaction. That's why the constantly residing of the local people increases the stress on the scarce resources. Agriculture is the back bone of the country and it enhances the industrial sector as it provides raw material (Bulkeley & Broto, 2013).

A significant (P=0.000) association detected between stability of the economy to the climate change effects on the life of the humans. Stability of the economy needs industrial growth to increase the productivity and contribute towards the reduction of the impacts of climate change as pointed out by Bosello & Zhang, (2005), who were of the opinion that for stable economic growth is necessary which may reciprocate and subsequent economic development. Such industries are the source of climate change adaptation with the innovations of modern practices and techniques to reduce the effects of climate change on the human lives.

Similarly, a high significant (P=0.000) association was found in the context to put checks on the sources of climate change by international community with the effects of climate change on the human life. As the global warming and climate change raises to occupy the top most issues, the global community facing. On other side the whole international community has realized to prevent and stop the long lasting impacts of climate change. Such rise in the perception about the climate change at the community level has compelled the international community to act against the harmful and disastrous impacts of climate change in the form of establishing the agencies, provided support to the local people in creating awareness and reduced the emission of CFCs and other poisonous gases (Helmer & Hilhorst, 2006).

Population increase and climate change is closely related with each other. In this perspective, a significant (P=0.000) relationship was identified that governments and international community has implemented policies of family planning to reduce the population growth rate with effects of climate change on human lives. Population is increasing with a high ratio as compared to the availability of the natural resources. Malthusian theory stands right in this context that population is increasing in a geometric progression while the natural resources increasing in an arithmetic progression. Evidence is provided by Satterthwaite, (2009), that without family planning and other contraceptive methods the population growth has been reduced to a low level at the community and international level. Although, growth rate is high in the developing countries but efforts have been going on to limit the population.

High population increases the chances for high exposure and vulnerability to climate change effects. Besides, a high significant level of (P=0.000) was disclosed between that Government encourage farmers to develop agro-forestry to combat effects of climate change. Agro-forestry is one of the important technique to overcome the exploitation of resources and cultivating crops and trees on the same plot of land to utilize the land in an efficient and sustainable way. According to Stavi & Lal, (2013), that agro-forestry plays an important role in combating the effects of climate change. Government has the mechanism to implement and support the agricultural practices and ensure the safety of the forestry. As these forests are the source to absorb huge amount of carbon dioxide released from the vehicles and industries. Awareness among the local people about such practices and techniques is essential to harmonize the energies between the local people and government and private sector.

Similarly, a significant (P=0.000) association has been emerged between that government and private sector has created awareness among the local people and climate change effects on the human life. (Shahid & Paracha, 2010a) were of the opinion that Pakistan is a resource poor country with high growth rate of

population, high vulnerability to disasters and unfavourable socio-economic conditions. These all factors combined together form a complex system of various stresses and environmental shocks. In such a situation, creating awareness among the local residents is of utmost duty of the government and private sector to invest and bringing the situation of uncomfortability to a normal and standing position.

Table 4: Association between Community Behaviour and Government Response to the Climate Change Effects on the Human Life

