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# The association between the perception of crime and walking in gated and non-gated neighbourhoods of Asian developing countries

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## Abstract

It has been reported in the literature that the perception of crime at the neighbourhood level inversely affects the walking behaviour of individuals. On the other hand, the gated neighbourhoods are considered safe from crime, however, there is a lack of research on the association of the perception of crime and walking in gated neighbourhoods. Therefore, the objectives of the study reported in this paper were to investigate the association between the perception of crime and walking in gated and non-gated neighbourhoods. A questionnaire was used to collect the data on walking and the perception of crime in 16 neighbourhoods of Karachi Pakistan, 8 out of which were gated. Independent sample t-test and gamma tests were used for the data analysis. The results show that although there is a lower perception of crime in the gated neighbourhoods, yet the inhabitants of gated neighbourhoods engage in less physical activity comprising of walking. In spite of a greater perception of crime in non-gated neighbourhoods, higher values of walking were reported by the residents of

those neighbourhoods. Therefore, it has been concluded that there does not exist a definite relationship between the perception of crime and walking behaviour at the neighbourhood level and the perceived safety from crime claimed by the proponents of the gated neighbourhoods does not encourage walking among the residents.

Keywords: Psychology, Public health, Law, Geography, Sociology

## 1. Introduction

Walking is considered an integral part of physical activity, which is a necessary condition for attaining and maintaining physical health of humans (Bauman et al., 2011). Therefore, many guidelines for the necessary amount of walking one should engage in have been formulated, for example, an important guideline by the World Health Organization is that one should be considered physically active if one gets 150 minutes of walking or 600 MET minutes in a week (World Health Organization, 2010). The calculation of MET (metabolic equivalent of task) is based on differentiating the body in rest and doing some activity. There is a different MET value assigned to each physical activity and the value for walking ranges from 3-5 (Ainsworth et al., 2000).

The neighbourhood environment is considered important for enhancing walking at the neighbourhood level and this has become a robust area of research investigation over the past couple of decades (Day and Cardinal, 2007). The neighbourhood environment has been broadly defined by transportation experts and urban planning professionals as to include the land use patterns, the accessibility, and the design features (Handy et al., 2002; National Research Council (US). Committee on Physical Activity and Land Use and Transportation Research Board and Institute of Medicine (2005); Gul et al., 2016), all of which can potentially affect walking. The health literature concludes that along with these neighbourhood environment aspects, the availability of sports facilities also plays a vital role towards enhancing physical activity (Sallis et al., 2009). Moreover, there are a few social environment factors that also affect physical activity at the neighbourhood level as agreed by both the public health and the urban planning experts.

It has been reported in the literature that the social environment factors, such as security from crime, traffic safety, and physical disorder, are neighbourhood environment variables that can affect people's willingness to be physically active outdoors in their neighbourhoods (CDC, 1999; DiGuseppi et al., 1998). The perception of crime (POC) is a very important social environment variable, which is measured subjectively by collecting data through appropriate questionnaires. The residents of a neighbourhood are asked how safe or vulnerable they feel with regards to crime

in their neighbourhood. There are standard questionnaires available with certain segments formulated to measure POC, such as Neighbourhood Environment Walkability Scale (NEWS). There are a few questions in NEWS for measuring POC, for example, people are asked if they feel safe while walking in their neighbourhoods at the day as well as night times and if they see other walkers or bikers in the streets while they walk. This walk can be for any utility or leisure purposes. The perceptions are then calculated by assigning numerical weightage to different answers, such as the Likert scale (Sallis et al., 2009).

Sallis et al. (2009) showed a significant negative association between POC and walking. Similarly, a significant negative association between POC and walking was also found in developing countries (Oyeyemi et al., 2012). On the other hand, in a review of 18 studies examining environmental correlates of walking, traffic and pedestrian-related safety were positively associated with walking for exercise, recreation, and transportation among children, but the same was not found to be associated with walking among adults (Owen et al., 2004). In some cases, the relationship between POC and walking has been found inconsistent (Bauman and Bull, 2007). Most of the studies focusing on adults, with some exceptions, have not found a significant association between crime-related safety and walking (Foster and Giles-Corti, 2008). Therefore, it can be said that the relationship between POC and walking is not conclusive because some researchers have reported a negative relationship between these two, while several others have failed to identify any relationship thereof.

