

Full Length Research Paper

Determination of hematological parameters among homeless children exposed to chemical intoxication in Khartoum State, Sudan

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Homelessness increases a person's exposure to infectious and communicable diseases paired with long periods of malnutrition which can cause some chronic conditions e.g anemia and degenerative bone diseases. Numerous studies in Canada, United States and Great Britain document the relationship between homelessness and health, the phenomenon does exist all around the world but in Sudan it was evident during the seventies and eighties of the 20th century. Chemicals used by homeless children such as inhalants are volatile substances producing chemical vapors that can be inhaled to induce a psychoactive, mind-altered euphoric state, in spite of health problems, homeless children generally lack access to consistent health care, and this lack of care can increase severity of illness. An analytical, descriptive cross-sectional study was conducted among homeless children from Tayba, Soba, and Althawra for Homeless Children Rehabilitation in Khartoum State, Sudan, during the period of August 2008 to March 2010, two hundred participants were recruited aged between 6 to 18 years. Blood collected for different hematological measurements and prior to the collection general questionnaire paper have been given to get the knowledge about age, gender, place of origin, education and experiences surrounding infectious diseases from all participants. The most prominent type of anaemia was *normocytic normochromic anaemia* (86%) followed by *microcytic hypochromic anaemia* (13%) with abnormal blood cell morphology. Normal count of white blood cells with marked lymphocytosis, eosinophilia & monocytosis and hypersegmentation of neutrophils. The iron profile showed serum ferritin (140.22 µg/dl), serum iron (56.75 µg/dl), TIBC (264 µg/dl) and saturation (24.27%). The majority of the homeless participants used silision (85%), Cigarette (77.5%), Snuff (41.5%), Benzene (34.5%), Alcohol (30%) and Shesha (16%). Most of the study participants showed abnormal hematological parameters mostly due to environmental, nutritional and medical status.

Key words: Chemicals, homeless children, blood cells, Khartoum, Sudan.

INTRODUCTION

Homelessness is critical social issue both a product of, and contributing to, poor mental and physical health. (Bridgman R, et.al., 1999). Homeless children are shown to be more vulnerable to nutritional factors inadequacies compared to the general population and the uses of tobacco, alcohol and street drugs at rates substantially

higher (Greene JM, et.al., 1997). Poor nutrition also contributes to homeless children's poor health, causing increased rates of stunted growth and anemia (Ellen Hart-Shegos, 1999), children are six times more likely than other children to have stunted growth and seven times more likely to experience iron deficiencies leading to anemia. (Fierman, AH, 1991). Despite these widespread health problems homeless children generally lack access to consistent health care and thus this lack of care can increase severity of illness.

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Homelessness is largely an urban phenomenon, yet children are homeless and living on the streets in every region of the world from developing countries to the most affluent countries. Latin America and India, for example, are known for their large populations of street children (Beasley and Rob, 1999). There are an estimated 100 million children living in the streets in the world today (<http://www.oneworld.org/guides/streetchildren/>), in America there are more than 1.3 million children who are homeless at some point every single year (Homeless Children with Disabilities in America, 2012). In Canada 150,000 youth are living on the streets everyday (Public Health Agency of Canada (PHAC), 2006) & DeMatteo D., 1999). Homelessness increases a person's exposure to communicable diseases (Ryan TA, 2008), rates of several infectious diseases are much higher among homeless and street youth than among their non-homeless peers (Boivin JF, 2005).