	Community Behaviour & Government Response		**Climate Change affects on human life**			
S. No	**Attributes**		**Agree**	**Disagree**	**Total**	**Statistics**
1		Agree	349(94.3)	17(4.6)	366(98.9)	
	The climate change has increased the apprehensions of community	Disagree	0(0.0)	1(0.3)	1(0.3)	$\chi 2 = 67.203$
		Neutral	0(0.0)	3(0.8)	3(0.8)	P=0.000
		Total	349(94.3)	21(5.7)	370(100.0)	
2	Community members are taking practical steps to prevent changes in the climate	Agree	188(50.8)	0(0.0)	188(50.8)	$\chi 2 = 69.265$
		Disagree	69(18.6)	21(5.7)	90(24.3)	P=0.000
		Neutral	92(24.9)	0(0.0)	92(24.9)	
		Total	349(94.3)	21(5.7)	370(100.0)	
3	Government has taken sufficient action to put check on the climate in order to keep the harmony in the eco-system	Agree	112(30.3)	0(0.0)	112(30.3)	$\chi 2 = 27.665$
		Disagree	237(64.0)	21(5.7)	258(69.7)	P=0.165
		Neutral	0(0.0)	0(0.0)	0(0.0)	
		Total	349(94.3)	21(5.7)	370(100.0)	
4	Government has the proper system through which it can cope from the hazardous situation resulted from climate change	Agree	153(41.4)	0(0.0)	153(41.4)	$\chi 2 = 21.785$
		Disagree	166(44.9)	21(5.7)	187(50.5)	P=0.170
		Neutral	30(8.1)	0(0.0)	30(8.1)	
		Total	349(94.3)	21(5.7)	370(100.0)	
5	People are constantly settling in the rural area which has decrease agriculture and forest land	Agree	285(77.1)	0(0.0)	285(77.1)	$\chi 2 = 97.121$
		Disagree	48(13.0)	21(5.7)	69(18.6)	P=0.000
		Neutral	16(4.2)	0(0.0)	16(4.3)	
		Total	349(94.3)	21(5.7)	370(100.0)	
6	For better economic output, government enhancing industrial growth for stable economy	Agree	160(43.2)	0(0.0)	160(43.2)	$\chi 2 = 23.248$
		Disagree	160(43.2)	21(5.7)	181(48.9)	P=0.000
		Neutral	29(7.9)	0(0.0)	29(7.9)	
		Total	349(94.3)	21(5.7)	370(100.0)	
	International community has realized to put checks on sources of climate changes	Agree	302(81.6)	0(0.0)	302(81.6)	$\chi 2 = 261.789$
7		Disagree	8(2.2)	21(5.7)	29(7.9)	P=0.000
		Neutral	39(10.5)	0(0.0)	39(10.5)	
		Total	349(94.3)	21(5.7)	370(100.0)	
	Governments and international community have implemented policies of family planning in order to reduce the population growth rate	Agree	340(91.9)	0(0.0)	340(91.9)	$\chi 2 = 257.925$
8		Disagree	0(0.0)	3(0.8)	3(0.8)	P=0.000
		Neutral	9(2.4)	18(4.9)	27(7.3)	
		Total	349(94.3)	21(5.7)	370(100.0)	
	Government encourage farmers to develop Agro-Forestry to combat climate change	Agree	205(55.4)	0(0.0)	205(55.4)	$\chi 2 = 76.984$
9		Disagree	62(16.8)	21(5.7)	83(22.4)	P=0.000
		Neutral	82(22.2)	0(0.0)	82(22.2)	
		Total	349(94.3)	21(5.7)	370(100.0)	
	Government and private sector has created awareness among the local people about climate change	Agree	299(80.8)	0(0.0)	299(80.8)	$\chi 2 = 183.675$
10		Disagree	19(5.1)	21(5.7)	40(10.8)	P=0.000
		Neutral	31(8.4)	0(0.0)	31(8.4)	
		Total	349(94.3)	21(5.7)	370(100.0)	

❖ **Number in the table represent frequencies and number in the parenthesis represent percentage proportion of respondents and in the last columns $\chi 2$represent value of Chi-Square and number in parenthesis represent P-value(Significance)**

Source: Field Survey, 2017

4. Conclusion and Recommendation's

The study tried to explore the effects of climate change on behavioural outcomes, and disclosed that increase in population at the rural areas had put immense pressure on the local resources like agriculture, land and biodiversity, which was further eroded by the government initiatives to enhance industrial outputs and to provide jobs to local, as well. The study further explained and explored that government was well aware of the drastic effects of climate change and had taken some concrete steps like reducing population pressure through family planning, expediting the agro forestry, encouraging the private sector participation and awareness drives in order to mitigate the relative and collective social, economic and behavioural distress at the community level. The government need to avoid a policy of paradox nature of establishment of industrial zone, provide jobs and mitigating drives of effects reduction by giving a framework on climate change with precision and reliability by foreseeing into the future on long term basis.

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A Comparison of the Effectiveness of Adding Neurofeedback to Standard Treatment (SSRIs + CBT) in Patients with Obsessive-Compulsive Disorder (OCD)

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ABSTRACT

The aim of this study was to investigate the effects of adding neurofeedback to selective SSRIs medication and CBT in patients with obsessive-compulsive disorder (OCD). Ten outpatients were diagnosed with OCD and they were randomized to NFT + SSRIs + CBT and SSRIs + CBT. Repeated-measures ANOVA tests were utilized for statistical analysis. The results showed significant differences in reducing OCD symptoms severity and obsessions in the group that had extra NFT. There were no significant differences in reducing compulsion and depression symptoms. The result of this study obviously showed that adding neurofeedback to standard medication and CBT could improve treatment results in reducing severity of OCD. This improvement could also be seen in Obsessions. Results showed that each one of the standard treatments and neurofeedback could affect reducing compulsion disorder and depression; however, by implementing both the treatments together, we could not see any significant results.

KEYWORDS: Obsessive-compulsive disorder (OCD), Neurofeedback, Cognitive behavior therapy (CBT), Selective serotonin reuptake Inhibitors (SSRIs), Obsession, Compulsion, Depression.

