Impact of Separation from parents on students of the University of medical sciences and technology

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Abstract
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Abstract

Background:

Normative chronic stressors are more frequent in adolescents than acute major life events. The current study aimed to determine the impact of separation from parents on university students.

Methods: A descriptive facility-based cross-sectional study was conducted in the final years of the 14 faculties of the University of Medical Sciences and Technology. The socio-demographic data were collected through a self-administrated questionnaire. The occurrence of depressive symptoms was assessed by using the Center for Epidemiology Studies - Depression Scale (CES-D). Clinical depressive symptoms were reported as CES-D values ≥ 21. Four hundred and sixty-five students completed both questionnaires anonymously and voluntarily.

Results: The prevalence of students separated from their parent’s was 54.1%. A statistically significant association was found between the frequency of communication with parents and the living conditions with a chi-square of 62.445 and a p-value=0.00. The living conditions was statistically associated with the students' appreciation of their current residence (p-value = 0.006). The clinical manifestations trouble sleeping and loss of appetite had a statistically significant association with the living conditions of the students with a p-value of 0.00 and 0.051 respectively. The prevalence of depressive symptoms was higher (48.2%) in students separated from their parents than in the group living with them (33.3%) with a statistically significant association (p-value =0.009).

Conclusion: The results of the research revealed that the normative chronic social demands were more important than the academic ones when students were separated from their parents. Thus, intervention should rather focus on an early recognition of health related behaviors in this group of future potential leaders.

Keywords: Separation, Depression, Academic behavior, Living conditions.

Background

Even with the daily advance in communication nowadays, the physical distances between family members play an important role in the family relationship. Educational attainment may force one to migrate, in this case, reaching personal goals may conflict with the desire to maintain family unity [1].

Psychological, social and relational transitions are characteristics of a young adult’s life [2]. Starting college occurs simultaneously with transition to adulthood and can therefore be considered a major life event, this is even more profound when the student has to relocate [2, 3]. This process can be difficult and requires social and mental adaptation to a new environment, and new challenges such as managing the demands of daily life, new social networks, academic overload and academic demands. Additional factors could be financial and success pressures, and loss of usual support network [3-5]. Adjustment to university life is positively affected by peer and parental attachment, and that among the two peer attachment was a stronger predictor [3, 6]. On the other hand, a study revealed that psychological separation among late teens positively predicted better adjustment to university; and independence from parents was associated with lower levels of positive separation feelings [7]. Some students are able to cope while others find it harder, which may lead to depression and psychological stress [8]. When the student adjusts well to the new environment, this is reflected on academic performance as well as their social and mental wellbeing, whereas poor adjustment may lead to academic stress and poor academic performance adverse mental affects and college dropout [3, 8-10].
Depression can be a result of mental disorders, socio-demographic factors, and stressful life events [4]. The prevalence of depression has increased by 18% from 2005 to 2015 affecting more than 300 million people globally [11]. It has become more apparent among younger people [12]. Depression affects a large proportion of university students, impacting their academic performance and potentially leading to dropping out [13-15]. When compared to adults and age-matched peers in the general population, university students have higher prevalence of psychological distress [14]. When adolescents leave home for college they leave behind a familiar and supportive environment, this may trigger symptoms of depression [16]. A prevalence of clinical depressive symptoms of 27.9% was recorded in a sample of 2,452 university students. The research findings indicated that clinical depressive symptoms were related to positive personal and family history of depression, poor physical and mental health [4, 12].

Family disruption has been shown to affect the academic performance of a child; his/her relationships, and personal development [17-19]. A study revealed that a reduction of 15.6% in math score in children with migrant parents, in addition the score decreased by 8.37% and 23.3% when the migrant was the father and the mother respectively [20]. Another study reported that children who were separated from both parents, as a result of migration for better job opportunities, had more mental health problems; while those who were living with one parent had similar prevalence of mental disorders as those living with both [21]. Moreover, parental divorce during childhood is associated with psychological disturbances in adulthood leading to depression and low self-esteem [17, 18]. Mental health complaints experienced by students was reported to increase as time of divorce elapse [18]. In addition, separation of the parents is associated with recurrence of depression and other mental illness later on; what is more, there’s a higher risk of the depression to progress to bipolar disorder [22, 23]. A study found that when compared to peers living with both parents, children from a separated household were more likely to have mental health problems [24]. Divorce usually results in decreased contact with the non-custodial parent resulting in lack of attention, social support and economical security [18, 22]. Children of divorce are more likely to have experienced residential change, and therefore changing of schools, which is linked with poorer mental health [22, 25, 26]. Furthermore, lower levels of academic achievement, more problems at school, and increased rates of grade retention were more likely related with residential mobility [27].