Homelessness and street life have extremely detrimental effects on children, their unstable lifestyles, lack of medical care, and inadequate living conditions increase young people's susceptibility to chronic illnesses such as respiratory or ear infections, gastrointestinal disorders, and sexually-transmitted diseases, including HIV/AIDS (Alston, Philip, 1998). Studies have found that up to 90 percent of street children use psychoactive substances, including medicines, alcohol, cigarettes, heroin, cannabis, and readily available industrial products such as shoe glue (Beasley and Rob, 1999). The intoxicating effects of certain chemical vapors are believed to have been discovered by the ancient Greeks about 3,500 years ago, gases were the first inhalants to become popular in more modern times. In the 1700s and the 1800s, chemists, doctors, and dentists in Europe and the United States experimented with three different anesthetic gases: nitrous oxide, ether, and chloroform. Inhaling gasoline gained popularity in the 1950s and 1960s. Gasoline remains a dangerous and widely abused inhalant around the world; inhalants come in many forms (Meyerhoff, Michael, 2001).

According to the National Institute on Drug Abuse (NIDA), there are four general categories of inhalants: volatile solvents, aerosols, gases, and nitrites. (Inhalant Abuse: NIDA Research Report Series, 2005), the chief organic morbidity, usually an outcome of chronic abuse, is central nervous system damage, resulting in dementia and cerebellar dysfunction (Flanagan RJ & Ives RJ, 1994). The most serious acute consequence of inhalant abuse is death, which usually occurs secondary to aspiration, accidental trauma, or asphyxia. (Pfeiffer H et al., 2005). Other acute causes of death include cardiac arrhythmias, anoxia, vagal inhibition, and respiratory depression. About 50% of inhalant-related deaths are caused by sudden sniffing death syndrome (American Academy of Pediatrics, 1996). Use of inhalants may also be associated with substantial hematological, renal, hepatic, and neurological morbidity and mortality (Anderson CE &

Loomis GA, 2003), aplastic anemia, bone marrow suppression, and leukemia are among the hematological adverse effects of inhalants, long-term inhalant use can result in bone marrow suppression, leading to leukopenia, anemia, thrombocytopenia, and hemolysis (Brouette T& Anton R, 2001).

The long lasting civil war in Sudan has left 5.6 million people displaced; villagers and peasants have moved from the fields into the northern urban areas escaping the war. Harsh living conditions, violence, drug abuse and war-related trauma considerably undermine any possibility of reintegrating these young victims back into society. Once a child lives on the street, the probability of breaking the cycle of poverty, illiteracy, and illness through his or her own efforts is extremely small, most of these children cannot access any form of educational programs. World Bank sponsored studies for the Northern Sudan Education Assessment, in 2012, clearly reveal the need for programs specifically targeting the reintegration of displaced children and the resulting need to offer them opportunities through non-formal educational programs (Hub1 Greiner & Mohamed Badawi, 2012).

METHODOLOGY

Study Design and Participants

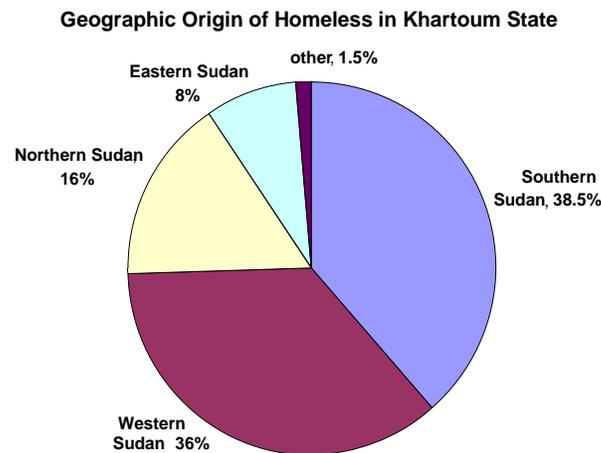
This was an analytical, descriptive and cross-sectional study conducted among homeless children. Participants were recruited from Tayba, Soba and Althawra for Homeless Children Rehabilitation in Khartoum State, Sudan, during the period of August 2008- March 2010. Two hundred homeless children were selected for the participations in this study, the selection criteria of the participants were those children aged 6 to 18 years old newly entering (from street) the rehabilitation centers in the first 24 hours.