A new trend in the neighbourhood design has come into being recently, claiming to provide more security from crime, in the shape of security zone gated neighbourhoods (Blakely and Snyder, 1997). These gated neighbourhoods have gained popularity around the world among consumers (Blakely and Snyder, 1997; Grant and Mittelsteadt, 2004). It has been reported that these communities have low POC (Wilson-Doenges, 2000; Sakip et al., 2012; Gul et al., 2018), but no actual difference in the crime rate (Breitung, 2012). The available research is inconclusive about the crime in the gated neighbourhoods and there is a gap in the literature comparing the POC and its effects on walking in gated and non-gated neighbourhoods. Therefore, the objective of this study is to investigate the relationship between POC and walking in gated and non-gated neighbourhoods. The methodology adopted for performing this study has been explained in the next section followed by a discussion and the conclusions drawn therefrom.

## 2. Methodology

The methodology for the present study mainly consisted of the selection of the study area, the selection of the study sample, the collection of the data, the data analysis,

and the formulation of conclusions and recommendations. There was no need for obtaining any Ethics Approval at any stage of this study.

## 2.1. Study area

A cross-sectional study was conducted by matching gated neighbourhoods with their counterpart non-gated neighbourhoods located in the largest metropolis of Pakistan. Karachi was selected as the study area because it is one of the largest cities, with a total area of 3,527 km<sup>2</sup> (Pakistan Bureau of Statistics, 1998), among Asian developing countries (United Nations Department of Economic and Social Affairs, 2016), and has a heterogeneous population (Amer, 2013). This study is part of a gated communities physical activity study (GCs-PAS). There are two major types of developments in Karachi city: planned, and unplanned. The planned development has two sub-types: single family, and multifamily. The multifamily development includes either walk-ups up to 5 stories or high-rises up to 16 stories. A new trend in neighbourhood development, a gated and guarded neighbourhood, is growing fast in Karachi city. It was reported in one study that by 2030, most of the neighbourhoods in the city will be gated for the sake of safety (Ahmad, 1993). There are 6 districts, 6 cantonments, 24 towns, 216 union councils, and 4 development authorities in the city. The districts are Karachi South, Karachi East, Karachi Central, Karachi West, and Malir. The Karachi South and West districts were not included in this study because there is not a noticeable number of gated neighbourhoods in those two districts. Four neighbourhoods from each development type — single-family gated, multifamily gated, single-family non-gated, and multifamily non-gated — were selected, yielding 16 neighbourhoods. The administrative map of Karachi is easily available online if anyone is interested in viewing it.

The other important factors which were taken into account for the selection of neighbourhoods were the income group, the population density, and the area. The selected neighbourhoods were from the upper-middle to high-income groups (Rs.65, 000 to Rs.250, 000 per month, which is approx. \$650–\$2,500 PM). The reason for selecting middle- to high-income neighbourhoods was because gated neighbourhoods are mostly in this category; therefore, the counterpart non-gated neighbourhoods were also selected from the same income group. It was tried to select the neighbourhoods that have the similar values of population density so that the relative effects of this factor are nullified. The population density was calculated through the gross housing density of each neighbourhood multiplied with the average household size of Karachi city (World Health Organization, 2010). The gross populations of gated and counterpart non-gated neighbourhoods were close to each other. The area of the neighbourhood was another important factor which was taken into account for selection of these neighbourhoods. The area of each neighbourhood was selected as close to 1 km<sup>2</sup> as possible. Most gated neighbourhoods in Karachi were from 0.5 to 1.5

km<sup>2</sup>, limited by the boundary walls; therefore, blocks of non-gated neighbourhoods that were as close in area as possible were selected. The details of the selected neighbourhoods are given in [Table 1](#).

## 2.2. Study sample

Convenient sampling was done by using the [Cochran \(1963\)](#) formula for sample size. The area under the normal curve was chosen as 1.96, which corresponds to a 95% confidence level; the true proportion was chosen as 0.5, and the acceptable error margin was chosen as 5%, resulting in a value of 0.05. According to this method, 384 respondents were needed in each of the two types of neighbourhoods (gated and non-gated), i.e. 768 in total. However, an oversampling approach was adopted. Seventy-five individuals from each neighbourhood, i.e. 1,200 in total, were selected who met the inclusion criteria for this study. The inclusion criteria were (1) being able to read and write Urdu or English, (2) having lived in the neighbourhood for at least three months, and (3) having no serious impaired ability to walk. The final study population for the analysis after exclusion due to missing data consisted of 1,042 individuals. The recruitment process and the survey were conducted by trained surveyors. The survey was conducted from January 2016 to June 2016 under the supervision of the first author of this study.

