information. The inhabitants live in an unhygienic environment in which pathogens are more likely to thrive. The outside support for the provision of health services is lacking, while the inhabitants do not participate in any sanitary activity to promote their living. The area, used to witness the outbreak of watery diarrheal diseases from time to time. Therefore, different approaches to encourage those inhabitants to take their responsibility for their health can yield positive health impact.

General Objectives: To determine the impact of improving environmental sanitation through community involvement in Alkhodeir area; Karrari locality.

Specific Objectives:

1. To promote the involvement of the inhabitants towards the proper ways of refuse disposal.
2. To increase the involvement of the inhabitants for proper ways of their child's excreta disposal.
3. To motivate community involvement towards environmental sanitation.

2. Methodology

This prospective intervention study, was conducted in Alkhodeir area; Karari Locality; Khartoum State – it is about 30 km. from central Khartoum. The study area lies in Umdurman in KarrariGovernate, Karrari Locality, as a new extension designed by the government as an official displaced settlement. Environmental health condition is deteriorated. The inhabitants are exposed to preventable environmental hazards such as contaminated food, unsanitary way of waste disposal pollutants, poisoning and injuries, vector borne infection. The inhabitants used to dispose their refuse on the streets in the area as there were no facilities for transportation outside the area. Almost all the inhabitants have pit latrines but they use them improperly. Each block has artesian wells used as a source of water. Some of them have water pipes in their houses; others used water vendors that called (ArabatAlkarro). There isn't any hospital or health center in the area. There are two environmental health officers and ten environmental health overseers; almost all of them work in the markets.

Study Population: The total population of the area, (Ahmed, 1998) [1]. and Karrari Locality is about 30,000 people. Most of the inhabitants resettle in the area; they were displaced from the origin, living in peripherals Ummdurman (Ahmed,. 1998)[1]. The government of Sudan resettled them in the area in 1994.This area has populations with different ethnic and religious backgrounds. Most of the inhabitants are unskilled laborers, soldiers, some engage in marginal activities as selling water, tobacco, cigarettes, second hand furniture, and clothes. The rest are working in small-scale handicrafts. The target group is households, where husbands and wives are targeted in the intervention.

Sample Size Determination: A 337 households were selected from the study population; a sample was taken proportionally from each block.

Sample Selection Technique: The stratified multi stage sampling technique was used to show the distribution of the sample in the area so three blocks were selected (blocks 37-42and 54). The sample number was taken proportionally from each block by using systematic random sampling technique.

Pre-intervention phase:

a. A pilot study was carried to obtain a base —line data and to design the intervention. The data were collected by; observation, questionnaire, focusing group discussions, interview the community leaders, health workers, staff of other health and development activities operating in the study communities.
b. Curriculum: A curriculum was designed to train public health officers, public health overseers and volunteers from the community to conduct the intervention.
c. Training sessions were carried on for seven days targeting volunteers from the community, community leaders, and health workers to carry out the intervention.

Intervention phase: The intervention phase includes: Creation awareness among the community leaders, creation of new societies, cleaning campaigns every month in each block, home visiting twice a week by the trained committees' members to enrich the inhabitants' knowledge about the proper ways of refuse disposal, the proper ways of excreta disposal, the risk factors of contaminated water, raise their awareness towards the impact of contaminated environment, contaminated water and contaminated food, encourage healthy behaviours concerning hand washing, proper use of latrines, proper ways of refuse and excreta disposal, transporting, keeping and using safe drinking water. One exhibition in each block, health talks concerning environmental sanitation accompanied with video show, or cinema were conducted from time to time. Follow up the intervention was done by health officer using repots and chick list and to remove the obstacles that face the households and to create mutual understanding concerning the involvement in sanitation and change misbelieves concerning the involvement in environmental sanitation.

Post-intervention phase: A post- test was carried out, after two months of the end of the intervention, by using the same pre-test questionnaire, interview, observation and focusing group discussions to collect data after the intervention. The indicators were; the degree of the involvement at the level of the community, sanitation indicators at households and community level, practices concerning the proper refuse disposals and safe handling of drinking water, and practices concerning proper disposal of children excreta.

