Morbidity and Mortality Associated with Community used Herbal (sagwa)use in Children with Acute Gastroenteritis in Diyala Governorate

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Abstract

Background: Gastroenteritis causes around (28%) of all mortalities among children less than 5 yr old. In our country herbal use (called sagwa in Iraq) is one of line of treatment of gastroenteritis mostly in the rural areas.

Objective: To determine the morbidity and mortality of herbal use in acute gastroenteritis in children.

Patients and Methods: Two hundred patients involved in a prospective case control study conducted in the Al-Batool Pediatrics, Obstetrics and Gynecology Teaching Hospital, Diyala, Iraq, during a period of six months from August 2017 to February 2018.

Results: There is significant association of sagwa use with the rural residency 81(81%), mother education level 57(57%) illiterate mother), the order of the child in the family 13(13%)1st child; the least), diarrhea complications (regarding central nervous system 43(43%), cardiac 58(58%), renal 49(49%) and metabolic 83(83%), hospital stay and condition deterioration and the mortality rate was 9(9%) in sagwa group .Sagwa toxicity is positively proportional to the number of doses 57(57%) in 3rd dose & more) given to children and grandmothers 66(66%) were the principle person who decided to use sagwa in children with diarrhea. The chemical analysis was done in (10) samples only which revealed that heavy metal like lead, cadmium and mercury; that exceed the permissible level.

Conclusion: There is significant morbidity and mortality caused by (sagwa) use in children with acute gastroenteritis**.**

Keywords: Gastroenteritis, Herbalism, Sagwa poisoning, Children.

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Introduction

Acute gastroenteritis (AGE) is common in children below 5 years old which last less than two weeks [1]. AGE may be infectious or non-infectious [2]. Many factors affecting the morbidity and mortality of the GE like antibiotics abuse, but the herbal (sagwa) use

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appears to be one of significant factor in our community [3]. The use of herbal products and supplements has increased over the last three decades with at least 80% of people worldwide depend on them. Many of these herbs are still unlicensed as well as their use is not monitored [4-7].

The potential herbal toxicity may include: Hepatotoxic, Neurotoxic, Nephrotoxic and Cardiotoxicity [8-13]. In Africa, up to 80% of the people use traditional medicine as herbal preparations for primary health problems, and in China, they account 30-50% of all medicinal consumption [14]. Many influences such as gender, age, education, ethnicity and social class have important relationship with prevalence of herbal use [15]. The use of herbs is a risky habit because these substances have a lot of harmful actions causing toxicity which may be lethal. Sagwa is one of these substances used to treat diarrhea in children in our country. Insufficient information about their mode of action; adverse reactions, contraindications, and interactions with existing conventional medications are inevitably hazardous [16,17]. Herbal remedies are seen by some as preferred treatment as medicines industrially prepared [18]. This study was conducted to determine the morbidity and mortality of herbals use in acute gastroenteritis in children and associated factors.

Patients and Methods

Study setting and Sample size: This is a prospective case control study conducted in the Al-Batool Pediatrics, Obstetrics and Gynecology Teaching Hospital, Diyala, Iraq, during a period of six months from August 2017 to February 2018. The sample size was calculated using the Epi Info program, version 7.1.0.6 (CDC, Atlanta, GA, USA).

In line with previous studies, we used Two-sided confidence level = 95%, power = 80%, ratio of controls to cases = 1; percent of controls exposed = 15%; odds ratio = 3. Accordingly, the sample size was calculated as 170 (85 cases and 85 control). Adding 20% for potential dropouts, we recruited 200 (100 cases and 100 controls) patients to avoid the effects of defaulters confounding the results:

$$n_O = \frac{Z^2 pq}{e^2} \quad [19].$$

-e is the desired level of precision (i.e. the margin of error)

-p is the (estimated) proportion of the population which has the attribute in question.

- q is $1 - p$.

Desired confidence level	z-score
80%	1.28
85%	1.44
90%	1.65
95%	1.96
99%	2.58

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The study population comprised 200 patients aged (6-59) months, one hundred of them were presented to the hospital with severe GE treated by family with herbals (case group, male = 51(51%), female = 49(49%) and the other hundred patients presented to hospital due to severe GE not treated by herbals (control group, male = 53(53%), female = 47(47%).