The participators were provided with full information about the study and any risk that may arise especially when the collection technique was applied. Concerning the consent form, a written agreement from the social welfare constitution was afforded, because most of participants were less than 18 years old and had no guardians so legally the caring entity should burden their consent signing. For each participant using general questionnaires about age, gender, places of origin, reasons for being homeless, history of infectious diseases, more specific questions about lesser known diseases such as malaria and experiences of any uses of chemicals.

All information that obtained from participants was kept as highly confidential data and specimens and results were not permitted. All data and blood have been collected to assess the hematological parameters of homeless children, the data was collected using

Table 1-1. Geographic Origin of homeless participants in Khartoum state.

Place	Frequency(out of 200)	Percent (%)
Southern Sudan	77	38.5%
Western Sudan	72	36%
Northern Sudan	32	16%
Eastern Sudan	16	08%
Other	3	1.5%

Figure. (1)**Table 1-2.** Reasons for being Homeless in Khartoum State.

Reasons	Frequency	Percent (%)
Exploited by family	105	52.5%
War	66	33%
Non extending family	18	9%
Other	11	5.5

laboratory investigation for complete blood count (CBC), reticulocytes count and iron profile.

Blood collection and Analysis

From all participant 5 ml of blood was collected using the standard procedure for blood collection, The following investigations were done in all participants :complete blood counts using automated hematology analyzer Sysmex Kx 21N , examination of stained peripheral blood film (Wrights stain) (Bain BJ,et.al.,2002), serum iron measured photometrically (International Committee for Standardization in Hematology,1978), total iron binding capacity (Ressler N& Zak B,1958), and serum ferritin (ELISA) (Bernard A & Lauwerys R,1984). A diagnosis of iron deficiency was made if % transferring saturation was

less than 16% and/or serum ferritin < 16µg/l . Statistical analysis were done to all collected data from participants using the SPSS statistical software (version 12) to obtain the mean, standard deviation and frequencies.

RESULT

DISCUSSION

The results revealed that most of study group came from Southern and Western Sudan, Table (1-1) & Fig (1) These areas where war took place resulted in the instability and separation of individuals within families leading to immigration of children to Khartoum where they were being homeless, Table (1-2) .The age of the homeless range from (6-18) years old, Table (1-3). The age

Table 1-3. Age of Homeless participants in Khartoum State.

Age (years)	Frequency	Percent (%)
13 - 15	77	38.5
16 - 18	61	30.5
10 - 12	60	30
6 - 9	2	1
Total	200	100

Table 1-4. Types of Chemicals used by the Homeless Children in Khartoum State.

Type of Chemical used	Frequency	Percent (%)
Silision	170	85%
Cigarette	155	77.5%
Snuff	83	41.5%
Benzene	69	34.5%
Alcohol	60	30%
Shesha	32	16%
Other chemicals	4	2%

Table1-5. Types of Diseases discovered in the Homeless Children in Khartoum State.

Disease	Frequency	Percent (%)
Malaria	81	40.5%
None (i.e., normal)	42	21%
Skin diseases	30	15%
Undiagnosed disease	28	14%
Bilharzias	19	9.5%

Table 1-6. Hb (g/dl), RBC ($10^3/\mu\text{l}$) and HCT (%) values in Homeless Children.

Parameter	Results	Frequency	Percent (%)
Hb (g/dl)	Less than 13	115	57.5%
	13.5 – 16	80	40%
	More than 16	5	2.5%
RBC ($10^3/\mu\text{l}$)	4 – 6.2	197	98.5%
	Less than 4	3	1.5%
HCT (%)	36 – 48	181	90.5%
	Less than 36	18	9%
	More than 48	1	0.5%

range was similar to that obtained in an Indian study on street children where age range of the participants were (8-15) years old (Institute for Home Science & Education ,India,2009). Moreover, most of homeless children had primary education with poor knowledge of infectious diseases which is reflected by the low economic status and instability of their families before being homeless. As it shown in Table (1-5) malaria represented the highest

percent of 40.5% because of the direct contact of homeless children with mosquitoes breeding area such as sewage and swimming ponds. The 15 % who had skin problems might be resulted from malnourishment, poor circulation, ill-fitting shoes, cuts and dirty clothing, consistent result concerning skin infection were obtained in Egypt by (Al-Amal ,1997).