INTRODUCTION

Obsessive-compulsive disorder (OCD) is a penetrating disorder in mental health problem that can affect quality of life and is followed by poor social function [1, 2]. OCD is recognized by obsessions, rituals, preoccupations, and compulsions. These obsessions and compulsions are time-consuming and cause clinically significant distress or impairment in social, occupational or other important areas of functioning [3]. Lifetime prevalence of OCD is seen in about 2 or 3% of general population; OCD is ranked as the fourth prevalent psychiatric disorders [4]. OCD is mostly comorbid with anxiety disorder, mood disorder, and, especially, bipolar disorder [5]. According to studies, OCD includes abnormalities in EEG and QEEG of frontal and frontotemporal areas. Specially, people who have sever OCD in comparison to the slight ones, have less alpha waves in frontal areas and Pz and higher delta and teta waves on the Fz and F7 [6-8]. Researches with LORETTA techniques in OCD patients, show an increase in low frequencies of EEG and beta activities in cingulate cortex while resting state [9, 10]. Increase in the low frequency waves (2-6 Hz) in medial frontal cortex has been observed [7]. Increasing Beta waves (13-30 Hz) can be seen in central frontal of the OCD patients, which can cause general arousal of whole brain [10-12].

Two treatments of choice for OCD are medication with SSRIs and CBT, with emphasis on exposure and response prevention (EX/ RP). These treatments have more empirical evidence and are used more than other treatments [13-16]. About 40-80% of patients respond to this treatment by reducing their Y-BOCS score by 30% after treatment [17-19]. However, researches show that approximately 50% of patients do not respond significantly [15, 20, 21]. Even after treatment many OCD patients still show symptoms, this signifies that standard treatment does not result in a complete treatment [22, 23]. The recurrence rate is more than 20-50% [24, 25], and moreover approximately 25% of patients refuse EX/ RP at first place [26, 27].

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Studies that used brain imaging techniques showed that in both psychotherapy and medication, glucose metabolism decreases in the lateral rostral caudate nucleus, and the psychological treatment of OCD results in the normalization of brain activity pattern [28, 29]. Psychotherapy also reduces the activity in certain areas of the brain that are bound to forced behavior. However, it decreases the activity of the amygdalohippocampal subcortical region (bottom-up processing) and increases the activity of the frontal cortex regions (top-down processing). Therefore, It can be concluded that the observed changes in the person´s overt behaviors reflect the changes in the brain (covert behaviors) [30, 31].

Neurofeedback therapy is based on the brain physiology and brain wave activity and can modify the neuroplasticity and neurogenesis of the brain through self-regulation. Therefore, it can be a powerful tool for treating this disorder [32]. The functional base of neurofeedback is that the brain regulates emotions, physical symptoms, thoughts, and behaviors that cause many psychological problems [33]. The distinctive feature of neurofeedback treatment is that its side effects are the least harmful and the patient is active in this treatment [34-36]. This means that the patient plays the central role in his treatment, which makes him control his brain activity [37]. In fact, unlike medication that regulates the brain, the neurofeedback helps the brain to self-regulate. During neurotherapy, Individuals reconstruct and reproduce waves, which the changes are initially short termed but gradually, become more stable [38].

The nature of brain activity is electrochemical and the general changes in brain activity can be seen by changing each of these two parts. In disorders, where the function of the brain has been impaired or altered, medication can manipulate the brain's chemistry and the neurofeedback will help the electrical part. CBT, with emphasis on EX/ PR, regulates the thoughts and beliefs and facilitate habituation by exposure. Therefore, it can lead to conscious control of the emotions and cerebral cortex affects the subcortical regions. Adding neurofeedback to cognitive therapy for OCD can probably increase the therapeutic effects and the effectiveness of the treatment remains more stable for the individual. The purpose of this study was to compare the efficacy of adding neurofeedback to standard treatment (Cognitive-behavioral and medication).

METHODS

Participants:

This research is a Quasi-experimental double-blind trial without placebo-controlled group. Around 30 outpatients were referred for the interview and diagnostic stages. A total of 10 outpatients with OCD were selected and placed in two groups for treatment: NFT + SSRIs + CBT group and SSRIs + CBT group, where the sampling was purposeful. Subjects were matched according to age, gender, education, and socioeconomic status. All participants were provided with informed consent form in order to participate in the study. The Y-BOCS and HDRS were administered by trained independent evaluators (licensed psychologists) who were unaware of condition assignment, at pre-, mid-, post-treatment, and two-month follow-up. The SCID was only collected at pretreatment by the therapist. At the end, collected data were analyzed by an independent analyzer.

Inclusion criteria are as follows: (1) primary diagnosis of OCD, based on a structured interview SCID (DSIMIV-TR) by a psychiatrist or master's degree holder in psychology, (2) a minimum score of 16 on the Y-BOCS intensity scale evaluated by the expert rater, (3) at least one year OCD duration, (4) 18-50 years old, (5) high school graduate, (6) outpatient, (7) at least eight weeks duration of SSRIs, and (8) informed consent to participate in research.

Exclusion criteria are as follows: (1) experience a full course of psychotherapy prior to the study, (2) refusal to receive treatment for neurofeedback or medication due to their obsessions and compulsion, (3) concurrent psychotherapy or medications, (4) suicidal thoughts, (5) comorbidity with developmental disorder, (6) psychosis, (7) active episode of mania, (8) substance use disorder, (9) nervous system disorders (10), borderline, antisocial and paranoid personality disorder, (11) pregnancy and lactation, (12) recent experience of physical or surgical trauma, and (13) loss of five sessions.