## 2.3. Data collection and statistical analysis

There were two variables in this study, one dependent and the other independent. The dependent variable was walking, which is the sum of two types of walk, the practical walk and the recreational walk. Practical walk is a walk for any utility purpose such as walk to school, place of worship, shops, or any other public building. On the other hand, recreational walk is only for leisure purposes or health benefits. Both the types of walk have different MET values; the MET value for practical walk is 4, whereas it is 3 for recreational walk ([Ainsworth et al., 2000](#)). The data was collected through a subjective method using the Neighbourhood Physical Activity Questionnaire (NPAQ) ([Sundquist et al., 2011](#)). The reason for using NPAQ was that it is convenient as it relies on recalling the names of places visited as compared to the walking trips a week. The participants were asked if they do any walk at stage first; if they replied affirmatively, then they were provided with different destination options for practical and recreational walks separately. They were asked about their return trips in a week to any of those destinations and time in minutes it usually takes for a trip. All the minutes were then multiplied with the MET values of practical or recreational walk according to the type of destination to get the total MET-minutes in a week through walking.

The independent variable in this study was the perception of crime (POC), which in an indicator of how safe people feel from crime while walking in their

**Table 1.** Details of selected neighbourhoods.

| Gated Neighbourhoods       |             |                                      |                    | Non-Gated Neighbourhoods     |             |                                      |                    | Development Type        | Income Group      |
|----------------------------|-------------|--------------------------------------|--------------------|------------------------------|-------------|--------------------------------------|--------------------|-------------------------|-------------------|
| Name                       | Area in K2m | Location                             | Population density | Name                         | Area in K2m | Location                             | Population density |                         |                   |
| Malir Cantonment           | 1.0         | Cantonments                          | 9,380              | Gulshan-e-Maymar             | 1.0         | Malir District (MDA)                 | 8,040              | Single-Family           | Upper middle-High |
| PAF Falcon Housing Society | 0.5         | Cantonments                          | 4,225              | DHA Phase-VI                 | 0.5         | Cantonments                          | 5,440              | Single-Family           | Upper middle-High |
| Chapal Suncity             | 0.5         | Karachi East District (Gulshan Town) | 14,657             | North Nazimabad Blocks C,D,E | 1.0         | Karachi Central District (KDA)       | 17,018             | Single-Family           | Upper middle      |
| Askari Phase-IV            | 0.5         | Cantonments                          | 12,294             | Nazimabad Block-5            | 1.0         | Karachi Central District (KDA)       | 11,564             | Single-Family           | Upper middle      |
| Creek Vista Apartments     | 0.5         | Cantonments (DHA)                    | 12,641             | Bahadarabad Chowrangi        | 1.0         | Cantonments                          | 11,932             | Multi-family High rises | Upper middle-High |
| West Wind Apartments       | 0.5         | Clifton Cantonments                  | 11,725             | Gulistan-e-Johar             | 1.0         | Cantonments                          | 15,845             | Multi-family High rises | Upper middle-High |
| Sea View Apartments        | 1.0         | Cantonments (DHA)                    | 11,457             | Gulshan-e-Iqbal Block-16     | 0.5         | Karachi East District (Gulshan Town) | 12,878             | Multi-family Walk-ups   | Upper middle      |
| Agha Khani Housing Society | 0.5         | Karachi East District (Gulshan Town) | 17,118             | FB Area Block-3              | 0.4         | Karachi East District (Gulshan Town) | 17,108             | Multi-family walk-ups   | Upper middle-High |

neighbourhoods. The POC was measured through the perceived method using the questionnaire of the Neighbourhood Environment Walkability Scale (NEWS) (Adams et al., 2009). This is a 4 point Likert scale where strongly agree, agree, disagree and strongly disagree questions are used. Strongly agree was given a value of 4 while strongly disagree was given a value of 1 for the purpose of calculations. The statistical analysis of POC data was then performed together with the survey data of walking using 'SPSS in two parts. The first part explained the group statistics and performed independent sample t-test between POC and walking in gated and non-gated neighbourhoods and the second part examined the relationships of POC and walking in gated and non-gated neighbourhoods through cross-tabulation and gamma tests. This study was exempted from requiring Ethics Approval.

