

Severity signs of childhood diarrhoea in north eastern Nigeria



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Abstract Oral Rehydration Therapy (ORT) use in Nigeria is currently far short of the national Control of Diarrhoeal Diseases (CDD) programme goals. Towards designing health education strategies to improve this, maternal lay health concerns during diarrhoea in under-fives were examined among two large ethnic groups, the Kanuris and Buras, in north-eastern Nigeria. Over half of the respondents judged the severity of diarrhoea by more than one sign and expected ORT to stop diarrhoea. Severity signs frequently described (averaging from a quarter to a half of respondents) included weakness and refusal of food; frequent stooling and fever were more frequently used by the Kanuris ($p < 0.001$) compared to Buras and weight loss and dehydration by the Buras ($p < 0.01$) compared to Kanuris. Generally, rural residents were less concerned with dehydration and weight loss ($p < 0.0001$ and 0.003 respectively, compared to urban residents) and more concerned with restlessness, including excessive crying ($p < 0.07$ to 0.0001). Stool characteristics and vomiting were rarely used as severity signs although the Kanuris in focus group discussions related severity to diarrhoea typology. Concerns with persistent diarrhoea, and diarrhoea associated with measles, were rarely expressed by participants, irrespective of ethnic group and domicile, suggesting that health education aimed at increasing awareness in relation to these two serious illnesses is urgently needed in Nigeria. Several of the lay health concerns expressed by participants in the study could form a useful basis for promoting ORT use in Nigeria and elsewhere.

Introduction

The successful promotion of oral rehydration therapy (ORT) in the appropriate home management of diarrhoea can reduce the burden on health facilities and improve the outcome of diarrhoea episodes (Varavithiya *et al*, 1990; Punyaratabandhu *et al*, 1991). To improve the chances of success, messages to promote ORTs should be 'based on the signs and symptoms that mothers consider important' (Henry, 1991). In this context, mothers' perceptions of severity signs of diarrhoea might provide a tangible basis on which to reinforce correct and sustained ORT use.

Surveys of ORT use in Nigeria have frequently shown an infrequent rate and method of use (Omotara and Padonu, 1987; Nyenwe and Osula, 1991; Oni *et al*, 1991; Babaniyi, 1991), although ORT was introduced nationwide over a decade ago and there have been intense efforts by the government at various levels (Federal, State, and Local) at promoting its use. Seeking to alter this situation requires qualitative as well as survey research among Nigeria's rich mix of ethnic, linguistic and religious groups in various regions of

the country such that the need for regional health education messages as opposed to national messages can be determined. In this context, knowledge of what mothers consider serious and deserving of attention during diarrhoea episodes can provide insights into the factors affecting treatment choice, including ORT use (Levine, 1990; Varavithiya *et al*, 1990; Malik *et al*, 1992; MacCormack and Draper, 1988; Rasheed, 1993).

During a recently concluded study of the perceptions and home-treatment practices related to diarrhoea in north eastern Nigeria (Igene *et al*, 1992), child carers, principally mothers, were asked to describe the features in under-five children with diarrhoea which are used as a basis for assessing whether the episode has become serious or dangerous. The responses form the basis for this paper in which cultural variations in perceptions of severity of diarrhoea are examined in relation to sociodemographic factors, perceptions of ORT and help-seeking practices. The findings could be of relevance to ORT programme planners not only in Nigeria but also elsewhere.