Inclusion criteria for cases children under five years old with sagwa administration and their outcome whether improved, deteriorated or dead; and the control with severe and complicated GE without herbal administration were all included.

Exclusion criteria: any child with mild and moderate GE, chronically ill child and other causes of severe dehydration like metabolic disease and drug toxicity etc. were excluded.

Data were collected by questionnaire form & information taken from mothers or caregivers including: The patient name, age in months, gender, weight and residence (classified into rural and urban areas), number and order of children in family, educational level of parents (divided into Illiterate, primary, secondary school and higher education) and type of feeding whether breast, bottle or both feeding. Herb Information includes; why and who decide & encourage to give the herbs (mother, grandmother), the dose times of herbs, is the deterioration appeared in 1st dose or more? Reason made family to use the herbs (social, financial, no response to medicals and no confidence to medicals.

General patient condition and the need for urgent interference as ER, RCU, the treatment needed as CPR, lifesaving drugs, condition of follow up; (Deterioration, improvement, no change, dead), days of hospitalization and the condition on discharge whether improved or died.

Laboratory Methods: (5cc) of blood are taken from the patient for investigations according to patient's clinical presentations and consider what tests are needed to determine the clinical effects of sagwa which lead to patient's deterioration; laboratory investigations carried on included:
-Complete Blood Count, serum electrolytes (Na+, K+, and Cl-), RBS, hs.CRP, G.U.E, G.S.E, renal function test and liver function test.
Other diagnostic tools are:
- ECG electrocardiography done to patients with cardiac manifestations.
- C.T scan or MRI magnetic resonant imaging done for some patients with neurotoxic manifestations.
- Lumbar Puncture LP was done to exclude CNS infection when it was indicated.
- Ten samples of brought sagwa that collected from the relative of the patient are sent for heavy metal detection by *Atomic Absorption Spectroscopy* (AAS) which is a technique for measuring the concentration of various elements in the sample.

These samples were given by the segwer (herbalist) for the child who is mostly brought by his mother or grandmother for management of diarrhea, which were prepared at segwer house, sagwa dissolved in

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unknown volume of water and the first an inexact dose ranging from one to two teaspoonful of powder in half glass of water, given to the child at segwer's home. Then more doses to be continued by the relative of the child at home.

The analysis of Sagwa contents: The powdered samples were parched in an oven at 60°C for four hours and kept in a drying and an air-tight pot at room temperature for about 10 days. The dried samples separately packed in clean plastic containers, other non-powdered samples were powdered, filtered and stored in plastic; each sample was analyzed in duplicate.

Statistical analysis

Analysis of data is carreid out using the available statistical package of SPSS-24 (Statistical Packages for Social Sciences-Version 24).Data were presented in simple measures of frequency, percentage,mean,standard deviation,and range (minimum-maximum values).

The significance of different percentages (qualitative data)were tested using Pearson Chi-square test (x^2 –test)with application of Yate's correction or Fisher Exact test whenever applicable.Statistical significance was considered whenever the P value is equal or less than(0.05).

Results

Table (1) showed the demographic characteristics of children in both groups involved in the study.

Table (2) showed the distribution of social and anthropometric characteristics for both groups involved in the study. There was a highly significant association between the days of diarrhea as a chief complaint and sagwa group (p = 0.0001) where the more days of diarrhea exists the more risk of sagwa use.

Table (3) showed the relationship of clinical characteristics and complications of GE both groups where vomiting and dehydration as well as CNS complications are more common in sagwa group.

Table (4) showed, why and who decide to give sagwa, and given to siblings before and drug used, where the grandmothers who were decided to give the sagwa in 66(66.0%) and the most apparent cause was "Influence of others" in 33(33 %).

Table (5) The deterioration of clinical condition with sagwa doses was noted more after the third and more doses 57(57%), while it was 32(32%) with 2nd dose and more less 11.0% with the first dose.

Table (6) showed the clinical outcome from admission to hospital, follow up and discharge.

Table (7) showed the chemical contents and heavy metal concentration in (mg/kg) in ten sagwa samples.