### 3. Results

#### 3.1. Differences between POC and walking in gated and non-gated neighbourhoods

Independent sample t-test was computed to check the differences between the POC and walking in gated and non-gated neighbourhoods. The group statistics for the POC and walking in gated and non-gated neighbourhoods are provided in Table 2, whereas the results of the t-test for the same are provided in Table 3. There was a significant difference in the POC in gated and non-gated neighbourhoods. The mean value of the POC in the gated neighbourhoods was 2.4 with a standard deviation of 0.9, whereas the mean value for the same in non-gated neighbourhoods was 2.7 with a standard deviation of 1.0. The t-test resulted in a t-value of -4.1 with the p-value of 0.0001, which shows that there exists a significant difference. Similarly the difference in walking in gated neighbourhoods (mean = 434.17, standard deviation = 490.7) and in non-gated (mean = 633.4, standard deviation = 674.5) was also significant with the t-value of -4.2, and the p-value of 0.0001. These results suggest that there is relatively more perception of crime in non-gated neighbourhoods than that in gated neighbourhoods. It means that relatively a higher number of people agreed in the non-gated neighbourhoods that their neighbourhoods environment is dangerous. Nevertheless, the walking results show that people do more

**Table 2.** Group statistics of POC and walking in gated and non-gated neighbourhoods.

| Neighbourhoods |           | N   | Mean     | Std. Deviation | Std. Error Mean |
|----------------|-----------|-----|----------|----------------|-----------------|
| POC            | Gated     | 499 | 2.4696   | .99627         | .04460          |
|                | Non-Gated | 543 | 2.7238   | 1.00257        | .04302          |
| Total Walk     | Gated     | 330 | 434.1727 | 490.75411      | 27.01512        |
|                | Non-Gated | 303 | 633.4950 | 674.57966      | 38.75359        |

**Table 3.** Independent sample T-test between POC and walking in gated and non-gated neighbourhoods.

|            |                             | Levene's Test for Equality of Variances |      | t-test for Equality of Means |          |                 |                 |                       |   |            |       |
|------------|-----------------------------|---|------|------------------------------|----------|-----------------|-----------------|-----------------------|---|------------|-------|
|            |                             | F                                       | Sig. | t                            | df       | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |            |       |
|            |                             |   |      |                              |          |                 |                 |                       |   | Lower      | Upper |
| POC Total  | Equal variances assumed     | .177                                    | .674 | -4.100                       | 1040     | .000            | -.25415         | .06199                | -.37578                                   | -.13252    |       |
|            | Equal variances not assumed |   |      | -4.101                       | 1033.661 | .000            | -.25415         | .06197                | -.37575                                   | -.13255    |       |
| Total Walk | Equal variances assumed     | 13.230                                  | .000 | -4.275                       | 631      | .000            | -199.32232      | 46.62318              | -290.87770                                | -107.76695 |       |
|            | Equal variances not assumed |   |      | -4.219                       | 548.034  | .000            | -199.32232      | 47.24042              | -292.11679                                | -106.52786 |       |



walking in non-gated neighbourhoods as compared to gated neighbourhoods. This indicates that the relatively higher fear of crime in the non-gated neighbourhoods does not deter the inhabitants of those localities from walking. It is worth noting here that these results have been obtained in an Asian developing country, and it is hypothesized that a similar behaviour is likely to be observed in other cities with similar socio-economic conditions.

### 3.2. Association between POC and walking in gated and non-gated neighbourhoods

Cross-tabulation and gamma tests were applied to investigate the association between POC and walking in gated and non-gated neighbourhoods. Walking was categorized into three; no walk at all, less than 600 MET minutes of walking per week, and more than 600 MET minutes of walking per week; in accordance with the WHO recommendations for walking for adults (age range of 18–65) (World Health Organization, 2010). The POC data were ordinal (Likert scale - 4), which were categorized into very low, low, high, and very high. The cross-tabulation results in Table 4 show that the association between the POC and walking in non-gated neighbourhoods is 21%, while it is 17.2% in gated neighbourhoods. Similarly, the results of the gamma test, presented in Table 5, show that the POC has a significant negative association with walking with p-value of 0.002 and R-value of 11%. It means that when the perception of crime is low, people tend to walk more. However, the effect size of this relationship is very small.