Table 1 Diarrhoea types and their signs as described by Kanuris in focus group discussions

DIARRHOEA TYPE	SIGNS
<i>Yerta kellinye</i> (Teething diarrhoea)	Greenish, foamy stools; excessive crying; weight loss; cloudy eyes; continuous stooling; preference for cold things.
<i>Yerta allaye</i> (Natural diarrhoea)	Colourless stools, sometimes whitish/greenish and foamy or oily; weight loss; fever; blood or pus-like stools at advanced stage; crying continuously.
<i>Yerta dankanama</i> (Diarrhoea due to rectal prolapse)	Weight loss; pallor; reddish anus with a protrusion; greenish stools; bloody stools passed when illness becomes critical.
<i>Yerta kukkuwu</i> (Diarrhoea due to whooping cough)	Persistent cough, vomiting and stooling; greenish stools; fever; fainting sometimes.
<i>Yerta suro de</i> (Hunger diarrhoea)	Very lean and pale; always crying; can develop <i>dankanama</i> .
<i>Yerta chambe</i> (Breast milk diarrhoea)	White, milk-like stools; weight loss; eventual death.
<i>Yerta soro zan</i> (Heat/sun diarrhoea)	Confusion; very high fever; bloody, <i>kansoye</i> greenish stools; greenish urine.

Study populations and methods

Study populations and locale

The study was conducted among the Kanuris and Buras, two of the major ethnic groups in Borno State, north-eastern Nigeria, resident in Bama and Hawul local government areas (LGAs) (target rural areas) and Maiduguri, the state capital (target urban area). Bama and Hawul LGAs were selected as rural target populations because of the relatively homogenous settlements of Kanuris and Buras in each; each of the two ethnic groups have settlements in Maiduguri. The study was conducted in Banki, Kumshe and Dar' el Ja'mal villages in Bama LGA for rural Kanuri residents and in Chuung, Shaffa, Sakwa, Kwajaffa, Yimirshika and Azare villages in Hawul LGA for rural Bura residents. In Maiduguri, the study was conducted in Gwange, Hausari, Shehuri, Mafoni, Government Reservation Area, Gomari and Maduganari wards for the Kanuris and in Gomari

airport, Kumshe, Kasuwa, Gwoza, Bolori, Wulari, and Maduganari wards for the Buras.

The Kanuris live in relatively large settlements and are mainly Moslems (Cohen, 1967); they have had only a relatively short period of contact with, and adoption of, western education and medicine. Compared to the Kanuris, the Buras live in smaller settlements and have been influenced by several decades of Christian missionary activities (Bwala, 1985), and are a mixed Christian/Moslem group. Polygamy is commonly practised by members of both ethnic groups. Farming is the main occupation in the rural areas of both ethnic groups while trading and other commercial activities are undertaken in Maiduguri, the state capital, and other LGA townships, in addition to farming.

Methods

The study was conducted from March 1993 to May 1994. Focus group dis-

cussions (FGDs) and complementary cross-sectional surveys, using structured questionnaires administered through face to face interviews, were used in data collection.

Sixteen FGDs were held, eight for members of each ethnic group, four for urban and four for rural residents. Each focus group consisted of six to eight participants of the same age (<35 years for young fathers/mothers and >35 years for older fathers/mothers and grandfathers/mothers) and sex. Each FGD lasted about 45 minutes to one hour. Facilitators and note-takers were indigenous Kanuri and Bura, fluent in the respective languages, who were postgraduates and graduates in sociology and anthropology. The agenda for the FGDs included identifying common illnesses and those having diarrhoea as a symptom or defining feature among under-five children, and discussing diarrhoea in terms of its seriousness and home-management practices, including the use of ORT and help-seeking practices.

The cross-sectional survey was conducted in the non-farming period in both urban and rural areas using a structured questionnaire, which had been validated and pre-tested and translated from English to the respective languages. Information on typology of diarrhoea illnesses, severity of diarrhoea and its management, including help-seeking, and ORT knowledge and use of the sugar salt solution (one of the home fluids recommended in the Nigerian CDD programme (Federal Ministry of Health, 1991) was elicited by using both open-ended and closed questions. For the assessment of severity signs of diarrhoea, each respondent was asked in an open-ended question to describe the features of a diarrhoeal episode which she uses to assess whether the diarrhoea has become serious or dangerous.