The change in the environment where the students live can affect the psychology and the academic performance of students. Separation from parents or living with only one parent because of expatriation for better income, divorce or death are crucial factors leading to antisocial problems, loss of self-confidence and self-esteem, separation anxiety, developing fears and phobias, depression and suicidal ideation, sleep and eating disorders, excessive emotional pain and distress. The separation also has a critically adverse effect on the academic performance and achievement of teenagers. Published data on academic environment in Sudan are yet to be available, hence the gap this paper aims to fill in assessing the impact of separation from parents on students of the University of Medical Sciences and Technology.

Methods

A descriptive facility-based cross-sectional study was conducted in the University of the Medical Sciences and Technology (UMST). The University (15deg34'37"N, 32deg33'27"E / 15.5770degN32.5575degE) is home to two thousand five hundred and forty-nine students and fourteen faculties. The faculties are Medicine, Pharmacy, Medical Laboratory Sciences, Law, Dentistry, Nursing Technology, Nursing Sciences, Computer Sciences and Information Technology, Business Administration, Engineering, Radiological Sciences, Economic, Social and Environmental Studies, Mass Communication and Anesthesia. In each faculty, the final batch enrolled in the academic year 2015-2016 was included in the research. Six hundred eighty-one were enrolled in the final batches of the fourteen faculties. In each faculty a stratified random sampling technique was used to select the appropriate number of students to be included proportionally to the size of each concerned batch. A sample of four hundred sixty-five students aged 18 to 28 years were included in the study.
A self-administrated standardized questionnaire developed by the researchers was used to collect the variables related to the socio-demographic characteristics, the living condition of the students (living or separated from parents), their academic performance, the clinical manifestations experienced, the hobbies, academic workload, and toxic habits.

The Center for Epidemiologic Studies Depression (CES-D) Scale was used to assess the presence or absence of depression [28, 29]. The CES-D scale consisted of twenty questions which address the major components of depression. Responders were asked to rate each item on a scale from 0 to 3, on the basis of 'how often have you felt this way during the past week', 0 rarely or none of the time (less than 1 day), 1 some or a little of the time (1 - 2 days), 2 occasionally or a moderate amount of time (3 - 4 days), and 3 most or all of the time (5 - 7 days). The items included statements about depressive mood, perception of worthlessness and feelings of hopelessness, loss of appetite, poor concentration and sleep disturbances. The scale did not include items for increased appetite or duration of sleep, anhedonia, psychomotor agitation or retardation, guilt, or suicidal thoughts [29]. Four of the items were worded in a positive direction to control for response bias. The CES-D scores ranged from 0 to 60.

The data collected was computerized through a data entry template designed in Epi Info TM 7.1.5.0 available for free use in public domain (developed by the Center of Disease Control and Prevention, CDC). The data cleaning, description and analysis were performed through the statistical package for social sciences, SPSS 21 for MS Windows (SPSS, Chicago, IL, USA). Frequencies, means and medians were tabulated for descriptive statistics and chi-square tests for comparing the groups of students separated from their parents and those living with them based on a significance level set at 0.05.

Results

Socio-demographic characteristics and living condition of the students

The total number of final year students enrolled during the academic year 2015-2016 in the fourteen faculties of the University of Medical Sciences and Technology (UMST) were six hundred eighty-one. Four hundred sixty-five participated in the study, which leads to a participation rate of 68.3%. Of the four hundred sixty-five who reported their gender, 73.3% were females and 26.7% were males. The mean age of the participants (n=446) was 21.5 years (SD=1.3, range: 18-28 years). The majority (n=396, 86.1%) were single. Of the 460 participants who addressed the question related to their living condition, 54.1% (249/460) were separated from their parents and 45.9% (211/460) were living with them. Of 214 separated from their parents and who responded to the question why they were not living with their parents, 59.2% (n=127) had their parents living out of Sudan, 22.4% (n=48) reported that their parents lived in another city in the country, 7.9% (n=17) and 2.3% (n=5) had only respectively their mother and father alive. One student (0.5%) reported having lost the two parents. 6.1% (n=13) and 1.5% (n=3) had the parents respectively divorced or separated.