**Table 4.** Cross-tabulation and gamma test results.

| Neighbourhoods |       |                  |              | Walking |                  |                  | Total  |
|----------------|-------|------------------|--------------|---------|------------------|------------------|--------|
|                |       |                  |              | 0 walk  | <600<br>MET/Week | >600<br>MET/Week |        |
| Total          | POC   | 1- Very Low POC  | % within POC | 41.5%   | 40.4%            | 18.1%            | 100.0% |
|                |       | 2- Low POC       | % within POC | 30.8%   | 47.4%            | 21.9%            | 100.0% |
|                |       | 3- High POC      | % within POC | 45.0%   | 42.4%            | 12.6%            | 100.0% |
|                |       | 4- Very high POC | % within POC | 50.6%   | 28.2%            | 21.2%            | 100.0% |
|                | Total | % within POC     | 39.3%        | 41.6%   | 19.2%            | 100.0%           |        |
| Non-Gated      | POC   | 1- Very Low POC  | % within POC | 42.6%   | 27.7%            | 29.8%            | 100%   |
|                |       | 2- Low POC       | % within POC | 38.2%   | 42.2%            | 19.6%            | 100.0% |
|                |       | 3-High POC       | % within POC | 46.3%   | 35.8%            | 17.9%            | 100.0% |
|                |       | 4-Very high POC  | % within POC | 51.9%   | 25.0%            | 23.1%            | 100.0% |
|                | Total | % within POC     | 44.2%        | 44.2%   | 34.8%            | 21.0%            | 100.0% |
| Gated          | POC   | 1- Very Low POC  | % within POC | 40.4%   | 53.2%            | 6.4%             | 100.0% |
|                |       | 2- Low POC       | % within POC | 27.0%   | 50.0%            | 23.0%            | 100.0% |
|                |       | 3- High POC      | % within POC | 43.3%   | 51.0%            | 5.8%             | 100.0% |
|                |       | 4- Very high POC | % within POC | 48.5%   | 33.3%            | 18.2%            | 100.0% |
|                | Total | % within POC     | 33.9%        | 48.9%   | 48.9%            | 17.2%            | 100.0% |

**Table 5.** Gamma test results.

| Neighbourhoods |                    |       |                  | Value | Asymp. Std. Error <sup>a</sup> | Approx. T <sup>b</sup> | Approx. Sig. |
|----------------|--------------------|-------|------------------|-------|--------------------------------|------------------------|--------------|
| Total          | Ordinal by Ordinal | Gamma | Zero-Order       | -.119 | .038                           | -3.089                 | .002         |
|                |                    |       | First-Order      | -.103 |                                |                        |              |
|                |                    |       | Partial          |       |                                |                        |              |
|                | N of Valid Cases   |       |                  | 1042  |                                |                        |              |
| Non-Gated      | Ordinal by Ordinal | Gamma | Zero-Order       | -.079 | .055                           | -1.438                 | .150         |
|                |                    |       | N of Valid Cases | 543   |                                |                        |              |
| Gated          | Ordinal by Ordinal | Gamma | Zero-Order       | -.133 | .057                           | -2.346                 | .019         |
|                |                    |       | N of Valid Cases | 499   |                                |                        |              |

<sup>a</sup>Not assuming the null hypothesis.

<sup>b</sup>Using the asymptotic standard error assuming the null hypothesis.

The association between the POC and walking was also investigated separately in gated and non-gated neighbourhoods through Gamma tests. The results show that there is a significant negative association between the POC and walking in gated neighbourhoods with the p-value of 0.019 and R-value of 13%. On the other hand, the results for the association of the POC and walking in non-gated neighbourhoods show that there is no significant association between POC and walking there.