Measures:

Yale-Brown Obsessive Compulsive Scale (Y-BOCS): it is a 10-item semi-structured interview that assesses the severity of obsessions and compulsions on a five-point scale. The sum of all the items yields a total score (range = 0–40) [39], with scores of 16 or greater generally represents clinically significant levels of OCD symptoms. Internal consistency estimates were excellent for the Y-BOCS across all time points (all $\alpha s \geq .90$) [40-42]. We utilized the translated version of Y-BOCS. Its validity and reliability with Cronbach's alpha, SC and SS were 0.97 and 0.95, respectively. However, the correlation coefficient between the two half-tests was 0.93 and 0.89, respectively [43]. The Y-BOCS was completed at pre-, mid-, and post-treatment as well as at two-month follow-up.

Hamilton Depression Rating Scale (HDRS): HDRS is a multiple item questionnaire used to provide an indication of depression and its symptoms severity. The patient is rated by a clinician on 24 items scored at a 0-3 or 0-4 likert-type score scale (based on scale type). The best Cutting score for screening depression is 12 [44].

This test has a good validity and reliability with Cronbach's alpha ≥ 0.70 [45]. The reported reliability of the Persian version is 0.66 [46].
The Structured Clinical Interview for DSM-IV Axis I and II Disorders (SCID): The SCID is a structured diagnostic interview that assesses DSM-IV Axis I and II diagnoses; it was used to determine patients' diagnoses. The measure shows adequate to excellent inter-rater reliability (Kappa coefficient of 0.71 for axis I and 0.84 for axis II) in prior studies [47]. In this research, the Persian version of SCID, translated by Sharifi et al. and adapted to the Iranian culture, was used [48].
Procedure: All patients are on at least eight weeks duration of SSRIs medication (with at least one pharmaceutical equivalents, such as sertraline 100mg, fluvoxamine 100mg, and fluoxetine 40mg). These are prescribed by the psychiatrist, started before pre-test and continued over treatment [49]. Moreover, all the patients received CBT for 15 weeks, a 1.5 hour session per week on Foa and Yadin protocol [50]. Patients in the NFT group (five patients) received 30 session of neurotherapy, two 45 minute session per week.
Data analyses
Shapiro-Wilk and Levene's methods were used to test for distribution normality and equality of variances and repeated-measures ANOVA tests were utilized for statistical analysis. Demographic data were analyzed employing Exact Fisher test.

RESULTS

The sample consisted of seven women and three men with a mean age of 30.80 years (*SD* = 6.01). The OCD duration mean was 13.90 years (SD = 5.21) and the minimum age of the onset was 14 and the maximum age was 23 (mean = 16.90, SD = 3.07). As many as five patients were randomly assigned to receive NFT+CBT+SSRIs, and five other patients were assigned to receive CBT+SSRIs treatment. A total of 60% participants are married. The mean and standard deviation of the other variables are in table 1.
Independent sample t-test showed no significant pretreatment differences for age (p = 0/ 49), age of onset (p = 0.02) and OCD duration (p = 0.78) between the two treatment groups. Groups did not differ in terms of age, sex or pre-treatment symptom severity.

Table 1. mean and standard deviation of variables

Measure	NFT+CBT+SSRI's				CBT+SSRI's			
	Pre	Mid	Post	Follow up	pre	mid	Post	Follow up
Y-BOCS	30.80	19.20	10	10.20	30.40	24.60	18.60	19.60
	4.43	1.92	2.73	1.92	3.28	3.43	3.36	7.76
Obsession	16	10	5.40	5.20	15.60	13.40	10.20	10.40
	2	0.7	1.67	1.30	1.81	1.51	1.78	3.20
Compulsion	14.80	9.20	4.60	5	14.80	11.20	8.40	9.20
	2.58	1.64	1.14	0.70	1.92	3.03	1.81	4.60
HDRS	44.40	21.60	13.80	9	36	23.20	15.40	13.40
	7.33	4.15	4.32	1.73	7.17	3.27	2.19	7.12

OCD symptom severity: Repeated-measures ANOVA analysis indicated a significant Time Intervention Effect, F(2) = 75.95, p=0, Cohen's d = 0.90 and significant Time × Condition interaction for Y-BOCS scores, F(2) = 5.94, p=0.01, Cohen's d = 0.42. Between-group comparisons indicated significant difference between the conditions post treatment, F(1) = 10.35, p=0.01, Cohen's d = 0.56, significant differences were found with follow-up, F(1) = 10.23, p=0.01. These findings indicated that both the treatment conditions had a large, significant impact on reducing OCD symptoms over the treatment period that continued through follow-up. However, the NFT + SSRI + CBT condition had significantly larger improvements post-treatment and during the follow-up than under the SSRI + CBT condition. Moreover, from the baseline to follow-up, there was an average of 66.26% improvement in Y-BOCS scores under NFT + SSRI + CBT condition, as compared to a 36.23% improvement under SSRI + CBT condition (Figure1).