3. Data Analysis

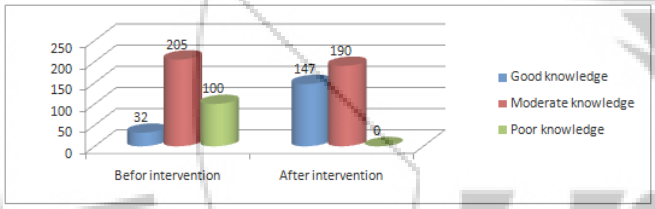
The data that was collected before and after the intervention was compared with by using t-test and the association were tested by using chi-square test (χ^2 tests) and analyzed by computer using the SPSS software program.

4. Result

This study was conducted to determine the health impact of improving environmental sanitation through community involvement. A total of 337 households were participating in the study and the results revealed the following: More than half of the participants' incomes are less than six thousands SDG per year, almost one third of the participants are illiterate or attended khalwa, there is strong association between educational level and participation in health programmes, see table 1, there were significant increases after the intervention in knowledge concerning water contamination and diseases caused by improper disposal of children excreta, see Figures 1 & 2. There is significant change in practices after the intervention, concerning ways of refuse disposal, practices of disposal of children excreta and practices concerning prevention of diarrheal diseases see figures 3, 4&7. There is highly significant change in participation of the participants in sanitation and health programmes, see figure 5, the high percentage of participation was in form of physical efforts 67%, and the lowest one was money, 2.7%,see figure 6.

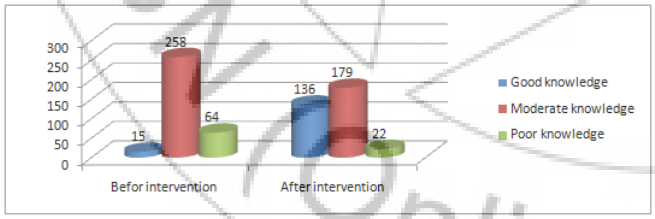
There significant reduction in the infectious diseases after the intervention, see figure 8.

Figure I: knowledge concerning water contamination
N=337



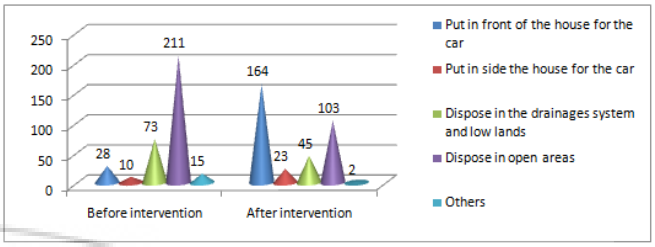
Paired t-test shows significant differences at t-test 4.031 df 336 p.000

Figure 2: Knowledge concerning diseases caused by improper disposal of children excreta.
N=337



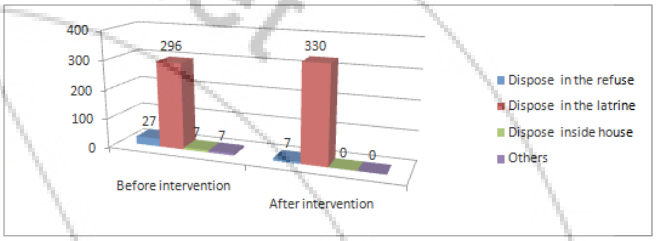
Paired t-test shows significant increase in knowledge concerning diseases caused by improper disposal of children excreta after the intervention at t-test 3.617 df 336 p.845,

Figure 3: Shows practices concerning ways of refuse disposal
N=337



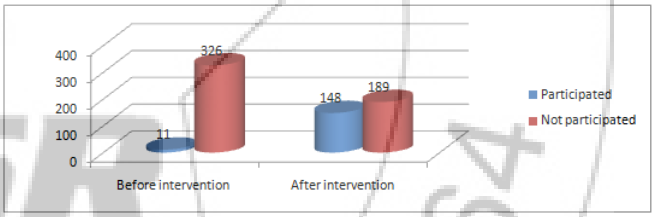
Paired t-test shows highly significant change in practices concerning ways of refuse disposal at t-test 13.705 df 336 p .000,