A multi-stage sampling technique in which each LGA was stratified successively into districts, villages and wards was used; proportional random samples of households were then drawn from the wards. A household was defined for this survey as a family unit consisting of the father, mother(s), chil-

dren, co-residing unmarried relatives and helpers (if any), and grandmother (if any). The wife or head wife (usually the first wife in a polygamous setting) was the respondent in a sampled household; the head wife is usually responsible for the supervision of domestic activities, including the care of children, in polygamous households in northern Nigeria.

Interviewers were selected from among female primary school teachers and secondary school leavers resident in, and indigenous to, the study areas and fluent in the language of the respective ethnic group; the use of female interviewers was necessary to facilitate access to households. Five interviewers were recruited and trained for each ethnic group survey per settlement.

One hundred and thirty mothers from each ethnic group in both urban and rural areas were interviewed. The sample size of 130 was calculated based on a diarrhoeal incidence rate of six episodes per child per year in northern Nigeria (Federal Ministry of Health, 1989), in order to have an adequate number of households in each group who were likely to have had diarrhoea in the two weeks preceding the survey. Verbal informed consent was obtained by explaining the objectives of the study to each respondent in her own language; only two urban Kanuri respondents declined to give consent.

Epi Info version 5 (Dean *et al*, 1990) was used in the analysis of the results of the survey data; p-values less than 0.05 for χ^2 test with Yates' correction for continuity were considered significant.

Results

An analysis of the FGDs is presented first followed by the survey data which pertain to the two ethnic groups in their rural and urban settings. The Kanuris and Buras are considered together and with marked differences in their perceptions of severity signs highlighted where present; such differences are further commented on in the discussion.

Diarrhoea was listed, without prompting, in FGDs as a frequent and dangerous illness affecting under-fives.

The types and associated signs of diarrhoea described in FGDs among the Kanuris are summarised in Table 1. Rural Kanuris were most afraid of diarrhoea associated with breast feeding by a pregnant mother (*yerta chambe*) and rectal prolapse (*dankanama*), the former because 'the child could eventually die' and the latter because it is a 'mysterious and new disease' whose cause is unknown and for which 'even the clinics have no treatment'; rural Kanuris

were further of the opinion that treatment at formal health facilities was capable of worsening the two illnesses. Furthermore, among the Kanuris, the passage of bloody stools is said to occur when diarrhoea associated with *dankanama* (rural areas) and excessive exposure to the heat of the sun (*yert soro zan kausoye*) (urban areas) become critical and some participants in the rural areas additionally noted that 'the passage of blood and pus-like stool

Table 2 Characteristics of respondents in the survey

	KANURIS		p-value	BURAS		p-value
	Urban	Rural		Urban	Rural	
Total (100%)	128	130		130	130	
Occupation:						
Trading	18.3	6.8	Total p =0.0000 df=3	16.9	1.6	Total p <0.0001
Housewives	53.2	81.8		50.8	50.4	
Farming	4.0	9.1		3.1	41.9	
Others	24.6	2.3		29.3	6.3	
Educational status:						
None	8.7	56.1	Total p <0.0001	20.8	48.5	Total p <0.0001
Kuranic	45.2	31.8		6.9	10.0	
Primary	11.1	6.8		23.1	15.4	
>Secondary	34.9	5.3		49.3	26.2	
Co-wives present	61.1	61.9	NS	55.4	57.7	NS
Christianity	4.8	5.3	NS	45.4	34.9	NS
Under-fives present	94.4	97.0	NS	77.7	93.8	<0.001
Diarrhoea recently in an under-five	47.6	53.9	NS	72.5	52.0	0.0026
ORT awareness	96.0	59.1	<0.0001	86.0	82.3	NS
Hospitals as source of ORT information*	75.2	83.1	NS	60.4	88.7	<0.0001
Recent use of ORT*	97.6	85.9	NS	91.1	85.0	NS
Would use ORT in future*	96.7	91.7	NS	93.8	97.2	NS
ORT function described*						
No idea	8.3	6.4	Total p <0.0001	11.7	1.9	Total p =0.0001
Stops diarrhoea	51.2	82.1		30.6	66.0	
Replaces water/salt						
Gives energy	25.6	11.5		47.7	20.8	
Both	14.9	0.0		9.9	11.3	
Seeks outside help in treatment of diarrhoea	93.3	97.0	NS	88.9	95.00	NS
Sources of help						
Relations/ neighbours	21.4	16.9	Total p =0.003	17.3	7.2	Total p NS
Traditional healers	7.1	9.2		14.1	8.8	
Chemists/pharmacies	7.1	33.8		12.5	14.0	
Hospitals/clinics	64.3	40.0		56.3	70.2	