Obsession severity: Repeated-measures ANOVA analysis indicated a significant Time Intervention Effect, F(2) = 92.32, p=0, Cohen's d = 0.92 and significant Time × Condition interaction for Obsession scores, F(2) = 10.44, p=0, Cohen's d = 0.56. Between-group comparisons indicated significant difference between the conditions post treatment, F(1) = 11.06, p=0.01, Cohen's d = 0.58, significant differences were found with follow up, F(1) = 13.18 , p=0. These findings indicated that both the treatment conditions had a large, significant impact on reducing obsession symptoms over the treatment period that continued through follow-up. However, the NFT + SSRI + CBT condition had significantly larger improvements post-treatment and follow-up than under the SSRI + CBT condition. Moreover, from the baseline to follow-up, there was an average of 67.07% improvement in the Obsession scores under NFT+SSRI+CBT condition, as compared to a 33.75% improvement under SSRI+CBT condition (Figure 2).

Compulsion severity: Repeated-measures ANOVA analysis indicated a significant Time Intervention Effect, $F(2) = 45.00$, $p=0$, Cohen's $d = 0.84$. However, no significant Time × Condition interaction for compulsion scores, $F(2) = 2.35$, $p=0.12$, Cohen's $d = 0.22$, was seen. Between-group comparisons indicated no significant difference between the conditions post treatment $F(1) = 4.86$, $p=0.05$, Cohen's $d = 0.37$ and at follow up $F(1) = 5.74$, $p=0.04$ was found. These findings indicate that both the treatment conditions had a large, significant impact on reducing compulsion symptoms over the treatment period that continued through follow-up. However, differences between the treatment conditions were not significant. Moreover, from the baseline to follow-up, there was an average of 65.35% improvement in the compulsion scores under NFT + SSRI + CBT condition, as compared to a 38.64% improvement under SSRI + CBT condition (Figure 3).

Depression severity: Repeated-measures ANOVA analysis indicated a significant Time Intervention Effect, $F(2) = 111.74$, $p=0$, Cohen's $d = 0.93$ and significant Time × Condition interaction for Depression severity scores, $F(2) = 5.40$, $p=0.01$, Cohen's $d = 0.40$. Between-group comparisons indicated no significant difference between the conditions post treatment $F(1) = 0.47$, $p=0.51$, Cohen's $d = 0.05$ and during the follow up, $F(1) = 0.007$, $p=0.93$. These findings indicated that both the treatment conditions had a large, significant impact on reducing depression severity over the treatment period that continued through follow-up. However, differences between the treatment conditions were not significant. Moreover, from the baseline to follow-up, there was an average of 79.02% improvement in the Depression scores under NFT + SSRI + CBT condition, as compared to a 63.88% improvement under SSRI + CBT condition (Figure 4).