Relationship between students and their parents

All the participants were asked about their relationship with their parents when living with them and when separated. When living with them (n=455), the relationship was excellent for 71.9%, (n=327), good for 23.7% (n=108), troublesome for 3.3% (n=15) and bad for 1.1% (n=5). However, when away from their parents (n=435), the relationship with the parents was qualified as excellent by 57.9% (n=252) and good by 31.1% (n=135); troublesome and bad by 4.6 % (n=20) and 6.4% (n=28) respectively.

The participants were asked about how often they communicated with their parents. Of the 451 participants, 73.4% communicate with their parents on a daily basis, 14.7% weekly, monthly communication and from time to time were respectively 1.3% and 10.6%. The frequency of contacts with parents was grouped into categories: the daily communication as regular communication and the remaining frequency of communication (weekly, monthly and from time to time) as periodic.
In the group of students separated from their parents (n=247), the communication with parents was regular for 58.2% (n=144) and periodic for the remaining 41.7% (n=103). For those living with their parents (n=201), the frequency of communication was daily (regular) for 91.5% (n=184) and periodic for 8.5% (n=17). A statistically significant association was found between the frequency of communication with parents and the living conditions (being separated or not) with a Pearson Chi-Square of 62.446 and a p-value =0.00.

Voice calls and messages were the most frequently used means of communication by the participants (n=414), 45.7% and 41.3% respectively. Face to face, emails and visit/travel were respectively 8.5%, 3.8% and 0.7%. The use of all other means of communication was higher in students separated from their parents. As expected, the students living with their parents had higher n=33, 94.3%) face-to-face contact with parents than those separated from them (n=2, 5.7%).

Appreciations of the students of their current residence

Regarding where they were living at the time of the interview, 41.4% of the participants (n=440) reported that the residence is comfortable, easy to access by 28.9%, and safe by 18.0%. However, the residence was qualified as uncomfortable by 7.0%, difficult to access by 4.0%, unsafe and noisy by respectively 0.5% and 0.2%. The appreciation of the participants towards their current residence was coded in two categories. Residence, which is comfortable, easy to access and safe, was coded as secured residence. When participants' appreciation was uncomfortable, difficult to access, unsafe and noisy, it was coded as unsecured residence. Of the 440 participants, 88.2% felt that the residence was secured and 11.8% reported their residence as unsecured. The association between the appreciation towards their residence and their living conditions was statistically significant with chi-square of 7.670 and p-value of 0.006.

Socialization of the participants

To evaluate the socialization, the participants were first asked if they had relatives in the city, then they were asked how regularly they visited them. The frequency of visits to family members was measured as daily, weekly, monthly, from time to time and never.

Of 465 participants, 90.0% had relatives in the city, 8.0% did not and eleven (2.0%) did not address the question related to having a relative in the city of Khartoum.

The frequency of visits was then grouped in two categories: periodic visits (daily, weekly, monthly and time-to-time) and not visiting (never). In the group of students separated from their parents (n=219), 94.5% paid periodic visits to their family members and 5.5% did not. Of the 189 participants living with their parents, 96.8% periodically visited their family members and 3.2% never did. There was no statistically significant association between the living conditions of the participants and the frequency of visits to relatives in the city (p =1.278; p =0.258).

Clinical manifestations as reported by the participants

Trouble sleeping was reported by 435 participants out which 236 were separated from parents and 199 lived with them. Participants separated from parents experienced trouble sleeping regularly and sometimes for respectively 30.1% and 50.8% and the remaining 19.1% never experienced this manifestation. On the other hand, 199 students living with their parents reported having trouble sleeping either on a regular basis (14.1%) or occasionally (56.3%) and 29.6% of them never experienced this. The frequency of trouble sleeping had a statistically significant association with the living conditions of the participants (either separated or living with them) with a chi-square for difference in proportion of 17.819 and a p-value =0.00 as revealed by table 1.