Figures are given as percentages.

*Figures given on ORT use and function and source of information relate only to those respondents who claimed to be aware of ORT. p-values are for χ^2 tests; NS = not significant.

occur when *yerta allaye* (natural diarrhoea) has reached an advanced state'. No similar perceptions relating severity to diarrhoea types were found among the Buras in FGDs.

Help-seeking among rural Kanuris generally appeared to be a late event when the child with diarrhoea is 'stooling continuously and losing weight, becoming lean and pale', after the failure of home remedies, mainly herbs, which have been tried in succession. Diarrhoea was also described by rural Kanuris as making the child 'cry more and become very feverish and restless' when serious. Urban Kanuris also judged the need for help by the seriousness of the diarrhoea episode and failure of home remedies in addition to its duration, participants in FGDs noting that 'diarrhoea lasting more than two days would make a child to grow lean'.

Signs of a severe episode of diarrhoea described by the Buras in FGDs included 'frequent stooling, weakness and inability to play,' and 'a dry mouth and wrinkled skin' in addition to 'fever'. Although urban residents did not indicate waiting for diarrhoea to become severe before seeking help, some rural residents noted that they seek outside help only when the diarrhoea 'goes out of control', this being recognised as being when 'the child become weaker and has a wrinkled skin'.

The characteristics of respondents in the survey are summarised in Table 2. Approximately equal number* of respondents were aged below and above 30 years and the majority were housewives. There were more farmers among Buras in the rural areas and literacy level (Western education) was poorer among the Kanuris, especially in the rural areas. Most households were polygamous and had an under-five child and approximately half gave a positive recent history (two weeks recall period) of diarrhoea in under-fives. The majority of the respondents from both ethnic groups were aware of ORT although the order was urban > rural and Buras > Kanuris and also more Kanuris than Buras expected ORT to stop diarrhoea, an expectation which was higher in the rural areas. Respondents from both ethnic groups indicated that they usually

sought outside help in managing diarrhoea and only a small proportion seemed to rely solely on 'self-management'. Formal health facilities (hospitals, clinics, dispensaries and health centres) were a frequent source of outside help and most health-related information was learned during visits to these facilities in addition to listening to radio and television broadcasts.

Only a small proportion of respondents in the survey seemed not to have any knowledge of severity signs of diarrhoea and over half judged severity by more than one feature (Table 3); the proportion of the former was higher and that of the latter lower among the Buras irrespective of domicile. Concerns during diarrhoeal episodes varied significantly not only between urban and rural residents but also between the two ethnic groups (Table 3).

Among the Kanuris, concerns with weakness and loss of appetite were

higher in the urban areas and concern with sleeplessness/excessive crying in the rural areas. Among the Buras, rural concerns with loss of appetite was higher and, in both ethnic groups, the concerns of urban residents with dehydration and weight loss were higher. There were no significant urban-rural variations in concerns with frequent stooling and fever in either ethnic group.

The concern with weakness and inability to play was a prominent feature among the Kanuris (Table 3); no sign had a similar prominence among the Buras. Whereas concerns with appetite was of approximately equal prominence in both ethnic groups, the Kanuris were more concerned with weakness, frequent stooling, fever and sleeplessness/restlessness and excessive crying and the Buras with weight loss and presence of signs of dehydration (Table 4).