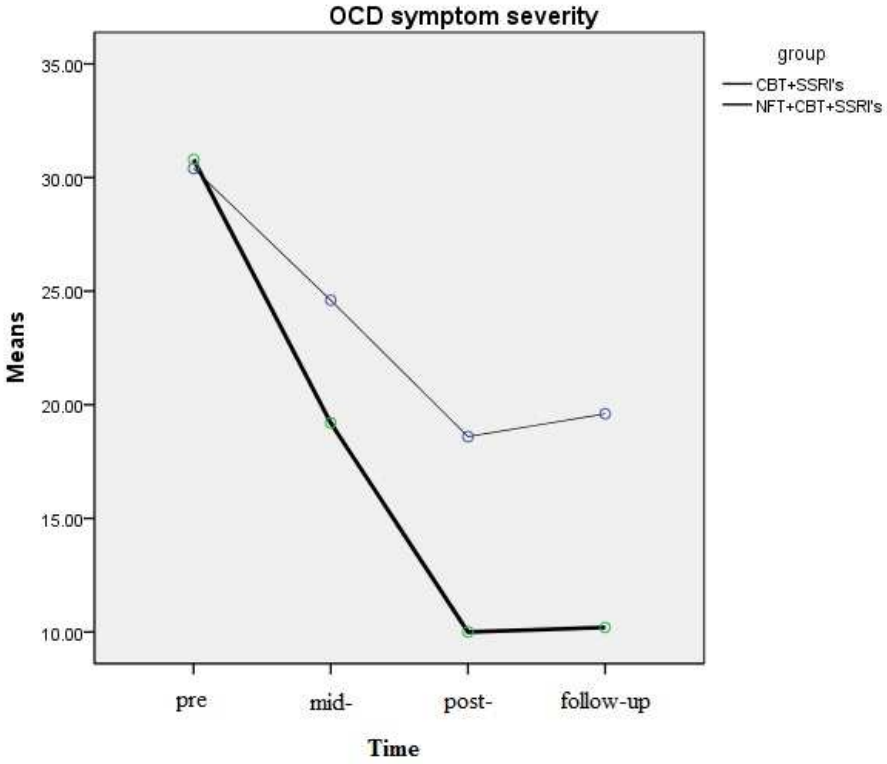

Figure 1. OCD symptom severity

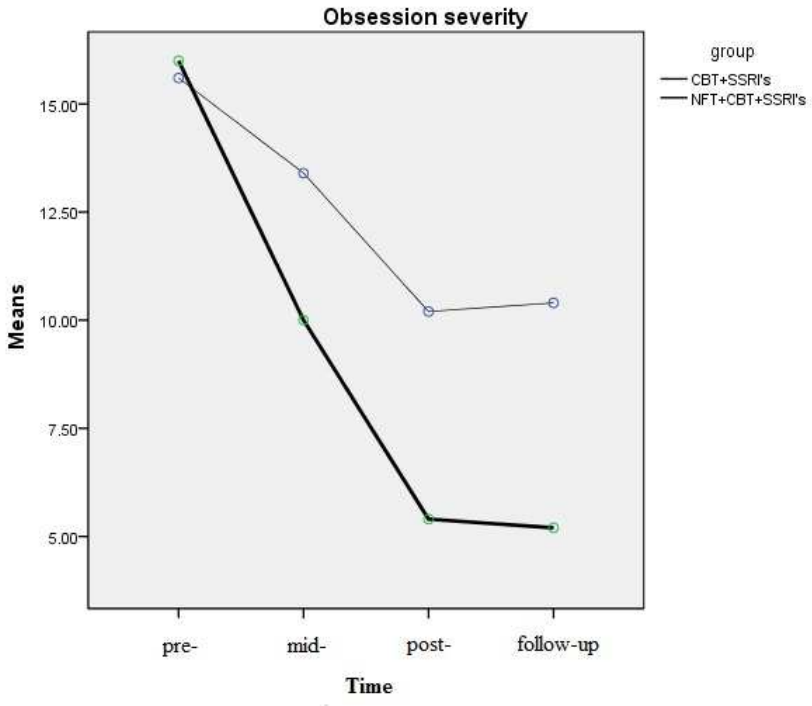

Figure 2. Obsession severity

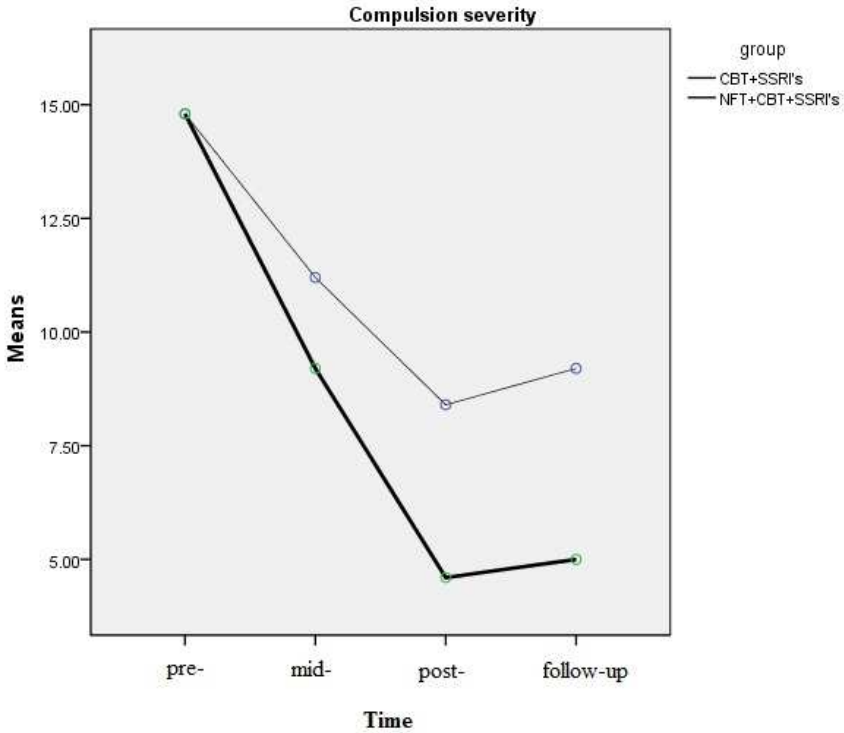

Figure 3. compulsion severity

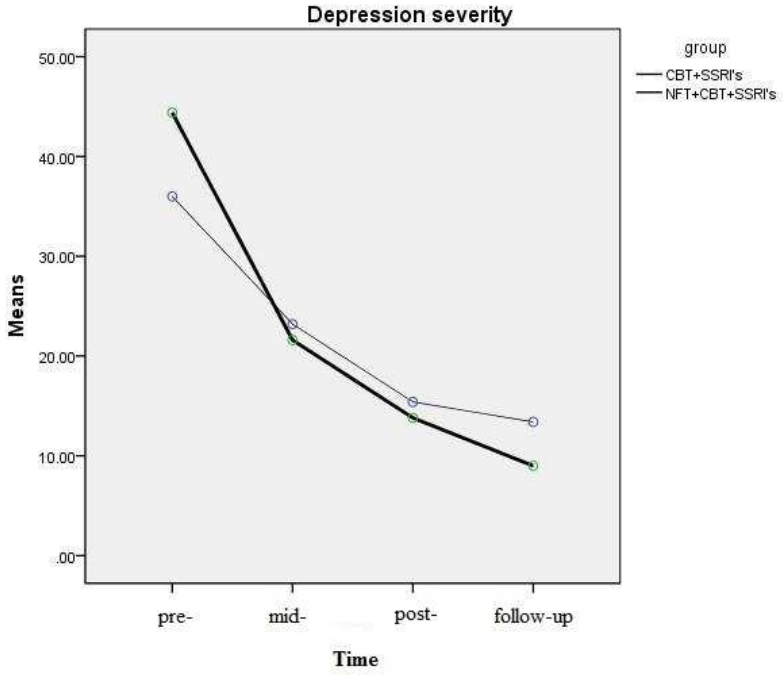

Figure 4. depression severity

DISCUSSION

Our findings provided clear evidence that adding Neurofeedback in the treatment of OCD patients can improve the effects of standard treatment with SSRIs medication and CBT. Greater improvement was observed in OCD symptoms -specifically in Obsessions- in the group that had extra treatment with neurofeedback. Their improvement was statistically significant by the end of treatment and in follow up. Reduction of compulsions and depression symptoms had a significant trend throughout the treatment in each group. However, there were no significant differences found between groups.

These findings were consistent with previous reports. According to those reports, neurofeedback alone [51, 52], as well as the addition of neurofeedback to medication [38], reduces the OCD symptoms. Moreover, our results were consistent with other findings, which indicated that different types of neurofeedback were effective in reducing contamination-related obsessions [53-55]. The findings of the present study were similar to that of Deng et al. (2014). Their study investigated the effectiveness of adjunctive treatment with neurofeedback to standard treatment with psychotherapy and medication and observed a reduction of 50% in OCD symptoms [56]. The main differences between the present study and Deng's research were the number of treatment sessions in both neurofeedback and psychotherapy treatments as well as sample size.

Based on each section of treatment, we could explain how adding neurofeedback to medication and CBT could result in decreasing OCD severity. Cognitive behavioral therapy and medication were common in both groups. Therefore, the significant difference observed in reducing the severity of OCD and obsessions between the two treatment groups could be explained by the effectiveness of adding neurofeedback to the treatment. In this study, neurotherpay had two parts: the first part consisting of training SMR, Alpha, and High Beta (18-22 Hz) on C4 and the second part on Fz-Pz by normalizing High Beta wave (18-30 Hz).