Although a significant negative association between the POC and walking has been noted overall and in gated neighbourhoods separately, the effect size (R-value) is small (less than 33%) in both the cases. The weak effect size and the significance of the relationship only in gated neighbourhoods, when both the types of neighbourhoods were looked at separately, show that the POC is not the only factor that affects walking at the neighbourhood level. It is hypothesized that there are some other factors that are more effective than the POC for walking. These factors may include, but may not be limited to; street connectivity, accessibility, streetscape, land-use patterns, etc.

#### 4. Discussion and conclusions

The results of this study show that gated neighbourhoods have more sense of security from crime than non-gated neighbourhoods in the city of Karachi, Pakistan. This result is consistent to some extent with the study of [Wilson-Doenges \(2000\)](#) and [Sakip et al. \(2012\)](#). They performed an empirical research and addressed the issues of sense of community, actual crime, and fear of crime in a comparative study of two gated and two non-gated communities with similar attributes in the United Kingdom and Malaysia, respectively. Their results showed that the high-income gated community residents reported a significantly higher perceived personal safety as compared to their non-gated counterparts. The results of the present study are also consistent with the review of 18 studies examining environmental correlates of

walking, where safety was negatively associated with walking in adults in most of the studies (Owen et al., 2004).

The second finding of this study is that the perception of crime has a significant negative association with walking. This result agrees with the previous research that neighbourhood safety encourages walking at the neighbourhood level which was done by Oyeyemi et al. (2012) in Nigeria. They investigated the effects on neighbourhood safety with walking in a developing country. Their study also examined associations between perceived neighbourhood safety and physical activity and reported that people did more walking in a given week if they felt safer from crime in their neighbourhoods.

The present study is the first that has investigated the relationship of the POC with walking subjectively in gated and non-gated neighbourhoods of Asian developing countries. The findings of this study can provide guidance to the policymakers that there is no conclusive association between the POC and walking, therefore, the veracity of the claim by the gated neighbourhood proponents that they are developing gated neighbourhoods to provide safety to promote more walking and physical activity, could not be established. Although the non-gated neighbourhoods in Asian developing countries have more POC, yet people walk more there, therefore, there are other factors which affect walking. The strength of the present study is the large sample size, which makes it one of the largest studies so far in Karachi Pakistan. However, since this is a cross-sectional one-time study, therefore, different effects of the different times of the year could not be reported. It is also worth noting that the data for the POC and walking was collected through the perceived method using questionnaire; therefore, the responses by the respondents could be biased. This study has broadly measured the perception of crime i.e. how safe people feel during daytime or night time to walk in their neighbourhoods. Future studies can investigate the effects of the perception of traffic hazard, the effects of physical disorder and their association with walking. It can also be investigated as to how the age and gender affect the perception of crime and the walking behaviour of the residents. Future studies can also investigate the actual crime rates in gated and non-gated neighbourhoods and the relative effects on walking. The actual crime and the perception of crime also can be compared in future studies.

In conclusion, the data on the perception of crime and the walking behaviour of the residents of gated and non-gated neighbourhoods in Karachi, Pakistan, an Asian developing country, was collected. The data was subjected to two types of tests during the analysis. First, the perception of crime and total walking in gated and non-gated neighbourhoods were compared through the independent sample t-test. The results showed that the perception of crime in the gated neighbourhoods was lower compared to the non-gated neighbourhoods. While there was a higher perception of crime in non-gated neighbourhoods, the residents involved in more walking

activity. This suggests that the perception of crime does not deter people from walking in Karachi. It is hypothesized that similar behaviour might be observed in other large cities of Asian developing countries with similar socio-economic conditions, however, further evidence is needed to make this generalization. There are other factors that can potentially affect walking at the neighbourhood level, such as, street connectivity, accessibility, land-use patterns, etc. Second, the association between the perception of crime and the walking behaviour was investigated through cross-tabulation and gamma test. The results showed that there is a negative association between the perception of crime and walking in gated neighbourhoods. However, no such association was noted in the non-gated neighbourhoods. While the negative relationship between the perception of crime and the walking activity in the gated neighbourhoods is statistically significant, the effect size is considerably small. This points to the possibility that the walking is generally low in the gated neighbourhoods due to other factors such as street connectivity, accessibility, etc. Therefore, there is no conclusive relationship between the POC and walking in Karachi, Pakistan.

## Declarations

### Author contribution statement

Yasmeen Gul: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Zahid Sultan: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Gul Jokhio: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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### Competing interest statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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