Regarding sleeping behaviors, 238 students separated from their parents, 24.4% experienced over sleeping regularly, 51.7% experienced it sometimes and 23.9% never over slept. Of the 200 participants living with their parents, over sleeping was reported to occur regularly, sometimes and never by respectively 29.0%,
48.0% and 23.0%. The difference in these groups of students regarding over sleeping was found to be not statistically significant ($\chi^2 = 1.216; p-value = 0.544$).

Over thinking was reported by 236 students separated from their parents. It was experienced on a regular basis by 50.4%, sometimes by 39.0% and never by 10.6%. On the other hand, of the 202 students residing with their parents reported over sleeping occurrence as regular, sometimes and never by 42.1%, 47.5% and 10.4% respectively. Overall, the living condition (with parents or separated from them) was not statistically associated with the frequency of over thinking with $\chi^2$ of 3.481 and a $p$-value of 0.175.

Loss of appetite in participants separated from parents (n=234) was reported as regular by 18.8%, sometimes and never by 52.6% and 28.6% respectively. While in the population of students living with their parents (n=203), the occurrence of the loss of appetite was reported as regular, sometimes and never by 14.3%, 46.3% and 39.4% respectively. A statistical significant association was found between the loss of appetite and the living condition of participants’ $\chi^2$ of 5.938 and a $p$-value of 0.051.

Of 234 students separated from their parents, over eating was reported as occurring regularly by 13.2%, sometimes by 49.1% and never 37.6 %. On the other hand, participants living with parents (n=203) over eating was reported to being a regular and occasional occurrence by13.8% and 47.3% respectively; while 38.9% never experienced it. However, a non-statistically significant association was found between over eating and the living condition of students with $\chi^2$ of 0.15 and a $p$-value of 0.928.

Of 237 students separated from their parents, 40.9% were regularly stressed, 55.3% were sometimes stressed and 3.8% were never stressed. In the population of the participants living with their parents (n=205), 34.1% were stress regularly, there were 53.7% who were sometimes stressed and 12.2% were never stressed. Stress and living conditions had a statistically significant association $\chi^2$ of 11.468 and a $p$-value of 0.003.

Among the participants separated from their parents (n=230), 49.1% reported to never experience migraines, 13.0% had migraines regularly and 37.8% had it sometimes. Of the 193 students residing with their parents, 51.3% never had migraines, 9.8% had it regularly and 38.9% experienced it sometimes. However, a statistical significant association did not exist between the living conditions of the participants and migraines ($\chi^2 = 1.054; p-value = 0.59$).

Prevalence of depressive symptoms among the study participants

The prevalence of depressive symptoms was assessed with the use of the Center for Epidemiology Studies – Depression Scale (CES-D). The CES-D was developed by Radloff [28] as a screen tool to measure the severity of symptoms of depression in community populations.

The participants who filled out the scale were 307, their respective score ranged from 1 to 52 with an average score of 20.81 ($\pm10.00$). In our research, the cut-off for presence of depressive symptoms was set up for values greater than 21.

Overall, depressive symptoms were recorded in 128 participants, which represent a prevalence of 41.7% (n=128). This prevalence varied according to the living conditions of the students. For those separated from their parents (n=170), the prevalence was 48.2% while for those living with their parents the prevalence was lower (33.3%, n=135). A statistically significant association was revealed between students living conditions and existence of depressive symptoms with a $\chi^2$ of 6.876 and a $p$-value of 0.009 (table 2).

Table 1: Clinical symptoms as reported by the study participants according to their living conditions
Table 2: Prevalence of depressive symptoms as measured based on Center for Epidemiology Studies – Depression Scale (CES-D) developed by Radloff.