Sensory motor rhythm was associated with physical relaxation, attention processing, physical activity preparation before it begins, and mental consciousness. In other words, with increasing SMR, the mobility of a person decreases and physical relaxation increased [57]. People with OCD experienced problems, such as tension, tachycardia, increasing blood pressure, brain wave changes, negative emotions, panic attacks, etc. These were due to the high level of anxiety they experienced when exposed to obsessive-compulsive stimuli [56]. According to the cognitive behavioral theory, anxiety plays an essential role in formation and continuation of OCD. The person makes compulsive behavior merely to reduce anxiety [58, 59]. Positive treatment outcome in the neurofeedback group could be attributed to the fact that in the part of neurotherapy of individuals, we trained SMR waves. By learning to adjust this wave, they could improve their relaxation skills and reduce muscle tension, thereby modify part of their anxiety symptoms. By reducing anxiety during treatment, symptoms of OCD would also be reduced.

Furthermore, in another part of the neurotherapy of the patients (as in the study of [51]), we normalized the High Beta wave (18-30). Beta wave was related to thinking, concentration, sustained attention, tension, vigilance, and excitement [57]. In addition, the High Beta wave was associated with obsessions, negative thoughts, rumination, anxiety, general arousal of the brain, worry, and disturbance in attention and concentration [60, 61]. The increase in Beta and High Beta was associated with anxiety, obsession, anger, rumination and hyper vigilance. During treatment, patients learnt to regulate this wave and might have been able to improve part of their OCD symptoms, which are associated with obsessions, negative thoughts, anxiety, and general arousal of the brain. Different components of neurofeedback treatment in this study focused on the reducing obsessions and training to maintaining physical relaxation. This might be the most important reason for the effectiveness of neurofeedback therapy to reduce OCD symptoms and obsessions.