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Table (1): the demographic characteristics of children in both groups

Variable	Sagwa(herb)		Control		P value
	No.	%	No.	%	
Residence					**0.024***
Urban	19	19.0	33	33.0	
Rural	81	81.0	67	67.0	
Total	100	100.0	100	100.0	
Children age					0.512
(6-11) months	69	69.0	70	70.0	
(12-23) months	25	25.0	23	23.0	
(24-59) months	6	6.0	7	7.0	
Total	100	100.0	100	100.0	
Children gender					0.777
Male	49	49.0	47	47.0	
Female	51	51.0	53	53.0	
Total	100	100.0	100	100.0	

* Significant Chi-square test.

Table (2): Distribution of social & anthropometrics for both groups

Variable	Sagwa(herb)		control		P value
	No.	%	No.	%	
Weight (kg)					0.892
< 4.0	7	7.0	6	6.0	
4.0-6.0	21	21.0	32	32.0	
7.0-9.0	43	43.0	38	38.0	
10.0-12.0	20	20.0	18	18.0	
> 12.0	9	9.0	6	6.0	
Mother education					0.0001*
Illiterate	57	57.0	26	26.0	
Primary	33	33.0	43	43.0	
Secondary	7	7.0	25	25.0	
College & Higher	3	3.0	6	6.0	

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Father education					0.246
Illiterate	32	32.0	25	25.0	
Primary	46	46.0	40	40.0	
Secondary	15	15.0	24	24.0	
College&Higher	7	7.0	11	11.0	
Order of kid in the family					0.040*S
First	13	13.0	26	26.0	
Second	19	19.0	23	23.0	
Third	19	19.0	19	19.0	
Fourth	20	20.0	18	18.0	
Fifth & later	29	29.0	14	14.0	
Type of feeding					0.524
Breast	16	16.0	19	19.0	
Bottle	53	53.0	57	57.0	
Mixed	31	31.0	24	24.0	

* Significant, Chi-square test

Table (3): Relationship of clinical characteristics and complications of both groups

Variable	Sagwa(herb)		control		P value
	No.	%	No.	%	
Vomiting after 3rd day of sagwa intake					0.001*
Yes	84	84.0	33	33.0	
No	16	16.0	67	67.0	
Total	100	100.0	100	100.0	
Duration of dehydration					0.001*
Less than 48 hr	35	35.0	97	97.0	
More than 48 hr.	65	65.0	3	3.0	
Total	100	100.0	100	100.0	
Respiratory distress					0.179
Yes	10	10.0	5	5.0	
No	90	90.0	95	95.0	
Total	100	100.0	100	100.0	
CNS					0.0001*

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Yes	43	43.0	10	10.0	
No	57	57.0	90	90.0	
Total	100	100.0	100	100.0	
Cyanosis					0.179
Yes	10	10.0	5	5.0	
No	90	90.0	95	95.0	
Total	100	100.0	100	100.0	
Arrhythmia					0.001*
Yes	58	58.0	24	24.0	
No	42	42.0	76	76.0	
Total	100	100.0	100	100.0	
Acidosis					0.001*
Yes	83	83.0	37	37.0	
No	17	17.0	63	63.0	
Total	100	100.0	100	100.0	
Oliguria & anuria					0.0001*
Yes	49	49.0	5	5.0	
No	51	51.0	95	95.0	
Total	100	100.0	100	100.0	

* Significant, Chi square test

Table (4): Why and who decide to give sagwa, previous use to siblings and drug used

Variable	Sagwa (herb)	
	No.	%
Who decide		
Mother	21	21.0
Father	4	4.0
Grandmother	66	66.0
Grandfather	6	6.0
Others	3	3.0
Total	100	100.0
Why decide		
No trust in drugs	22	22.0
No response to drugs	21	21.0
Belief of herbs safety	9	9.0

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Available & cheaper	15	15.0
Influence of others	33	33.0
Total	100	100.0

Table (5): Deterioration of child condition with sagwa dosing

Variable	Sagwa (herb)	
	No.	%
Deterioration after dosing		
1st dose	11	11.0
2nd dose	32	32.0
3rd dose & more	57	57.0
Total	100	100.0

Table (6): The clinical outcome from admission to hospital, follow up and discharge in both groups