The studied groups in our study showed that, silision

Table 1-7. The values of MCV (fl), MCH (pg), MCHC (g/dl) in Homeless Children.

Parameter	Results	Frequency	Percent (%)
MCV (fL)	80 - 100	150	75%
	Less than 80	50	25%
MCH (pg)	27 -32	134	67%
	Less than 27	66	33%
MCHC (g/dl)	Less than 30	9	4.5%
	30 – 36	180	90%
	More than 36	11	5.5%

Table 1-8. Total WBCS , differential count of WBCs and platelets count in Homeless.

Parameter	Results	Frequency	Percent (%)
WBC	Less than 4	6	3%
	4 – 11	180	90
	More than 11	14	7%
Neutrophils	Less than 40	85	42.5%
	40 – 70	102	51%
	More than 70	13	6.6%
Lymphocytes	20 – 45	105	52.5%
	More than 45	95	47.5%
Mixed	Normal	46	23%
Platelets (%)	Less than 140	4	2%
	140 – 450	187	93.5%
	More than 450	9	4.5%

Table 1-9. The Analysis of Peripheral Blood Film in Homeless Children.

Parameter	Frequency	Percent (%)
Microcytic hypochromic	26	13 %
Normocytic normochromic	172	86 %
Macrocytic hyperchromic	2	1 %
Neutrophils	192	Normal 96%
	8	Abnormal 4%
Lymphocytes	161	Normal 80.5%
	39	Abnormal 19.5%
Esinophils	132	66%
Monocytes	20	10%
Basophils	2	1%
Platelets (%)	185	Normal 92.5%
	15	Abnormal 7.5%

represented the most chemical used by the homeless children 85% Table (1-4),this may be due to the

cheapness and availability of silision, the marked eosinophilia that observed among the studied groups

Table1-10. The Iron Profile in Homeless Children.

Parameter	Mean±SEM
Serum ferritin	140.22±23.33µg/L
Serum iron	56.75±2.55µg/dl
TIBC	264.00±15.36µg/dl
Saturation %	24.27±1.98 %

might be due to the usage of silision by the majority of the homeless children, also the possibility of parasitic infections may have been contributed to the marked eosinophilia, Table (1-9) with normal white blood cells and platelets, Table (1-8). Furthermore, 77.5% of the homeless children were smokers, Table (1-4), similar results concerning use of chemicals among street children proved the presence of anaemia & skin diseases (A-Amal, 1997). In our studied groups 57.5% of the had Hb less than 13g/dl, which is anemia indicator Table (1-6), similar results were obtained in an Indian study on homeless children where mean Hb were 11.2 g/dl (26). Furthermore, 75% of the homeless children have MCV within normal range (80 – 100 fl), 67% have MCH within normal range (27 – 32 pg), and 90% have MCHC within normal range (30 – 36g/dl). Table (1-7).

Less published literature was there on the relationship between homelessness and hematological parameter and the uses of chemicals, individuals who were recruited to participate in this research exhibited a diverse range of knowledge, attitudes and behavior A clear finding from this study is that active targeting of homeless children for the health care and infectious diseases is needed and would be largely welcomed.

CONCLUSION

Family exploitation and war were the major causes of homelessness and the majority of them came from southern and western of Sudan. Silision and cigarette were the most abused substances among the study group. Iron profile among the study group was almost normal in the majority of them with just few of them having mild abnormalities. Regarding the white blood cells the study showed that majority of them had normal total count with marked eosinophilia, lymphocytosis and monocytosis with some atypical lymphocytes and hypersegmentation of neutrophils. The poor nutrition and environmental factors also contributes to homeless children's poor health. Homeless children are more likely than other children to have health problems.

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