Figure 4: Shows practices of disposal of children excreta
N=337



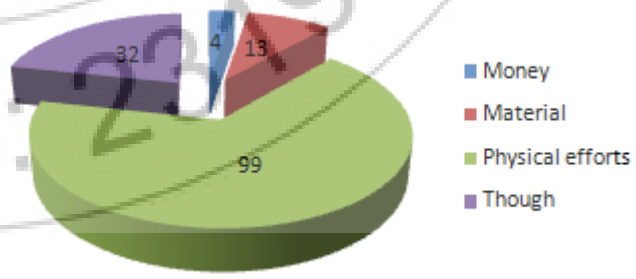
Paired t-test shows insignificant change in practices of disposal of children excreta after the intervention at t-test .122df 336 p .903

Figure 5: shows the participation of the participants in sanitation and health programmes.
N=337



Paired t-test shows highly significant change in participation of the participants in sanitation and health programmes at t-test 14.162 df 336 p .000

Figure 6: Shows the distribution of the participants according to the forms of participation after the intervention
N=337



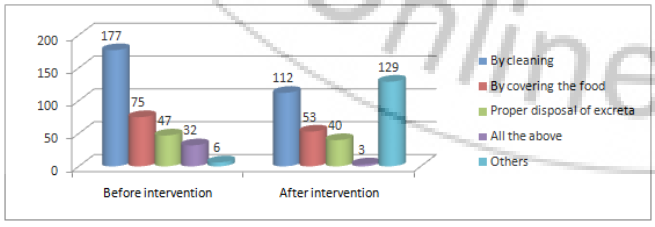
The high percentage of participation was in form of physical efforts 67%, and the lowest one was money, 2.7%

Table 1 shows the association between educational level and participation in health programmes in case group after the intervention.
(*N= 337*)

			Participation in health and sanitation programmes		Total
			Yes	No	
level of education	illiterate	Count	26	26	52
		% of Total	7.7%	7.7%	15.4%
	Khalwa	Count	22	37	59
		% of Total	6.5%	11.0 %	17.5%
	Primary	Count	38	55	93
		% of Total	11.3 %	16.3 %	27.6%
	Intermediate	Count	19	21	40
		% of Total	5.6%	6.2%	11.9%
	secondary	Count	30	36	66
		% of Total	8.9%	10.7 %	19.6%
	graduate and above	Count	12	15	27
		% of Total	3.6%	4.5%	8.0%
Total		Count	147	190	337
		% of Total	43.6 %	56.4 %	100.0 %

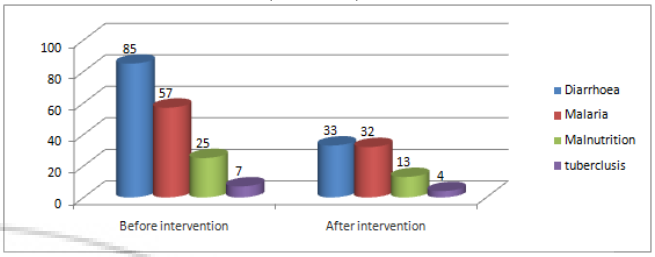
There is an association between educational level and participation in health programmes after the intervention at $\chi 2$ = 28.346 df 5 p .002.

Figure 7: Shows the distribution of the participants according to the practices concerning prevention of diarrhea.
(*N= 337*)



Paired t-test shows significant change in practices concerning prevention of diarrhea. at t-test -9.680 df 336 p .000,

Figure 8: Shows the distribution of the participants according to the incidence of infectious diseases.
(*N= 337*)



Paired t-test shows highly significant differences at t-test 14.162 df 154 p .000

5. Discussions

Introduction: This quasi interventional study aims at determining the health impact of improving sanitation, has both functional and developmental objectives. Functional objectives are that, safe environmental sanitation is maintained; the waste disposal systems are functioning well, the environment is protected, and conditions and practices of environmental sanitation and hygiene are improved. Development objectives are realized when the improvements are as much as possible made *with* them and *by* them. Since the study is a typical community study, it can only have an impact when there is support and participation of the community at large.