Table 3 Severity signs of diarrhoea described by respondents in the survey

	KANURIS			BURAS		
	Urban	Rural	p-value	Urban	Rural	p-value
Total (100%)	128	130		130	130	
Don't know response	1.6	8.3	0.028	24.6	13.8	0.041
More than one sign described	61.1	55.3	NS	50.0	51.5	NS
Weakness/not playing	64.3	43.9	0.0016	32.3	42.3	NS
Refusal of food/drink	33.3	18.3	0.008	16.2	42.3	<0.001
Frequent/continuous stooling	25.4	28.8	NS	12.3	13.8	NS
Sleeplessness/restlessness/excessive crying	4.8	20.5	<0.0001	3.1	9.2	0.07
Fever/hotness of body	26.2	18.9	NS	8.5	10.8	NS
Dehydration*	18.3	2.3	<0.0001	28.5	6.9	<0.0001
Weight loss/getting lean	11.9	3.8	0.027	30.0	10.8	<0.0001
Miscellaneous**	23.7†			16.2††		

Figures are given as percentages.

p-values are for χ^2 tests; NS = not significant

* Sunken eyes/fontanelle

*The figures given are average for urban/rural areas: † Kanuris: vomiting 3.9%; stomach pain 3.5%; altered stool colour, bloody stools, bloody/mucoid stools, and pale appearance, 2.7% each; loss of consciousness 1.9%; reddish anus 1.6%; showing white of the eyes 0.8%; and mucoid stools, headache, and not breathing well, 0.4% each. ††Buras: signs of shock 2.7%, dry skin 2.3%; sore mouth, vomiting and irritability, 1.9% each; thirst, change of hair; dizziness, stomach pain and refusal of drugs, 0.8% each; and straining at stool, sweating, rashes and failure of suspected measles rash to appear, 0.4% each.

4

Confounding factors and severity signs described by respondents in the survey

Of the several factors examined (education, religion, occupation, sources of information on ORT, expectations of treatment with ORT, recent history of diarrhoea in under-fives, polygamy, and presence of under-fives in the households) only a few, and these mainly among the Buras, had a significant influence on the knowledge of severity signs.

Among the Kanuris, 10.5% of those with none or only primary education versus 20.6% with a higher education ($p = 0.132$) used the presence of signs of dehydration as a measure of severity and 55.7% of those who expected ORT to stop diarrhoea versus 22.6% of those who said that it replaced lost water/salt and gave energy ($p = 0.0005$) used the presence of weakness. With the Buras, among whom almost one-fifth seemed to lack knowledge of severity signs, mothers from polygamous households were more likely to have some knowledge (27.4% of respondents without co-wives versus 12.9% with co-wives had no idea, $p = 0.0054$). Among Bura respondents who had knowledge of severity signs, 11.3% of those without western education versus 22.1% with at least a primary education ($p = 0.039$) used presence of signs of dehydration (sunken fontanelle, sunken eyes) as a severity sign, households without an under-five child were less likely to have knowledge of severity signs (51.4% of households without versus 13.9% with an under-five had no idea; $p = 0.0001$), 14.6% of those who learnt about ORT during hospital visits versus 33.3% of those who did through other sources ($p = 0.0049$) had no idea and 52.4% of those who expected ORT to stop diarrhoea versus 31.0% of those who said that it replaces water/salt ($p = 0.006$) had no idea.

Discussion

The importance of the need to become familiar with what is already existing before attempting to introduce something new, to understand what is being done in the home and why, and to give attention to 'lay health concerns', in tackling the problem of diarrhoea in

children has been addressed by Mull and Mull (1988) and Nichter (1988). Such concerns motivated this study.

The population characteristics of mothers in north eastern Nigeria is not unlike what would be found in most parts of sub-Saharan West Africa. Our results could therefore be of relevance at least across the region. That significant similarities and differences were found both within and between ethnic groups in the same region, among populations apparently exposed to the same government-sponsored messages, suggests the need for a mix of both broad-based and group-specific messages.