Variable	Sagwa(herb) group		Control group		P value
	No.	%	No.	%	
Need urgent					0.001*
ER & RCU	13	13.0	1	1.0	
Only ER	87	87.0	99	99.0	
Total	100	100.0	100	100.0	
Condition during hospitalization & follow up					0.0001*
Deteriorated	77	77.0	14	14.0	
Improved	23	23.0	86	86.0	
Total	100	100.0	100	100.0	
Days of hospitalization					0.0001*
(1-3 days)	9	9.0	39	39.0	
(4-6 days)	14	14.0	50	50.0	
7 days & more	77	77.0	11	11.0	
Total	100	100.0	100	100.0	
On discharge					0.001*
Death	9	9.0	1	1.0	
Improved	68	68.0	96	96.0	
Referred	23	23.0	3	3.0	
Total	100	100.0	100	100.0	

* Significant, Chi-square test

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Table (7): the chemical contents and heavy metal concentration in (mg/kg) in ten sagwa samples

No.	Herb samples (Sagwa)	Heavy metals mg/kg			
		Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Arsenic (As)
1	A	13.3	0.1	0.32	0.01
2	B	11.7	0.01	0.13	0.2
3	C	15.5	0.01	0.5	0.1
4	D	14.1	0.3	0.23	0.03
5	E	12.6	0.05	0.7	0.2
6	F	10.7	0.02	0.66	0.0
7	G	14.5	0.033	0.01	0.02
8	H	12.5	0.021	0.1	0.05
9	I	8.0	0.13	0.33	0.01
10	J	5.0	0.15	0.77	0.2

Table of Permissible limits, PL of heavy metals

Permissible limits mg/kg	Lead Pb	Mercury Hg	Cadmium Cd	Arsenic As	Ref.
WHO	10	0.2	0.3	0.5	[20]
Euro-Pharma-copoeia	5	0.1	0.5	0.5	[21]

Discussion

Sagwa use is a common problem in our community especially in rural areas where most of admitted patients were from the rural area 81(81.0%) since mothers from these areas are more likely to use the sagwa due to the low level of their education, low socioeconomic status of the families and easy accessibility to sagwa. moreover, thinking of the sagwa is safer than the medications as well as difficulty access the health centers [3, 22], but this in contrast to that found in Turkey [23, 24]. Probably due to different sampling techniques.

Regarding age groups, there is no significance difference between cases and control, but both groups showed high percentage 69(69.0%), 70(70.0%) of diseased children in age group (6-11 months), and nearly the same thing regarding the gender for both groups, which is in contrast to that found in Germany [25].since both groups are from the same community.

No statistical significance difference obtained in relation to gender where males and females were affected almost equally similarly found by many previous studies in Iraq [3] and in Germany [25].

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Regarding the social and anthropometric measures there is significant association with the order of the child in the family in sagwa group than in the control group, where the fifth & later children are more likely to be given sagwa, probably due to previous mothers experience with sagwa and advice from other family members. As well as the heavy burden on the mother make her seeking advice to stop diarrhoea and may be the delayed recovery from the illness. The health education plays major role in preventing the use of sagwa in these children. Sagwa intake was more common in children of low education level or illiterate mothers and primary school mother, similar results was found in Iraq by [26, 27, 28]. Since illiterate mother has no proper ideas about treating diarrheal disease and easily misled by others to use sagwa, and she cannot appreciate the biohazards of sagwa to their children.

The other parameters like body weight, father education and type of feeding, have no significant association with sagwa intake group in comparison to control group.

Regarding clinical features of the both groups, there was significant association with vomiting after third day of illness in sagwa group 84(84.0%), whereas in control group it was 33(33.0%), since sagwa cause gastric irritation and vomiting as side effect which affect the regeneration of gastric mucosa. Dehydration present for more than forty eight hours in sagwa group than control group; due to delayed presentation to the hospital as well as side effects of sagwa. This is in agreement with previous studies in South Africa [29, 30, 31].