<table>
<thead>
<tr>
<th>Separated from parents</th>
<th>Trouble sleeping (χ² = 17.819, p-value = 0.000)</th>
<th>Trouble sleeping (χ² = 1.216, p-value = 0.544)</th>
<th>Trouble sleeping (χ² = 3.481, p-value = 0.175)</th>
<th>Trouble sleeping (χ² = 5.93, p-value = 0.051)</th>
<th>Chi-squared p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Regularly: 71</td>
<td>Sometimes: 120</td>
<td>Never: 45</td>
<td>Total: 236</td>
<td>y² = 17.819</td>
</tr>
<tr>
<td></td>
<td>No: 28</td>
<td>112</td>
<td>59</td>
<td>199</td>
<td>y² = 1.216</td>
</tr>
<tr>
<td></td>
<td>Total: 99</td>
<td>232</td>
<td>104</td>
<td>435</td>
<td>y² = 3.481</td>
</tr>
<tr>
<td></td>
<td>Over Sleeping: 58</td>
<td>Sometimes: 123</td>
<td>Never: 57</td>
<td>Total: 238</td>
<td>y² = 5.93</td>
</tr>
<tr>
<td></td>
<td>No: 58</td>
<td>96</td>
<td>46</td>
<td>200</td>
<td>y² = 0.15</td>
</tr>
<tr>
<td></td>
<td>Total: 116</td>
<td>219</td>
<td>103</td>
<td>438</td>
<td>y² = 0.175</td>
</tr>
<tr>
<td></td>
<td>Overthinking: 119</td>
<td>Sometimes: 92</td>
<td>Never: 25</td>
<td>Total: 236</td>
<td>y² = 11.468</td>
</tr>
<tr>
<td></td>
<td>No: 85</td>
<td>96</td>
<td>21</td>
<td>202</td>
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</tr>
<tr>
<td></td>
<td>Total: 204</td>
<td>188</td>
<td>46</td>
<td>438</td>
<td>y² = 11.468</td>
</tr>
<tr>
<td></td>
<td>Loss of appetite: 44</td>
<td>Sometimes: 123</td>
<td>Never: 67</td>
<td>Total: 234</td>
<td>y² = 0.59</td>
</tr>
<tr>
<td></td>
<td>No: 29</td>
<td>94</td>
<td>80</td>
<td>203</td>
<td>y² = 0.59</td>
</tr>
<tr>
<td></td>
<td>Total: 73</td>
<td>217</td>
<td>147</td>
<td>437</td>
<td>y² = 0.59</td>
</tr>
<tr>
<td></td>
<td>Over eating: 31</td>
<td>Sometimes: 115</td>
<td>Never: 88</td>
<td>Total: 234</td>
<td>y² = 0.59</td>
</tr>
<tr>
<td></td>
<td>No: 28</td>
<td>96</td>
<td>79</td>
<td>203</td>
<td>y² = 0.59</td>
</tr>
<tr>
<td></td>
<td>Total: 59</td>
<td>211</td>
<td>167</td>
<td>437</td>
<td>y² = 0.59</td>
</tr>
<tr>
<td></td>
<td>Stress: 97</td>
<td>Sometimes: 131</td>
<td>Never: 9</td>
<td>Total: 237</td>
<td>y² = 1.06</td>
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<td></td>
<td>No: 70</td>
<td>110</td>
<td>25</td>
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<tr>
<td></td>
<td>Total: 167</td>
<td>241</td>
<td>34</td>
<td>442</td>
<td>y² = 1.06</td>
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<tr>
<td></td>
<td>Migraine: 30</td>
<td>Sometimes: 87</td>
<td>Never: 133</td>
<td>Total: 230</td>
<td>y² = 1.82</td>
</tr>
<tr>
<td></td>
<td>No: 19</td>
<td>75</td>
<td>99</td>
<td>193</td>
<td>y² = 1.82</td>
</tr>
<tr>
<td></td>
<td>Total: 49</td>
<td>162</td>
<td>212</td>
<td>423</td>
<td>y² = 1.82</td>
</tr>
<tr>
<td></td>
<td>Body pain: 30</td>
<td>Sometimes: 87</td>
<td>Never: 133</td>
<td>Total: 230</td>
<td>y² = 1.82</td>
</tr>
<tr>
<td></td>
<td>No: 68</td>
<td>116</td>
<td>57</td>
<td>241</td>
<td>y² = 1.82</td>
</tr>
<tr>
<td></td>
<td>Total: 129</td>
<td>223</td>
<td>95</td>
<td>447</td>
<td>y² = 1.82</td>
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</table>

<table>
<thead>
<tr>
<th>Existence of depressive symptoms</th>
<th>Existence of depressive symptoms</th>
<th>Existence of depressive symptoms</th>
<th>Chi-square p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separated from parents</td>
<td>No</td>
<td>Yes</td>
<td>Total</td>
</tr>
<tr>
<td>Yes</td>
<td>88</td>
<td>82</td>
<td>170</td>
</tr>
</tbody>
</table>
Academic performance

A total of 455 participants answered the question related to university courses, 245 were separated from their parents and 210 lived with them. In the group of students separated from their parents, the courses were reported to be easy for 25.7%, 60.4% qualified the subjects as somewhat difficult and the remaining 13.9% found them difficult. The trend was almost similar in the group living with their parents, 32.4% found the courses easy, they were somewhat difficult for 55.2% and difficult for 12.4%. However, there was no statistically significant association between the living condition of the students and the subjects of study ($\chi^2 = 2.454; p-value = 0.293$).