Urbanisation, including the ease of reception of messages broadcast in the electronic media in urban areas, could explain the rural-urban variations while the better education and longer contact with, and acceptance of, western medicine might be responsible for the better knowledge of ORT and greater tendency to help-seeking at formal health facilities shown by the Buras. Luft *et al* (1976) and Okafor (1983) have previously commented on the role of education, etc as factors in help-seeking.

Differences in education and utilization of formal health facilities were also reflected in the patterns of severity signs described by members of the two ethnic groups in their urban and rural settlements. Perhaps because the Kanuris tended to rely more on the occurrence of danger signs as prompts for help-seeking, they had a greater array of signs and were more likely to be able to describe severity signs during the survey. In contrast, some of the more objective features, such as signs of dehydration and weight loss, were more commonly described by the Buras who seemed to resort more readily to hospital-care.

Diarrhoea may not be identified as an illness by mothers unless it is accompanied by other symptoms which then act as prompts for help-seeking (Mull and Mull, 1988; Nichter, 1988). Some of the severity signs described by mothers in this study, such as fever and bloody stools, are of clinical relevance being indicative of specific problems in the child with diarrhoea (WHO, 1990), and some, such as fever and dehydration, are also correlated in clinical practice with an increased risk of death from diarrhoea (Griffin *et al*, 1988).

Table 4 Summary of important differences between Kanuris and Bura respondents

	KANURIS	BURAS	p-values
Total (100%)	258	260	
Full time housewives	67.8	50.6	0.0001
Has at least a primary education	28.8	57.0	<0.0001
Christian faith	5.1	40.2	<0.0001
Expects ORT to stop diarrhoea	63.3	47.9	<0.001
Severity signs of diarrhoea described:			
Don't know response	5.0	19.2	<0.0001
Weakness/not playing	53.9	37.3	0.002
Frequent/continuous stooling	27.1	13.1	0.001
Sleeplessness/crying excessively; restlessness	12.8	6.2	0.015
Fever/hotness of the body	22.5	9.6	0.001
Dehydration	10.1	17.7	0.017
Weight loss/getting lean	7.8	20.4	<0.0001
Miscellaneous signs	23.7	16.7	0.05

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received danger signs would indeed become dangerous if mothers were to be encouraged to use them solely as prompts for help-seeking. However, such concepts as 'ORT prevents weakness/gives energy', 'ORT replaces lost water/salt and prevents dehydration', 'ORT prevents weight loss', and 'ORT prevents loss of appetite/ORT restores lost appetite', which conforms with some of the expectations of treatment with ORT and also with the concerns expressed by mothers, can be reinforced to encourage, from the preventive point of view, the use of ORT in the appropriate home management of diarrhoea. Addressing such lay health concerns might facilitate the social marketing of ORT. However, in anticipation of the expected limitations of such a promotional strategy (Nichter, 1988), it would be necessary to clearly highlight to mothers, and other child carers, that ORT does not stop diarrhoea or treat fever as part of the health education which would be needed simultaneously to enhance the appropriate knowledge of the function of ORT in the community. Mothers' knowledge of the function of ORT was largely inappropriate in this study as has been reported in others (Shahid *et al*, 1983; Nichter, 1988; Cutts *et al*, 1988; de Swardt and Ijsselmuiden, 1989). Also, it would be necessary to stress to mothers that the appetite and strength-restoring functions etc, of ORT occurs only in children with diarrhoea or illnesses associated with diarrhoea, as other perceptions might otherwise encourage the inappropriately use of ORT (Nichter, 1988).

Whereas the range of severity signs described by mothers in this study is similar to what has been reported from other areas (MacCormack and Draper, 1988; Nichter, 1988; Ismail *et al*, 1991; Malik *et al*, 1992), the areas of emphasis have marked similarities as well as differences. The similarities include the popular use of frequency of stool motions and occurrence of fever; presence of blood in the stools, although emphasised in FGDs among the Kanuris, was not popularly expressed in the survey.