The complications of AGE with sagwa, the CNS and renal complications have a high significant association in comparison to control group (p=0.0001). Regarding arrhythmias (bradycardia, sinus tachycardia, ventricular ectopics, ventricular tachycardia, and ventricular fibrillation and heart block) and acidosis both of which have significant association with sagwa (p=0.001) in sagwa group; in comparison to control group, this is mostly related to the toxic effects of the sagwa; (neurotoxicity, nephrotoxicity and cardiotoxicity). There are many factors which increase the toxicity of sagwa which include the following; most of them do not meet the standards of good manufacturing practices, concentrations of active ingredients are unpredictable, their labeling is inadequate, wrong dose or diagnosis, herb contamination, debasement and interaction by herb to herb or to drug. Our findings are similar to previous studies conducted in Iran, South Africa and USA [26, 29, 32]. The grandmothers had great impact on the use of sagwa in affected children. The decision to use sagwa may be due to the following influence of others, no trust in drugs and no response to drugs as noted in South Africa [30]. While in other studies they didn't find any significant justification to the sagwa use in Iraq and South Africa [27, 33, 34] .The deterioration of child condition, is worse following the third dose and more of sagwa intake, this is probably related to dose-

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toxicity which is in agreement with previous studies in Nigeria and S. Africa [30, 35].

The clinical consequences from hospitalization, follow up till discharge, where most of children with sagwa necessitate emergency room visit as well as emergency room and respiratory care unit in comparison to control group; this is mostly due to detrimental effect of sagwa use. The child condition during hospitalization was deteriorated in 77(77.0%) of children in sagwa group; while only 14(14.0%) control group was deteriorated; this led to more days of hospitalization and its cost and burden on the hospital which is in agreement with previous study in Iran [32]. In regard to the condition on discharging, we found that 96(96.0%) of control group improved but only 68(68.0%) in sagwa group, and 23(23.0%) in sagwa group was referred to another centers for further management, while only 3(3.0%) in control group was referred. Unfortunately 9(9.0%) of children died in sagwa group while only 1(1.0%) in control group due to the toxic effect of the sagwa, which is in agreement with previous studies Iran and S. Africa[29, 32].

Regarding the constituents of sagwa, unfortunately chemical analysis was carried out in [10] samples of sagwa only due to similarity of the taken samples, which was done by Atomic Absorption Spectroscopy, where lead contents exceeded the permissible level (PL) in [8] samples, cadmium exceeded the PL in [6] samples, while the mercury exceeded PL only in [1] sample, but arsenic not found in any of analyzed samples. The source of these heavy metals could be by environmental pollution of the soil where the root of the herbs or by insecticides or pesticides and fertilizers in the agricultural fields, or contamination during preparation or processing of the sagwa by the herbalist. These results agreed with studies in Iran, Pakistan and Emirates [36,37, 38].

Conclusions

There is significant morbidity and mortality caused by (sagwa) use in children with acute gastroenteritis:

1-There is significant association of sagwa use with the residency, mother education level and the order of the child in the family. And grandmothers are the principle person who decided to use sagwa.

2-There is significant association between sagwa use with appearance of CNS, cardiac, renal and metabolic complications.

3-Sagwa toxicity is positively proportional to the number of doses of sagwa given to children.

4-The hospital stay, condition deterioration and case fatality rate are more significant in sagwa group than control.

5-The chemical analysis revealed that heavy metal like lead, cadmium and mercury; that exceed the permissible limit.

Recommendations

Regarding the study : Multicenter studies including the health centers and hospitals in the districts should be performed to cover all sagwa poisoning cases and its consequences.

Larger sample size with extended period of study to involve all cases of sagwa poisoning

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as well as the referred and dead cases in the other centers or forensic medicine centers.

Providing a poisoning consultation center in Diyala governorate to facilitate the herbs or sagwa samples screening and for phone contacts management consultation for poisoning cases.

Regarding the poisonous cases and the community: Consider the sagwa poisonings as a police cases need medicolegal documentation.

Community education by employment of media channels, social media's, health messages and mothers' education at health centers during vaccination schedule and involving non-governmental organizations especially to the risks of the sagwa administration and poisoning.

Facilitate phone contacts of the community with the poisoning center in sagwa poisoning cases.

Herb educational courses and training for the herbalists by governmental skilled teams.

Limitation of herbalists' license in the department of herbal Medicine in Iraqi ministry of health to control their work regarding dispersion of herbal products in the community and to decrease their unwanted effects.

Regarding the hospitals and health centers: Informative education of the medical staff in the sagwa poisoning cases.

Documentation and recording all cases of sagwa poisoning and send them to the pharmacovigilance center in the Iraq ministry of health.

Because of the burden of sagwa poisoning cases with significant morbidity and mortality, it is recommended the major hospitals in the governorate to set applicable guidelines to manage sagwa poisoning cases.

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