Discussion

Separation is the result of the parents living in another city, whether inside Sudan or outside the country. Our research revealed that 54.1% of the participants were separated from their parents. The clinical manifestations: trouble sleeping, loss of appetite and stress had a statistically significant association with the living conditions of the participants (either separated or living with the parents) with a $p$-value of 0.00, 0.051 and 0.003 respectively. However, there was no statistically significant association between the living condition of the students and their perception of the university courses ($p$-value = 0.293).

Flanagan et al. stated that students who resided at college said they had more conflict with their parents during semester breaks when they lived at home [30]. However, this contradicted our results in which students reported an excellent relationship (71.9%) with their parents when they are living together compared to when living apart (57.9%). In 2009, Zhao et al conducted a study on a sample of 7648 school children. They concluded that parental migration had a major negative impact on school performance of a child [20]. Li et al. also reported a strong correlation between parental migration and intellectual growth of their children [31]. Another study among dental students, showed that only students living with their families showed significant correlations between academic performance and the motivation subscales. According to the author, the positive feedback and motivation from families increased the students’ self-efficacy [32]. On the other hand, our study found no statistically significant association between the living conditions and the academic performance in both current and previous academic year ($p$-values respectively 0.278 and 0.174).

The prevalence of clinical depressive symptoms among university students varied across counties and continents as reported by various authors [12, 15, 33-47] ranging from 7.9 % to 71.2 %. According to a few studies, females were found to be affected more by depression than males [12, 43]. Additionally, Flesch et al. found university students who are older and are of low socioeconomic status tend to have higher prevalence of depression when compared to other groups. Of those 32% had associated with family history of depression. Depression was higher in students living away from their families; those living with friends and acquaintance [12]. Out of the 307 participants, depressive symptoms (score above 21) was recorded in 128 participants (prevalence of 41.7%). Among those separated from their parents the prevalence was 48.2% while for those living with their parents the prevalence was 33.3%. A lower prevalence (27.9%) of clinical depressive symptoms was reported by Sokratous et al [4]. They found a statistically significant association between students living conditions and existence of depressive symptoms. Our results are consistent with their findings in revealing a statistical significant association ($p = 0.009$).
Our research did not find a significant association between academic performance and the living condition of students. However, it revealed a statistical significant association between being separated from the parents and depressive symptoms. This is a crucial finding for those concerned by the wellbeing of students.

Conclusion

This research pointed out the existence of depressive symptoms in a group generally thought to be well off. The findings also rose concerns towards paying more attention to mental health in academic setting where depression can be multifactorial such as workload, poor or unbalanced diet, lack of sleep and deficiency in parent-child relationship. The availability of psychologists in academic settings is definitely indicated.

Finally, the present study supplement the existing literature providing new data on the impact of separation from parents on university students. It’s the first study conducted in academic setting in Sudan, it’s a starting point for other universities, despite the fact that UMST is a private university this research opens a door for further research on the topic in both public and private universities in the whole country.

Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Committee Review Board of the University of Medical sciences and technology (Sudan Medical and Scientific Research Institute, Protocol Number: SUM 456, IRB Number: 00008867); a verbal well informed consent was obtained from the study participants.

Consent for publication

Not applicable.

Availability of data and materials

The data are available on request from the corresponding author.

Competing interest

The authors declare that there is no conflict of interest.

Authors’ contributions

All authors contributed equally during the data analysis and data collection stages. All authors discussed the result and contributed to the final manuscript.

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Manuscript Note

At the time of the research all the authors, with the exception of Dr. Noma, were enrolled in the research methodology and biostatistics diploma at the University of Medical Science and technology. Since then the authors have moved to new institutes.
References