The differences are, however, more prominent. Stool characteristics and

vomiting were not popularly described as severity signs where weakness, refusal of food and drink, including drugs in some instances, and concerns with weight loss and dehydration were quite prominent; stool characteristics were used instead in the categorization of diarrhoea in the study areas (Akpede *et al*, 1994). Also, whereas dehydration, weakness and fever are viewed as causes of diarrhoea in some other communities (Malik *et al*, 1992), mothers in north eastern Nigeria instead use such features to gauge the severity. The concern with dehydration shown by mothers in this study is, perhaps, a tribute to the efforts of both governmental and non-governmental agencies and organisations in the Nigerian CDD programme and can be further built upon to promote the use of ORT.

Surprisingly, few participants in this study seemed to place emphasis on the duration of diarrhoea or on diarrhoea associated with measles as issues of concern although measles is recognised as a common and serious disease and a cause of diarrhoea in the study communities (Akpede *et al*, 1994). In clinical practice, both persistent diarrhoea and diarrhoea due to measles are known to be risk factors for subsequent ill health, including malnutrition and death (Griffin *et al*, 1988), and rural Sinhalese recognise the danger of prolonged episodes of diarrhoea (Nichter, 1988). Health education would be needed in Nigeria to sensitize child carers to the dangers of persistent diarrhoea and diarrhoea due to measles.

Acknowledgements

Financial support for this research was provided in whole by the Applied Diarrhoeal Disease Research Project at Harvard University by means of a Co-operative Agreement with US Agency for International Development.

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Helium's century

Helium, the gas lighter than air, that keeps balloons and parties afloat and makes one sound like a character from Disney, celebrates its 100th anniversary this year.

For those of us who feel that the above account of helium is the sum total of its uses, you may even be forgiven 'What else is so special about helium?' The simple answer to this simple question, is 'lots'.

Helium is the second most common element in creation, and as such accounts for one in every ten atoms in the universe. It had avoided earlier detection as it is chemically inert which means it is rarely trapped in compounds and being lighter than air, it escapes into space when released.

It is therefore not altogether surprising that helium was first discovered in space by Norman Lockyer, a civil servant from South London. Lockyer, in 1868 on pointing his hobby telescope at the sun observed a new frequency in the spectrum of the sun that did not correspond to a previously known element. Like many discoveries in science, Lockyer was ridiculed for proposing the existence of He.

Lockyer's other claims to fame include writing the first rule book on golf, he founded the Science museum in London and launched the international science journal, *Nature*, which he also edited for the first 50 years of its life.

It took a further seventeen years for a Scottish chemist, William Ramsay, who in 1885 finally confirmed the existence of helium when he discovered, on earth, the entire group of 'noble gases' ie Helium, Neon, Argon, Krypton, Xenon and Radon, The 'noble gases' occupy Group 18/VIII in the periodic table. It is Ramsay's final discovery, not Lockyer's, that is being celebrated this year writes Marcus Chow in an article for *The New Scientist* (8 April, 1995, p47).

Today, helium is used in lasers, gas-cooled nuclear reactors, deep-sea diving (to avoid the 'bends') and also in arch-welding. It is also by far the best refrigerant known to man, as it boils at -269 °C and is used to cool astronomical detectors, superconducting magnets (for example in magnetic resonance imaging body scanners) and has been crucial to the NASA space programme, where it is also used as a refrigerant in the fuel rockets.

When cooled below -275 °C, Helium becomes a supercritical fluid, possessing properties between a gas and a liquid. It can in this state flow without resistance or friction, squeeze through the smallest of openings and even run up hill! Helium also has the distinction of being the only substance that will never solidify in the universe.

Most of the helium on earth comes from the radioactive decay of heavy nuclei deep in the planets. Some concern has been expressed at the 100 million cubic metres of helium presently being used each year. It won't be long before serious efforts will have to be made in finding a new source to this ancient noble partner.

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