The results of this study was consistent with various other studies [36, 62-64] that have shown that beta wave training was effective in reducing anxiety, over thinking, obsessions, and enhancing SMR on C4 to reduce arousal. Moreover, our results were consistent with the findings of Paquette et al. (2009) and Hammond et al. (2003). These studies showed that normalized High Beta wave decreased obsessions, negative thoughts, rumination, and worries [60, 65]. In describing how to reduce obsessive-compulsive disorder with neurotherapy, the role of normalization of the High Beta wave in the neurofeedback treatment protocol could be noted. As already mentioned, the High Beta wave was associated with obsessions, negative thoughts, ruminations, and so on.

Treatment of exposure and prevention of response was the most effective treatment for OCD [14, 16]. EX/ RP was more effective in treating compulsions than obsessions [21, 66]. In line with these studies, our results showed a significant trend in reducing the symptoms of OCD in both treatment groups. Our results were consistent with the studies which showed that neurofeedback with medication was effective in reducing compulsions and rituals [8, 38, 56]. Since in both the groups compulsions were reduced, this contradiction with the previous studies could be attributed to differences in neurofeedback protocols and sample size. In the study of Kopřivová et al. (2013), neurotherapy was based on QEEG and possibly the clinically significant results of this study was related to this protocol. Moreover, due to the difference observed in our finding (but not significant), we could mention the role of sample size in this section. From the result of previous studies and the present study, it could be concluded that both the psychotherapy and neurofeedback was effective in reducing compulsions. However, significant differences could not be expected to be seen by simultaneous provision of two treatments.

The findings of this study were consistent with the results of the previous studies, which showed that QEEG-guided neurotherapy was effective in reducing depression symptoms associated (comorbid) with OCD [61, 65]. However, the finding of the present study were inconsistent with that of Joseph et al. (2009) that did not show significant improvement in addition of neurofeedback to medication in reducing obsessive compulsive symptoms and depression [67]. Of course, this discrepancy is partly justifiable. The number of neurofeedback sessions in the present study was twice the number in Joseph's research (2009). In studies such of Kopřivová et al. (2013) and Deng et al. (2014), which added neurofeedback to medication and CBT, there was no information on the reduction of comorbid depression with OCD [8, 56]. To explain the efficacy of adding neurofeedback to medication and CBT to reduce depression symptoms without targeting these symptoms in treatment, we could point that symptoms of depression might be secondary to OCD symptoms, resulting in helplessness and feeling of being unable to control obsessive compulsive symptoms. By reducing symptoms of OCD, depression symptoms were also reduced. Reduced OCD symptoms were associated with increased availability of time, ability to return to work and education, increasing self-esteem due to overcoming OCD, etc. Each of these achievements could also contribute to reducing the symptoms of depression. Previous studies on the effectiveness of treatment on reducing the severity of depression with OCD did not report the effectiveness of CBT, medication, and neurofeedback. Therefore, it could be concluded that psychotherapy and neurofeedback separately could reduce the severity of comorbid depression with OCD. However, simultaneous provision of these two treatments could not be significantly different.

Limitations and implications:

Several limitations were noticed while interpreting the findings of this study. First, our study included small sample size that might have reduced the power to detect the true differences. Therefore, we suggest larger sample size to enhance the generalizability of the findings and the application of results in the treatment of patients with OCD for future studies. Second, in our study there was no placebo control of neurofeedback (e.g. shamfeedback). Therefore, it is possible that greater improvement in neurofeedback group was due to the placebo effect of 30 additional contacts with therapist. Hence, implementing various control group such as medication + neurofeedback or medication + CBT + SHAM feedback were suggested for future studies in order to clarify these observed differences.

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Compliance with Ethical Standards:
Funding: This study was not funded by any company.
Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.
Informed consent: Informed consent was obtained from all individual participants included in the study.
Competing Interests: The authors declare that they have no competing interests.

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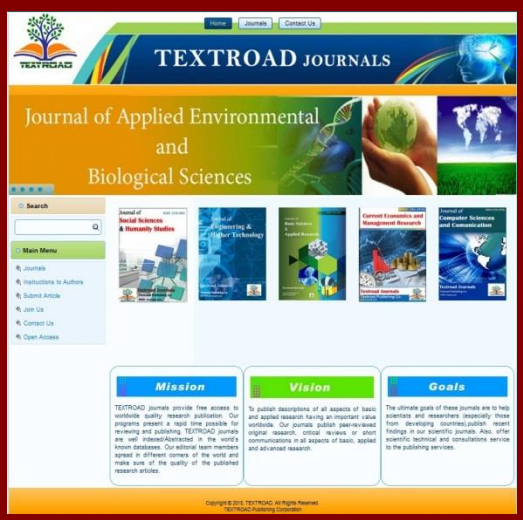

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