Socioeconomic characteristics of the participants: 85.2% of the households have income, less than 6,000 SDG per year, this is less than minimum wage, GNI, PPP per Capita US$,$1,740, (UNAIDS/WHO, 2000) [14]. The educational levels among the respondents are low, about 32.9% of the respondents constituting the literates, 27.6%, this fact shows that the literacy rate in the study group is less than the national rate 70% for male and 45% for female (UNAIDS/WHO Working Group, 2000) [14] . The low income has a direct effect on inhabitants' felt needs of good environmental sanitation, better health services, education, and participation in health activities. There is an association between the income and forms of participation. These findings is not in line with the study conducted by Ardeshier & Pettigrew, 1996 (3), in Nepal which concluded that community participation in healthy activities is largely influenced by the physical, social and cultural environment rather than the impacts of socioeconomic and cultural factors. The result showed that, there is an association between educational level and participation in environmental sanitation programmes. This result is similar to the study conducted by Khan, 1996, (6), about Public Participation and Environmental Decision making in South Africa – The Frankdale Environmental Health Project. Which showed that, socioeconomic factors such as low levels of education and widespread illiteracy among the poor pose considerable obstacles to public participation since the extent of public participation in environmental issues is largely dependent on the existence of an informed, environmentally aware public. In South Africa, literacy rates are severely restricting the extent of public participation. The low level of education affects negatively the inhabitants' participation in health programs as the study showed there

was a strong association between level of education and participation of the respondents in reference to environmental sanitation, see tables 1.

Involvement: Initially, only 3.3 percent of the respondents participated in sanitation and health programmes, where the number increased significantly after the intervention to 43.9%, which indicates highly significant increases see figure 5. The results indicated that, the intervention created positive changes among the inhabitants towards their involvement in health programmes. These findings agreed with the outcome of the community involvement experiment conducted in the Hunsur Block of the Mysore District in Karnataka by USAID 2004, (13). This project proved that, the community could exert pressure on service providers by actively participating in the service delivery process and by providing them with support. These finding also similar to the outcome of the study conducted by Perez, M (10), which revealed that, the improvement or deterioration of housing and environment is directly related to the degree of people's participation in the planning and management of their immediate surrounding areas. The results revealed that 66.9% the respondents participated in a form of physical efforts, (seen figure 6). The low participation in the form of money or material is due to their low income. More than half of the participants' incomes are less than six thousands SDG per year. This finding agreed with the finding from the research conducted by Paepar and Herivelo, 2003, (8), in Madagascar's, which revealed that, villagers make a financial contribution next to labour and materials. It also agreed with the research conducted by Tafeng and Elizala, 2006, (12), which revealed that, the participations are usually in the form of work 43%, money 10% and material 7%. and others 40%.

Relationship between Knowledge, practices and attitudes on one hand and infectious diseases: Knowledge concerning water contamination, diseases caused by improper disposal of children excreta have increased significantly after the intervention see figures 1, and 2. The practices concerning ways of refuse disposal, disposal of children excreta and prevention of diarrhea have improved significantly after the intervention. 97.6% of the respondents showed healthy practices concerning prevention of diarrhea, i.e. (Proper disposal of excreta, covering the food and cleaning). The practice of refusal disposal has made some impact in the cleanliness of the area. This finding in line with the study conducted by Sharp &Donald, 1982, (11) which showed that the health education efforts resulted in improved household sanitary practices. The present finding also agreed with WHO, 2003, (16), which reflected that, improvement in hygiene behavior alone has shown a positive health impact whereas improvement in sanitation facilities alone may not bring health benefits. The findings showed significant reduction in infectious diseases, see figure 8. This means that health education efforts resulted in improvement of household sanitary practices and made changes in health situations. These findings agree d with the research conducted by Esrey, 1996, (4), which concluded that improvements in sanitation led to more significant reductions in diarrheal disease. 87.8% of the respondents showed healthy practices concerning the disposal of children excreta, as they disposed their children excreta in the latrines. The number increases insignificantly after the intervention. The increase is insignificant because initially the level of practice was very high.

6. Conclusion

This research has been conducted to determine the health impact of improving sanitation through community involvement of the inhabitants of Alkhodier area, Karrari Locality, through improving environmental sanitation. The intervention continued for six months, including regular home visiting, cleaning campaigns, symposiums, health days, exhibitions and focus group discussions. The intensive health education programme has successfully raised the awareness of the inhabitants towards their involvement, improving sanitation, promotion of hygienic behaviors. The newly created committees and associations showed good performance, as changes occurred including delivery of Khartoum Refuse Cleaning System Services with a promotion of behaviors related to the issue. The final evaluation showed that, there was a significant reduction in the incidence rate of the infectious diseases in the area. Finally the present study recommend that Health workers have to apply effective health education methods to create active involvement of the community members' towards their environmental sanitation and expansion and improvement of sewage, garbage disposal, and water.

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