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Acceptability of the use of iron cooking pots to reduce anaemia in developing countries

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Abstract

Objective: To evaluate acceptability, compliance and attitude towards the use of iron pots compared with aluminium pots, for cooking in a community that traditionally did not use iron pots.
Design: Randomised trial.
Setting: Two rural Malawian villages.
Subjects: Fifty-two households received iron pots and 61 aluminium pots.
Results: Pot characteristics were assessed by a questionnaire after 3, 6, 11 and 20 weeks of use. Within households using iron pots there was a significant decrease in acceptability score with usage, from an initial value of 13.7 to 11.4 (range 1–20) ($P = 0.01$). Answers to questions concerning cooking characteristics showed that after 3 weeks' use the aluminium pot scored better, whereas after 20 weeks fewer answers differed between the iron and aluminium pot groups. Almost a third of the households planned to continue using iron pots daily after 20 weeks, although they had ready access to their former aluminium pot. The presence of a group of consistent pot users suggests that if households were convinced about daily use, then they were likely to maintain consistent use. Some householders considered that iron pots required less firewood for cooking than aluminium pots. The main problems related to lower acceptability were rusting and pot weight. About 25% of problems with iron pots were unrelated to their cast iron characteristics. Overall 23.4% of the households indicated they would buy an iron pot.
Conclusions: The low acceptability of iron pots for cooking could limit their value as an intervention to control iron-deficiency anaemia. Design modifications and better instructions on pot use should improve acceptability. The study highlights the need to assess the acceptability of interventions in order to facilitate their adoption in traditional communities.

Keywords
Iron cooking pots
Anaemia

Iron deficiency and iron-deficiency anaemia continue to be major public health problems. An estimated 3.6 billion people are iron-deficient and of these 2 billion are anaemic despite the introduction of preventive interventions[1]. The two main interventions, iron supplementation and food fortification, have various limitations related to costs, logistics and compliance[2–4].

In 1991 the World Health Organization reported on the use of iron pots for cooking as an innovative way for reducing iron-deficiency anaemia[5]. Two studies have been undertaken in children that have shown the efficacy of this approach[6,7], which, in rural communities, could offer an effective and sustainable means of combating iron-deficiency anaemia. Further evaluation is required particularly concerning acceptability and compliance. We conducted a randomised controlled trial in rural Malawian households of the effect of cooking in iron pots on haemoglobin concentration in adults and children[8]. This study demonstrated a significant improvement in the iron status of children and adults, and of mean haemoglobin values in adults[8]. Here we report the results of that part of the study which aimed to evaluate acceptability, compliance and attitudes to the use of iron pots in a community that traditionally had not previously used them.

Methods

Study site

The study was undertaken between May and November 2000 in the Shire Valley in Southern Malawi. Small-scale agriculture of maize, sorghum, cotton and sugar cane are

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the primary sources of food and income. Traditionally people used clay pots for cooking and more recently aluminium pots.

Two villages (Meja and Tsamba) were selected because of their accessibility by road, willingness of the population to participate and their appropriate size. A census showed that the villages comprised 132 households. Households were invited to participate after village meetings were held to explain the study aims.

Pot characteristics

Households who agreed to participate received either an iron or an aluminium pot. Pots were allocated using a random number selected by drawing lots. The aluminium pots were 6 litres in volume (Near East Ltd, Blantyre, Malawi) with a flat base, two insulated handles and a lid with an insulated handle. The cast iron pots had a volume of 10 litres (Falkirk size 4) and weighed 12 kg. They had a round base with three legs for standing, two side handles and a lid with a handle that were not insulated (Fig. 1). These were imported from Zimbabwe (Zimcast, Zimbabwe).

Fig. 1 Study iron pot

Assessment of pot acceptability

Participants were requested to use the pots for the daily preparation of their food. To encourage use a cooking demonstration was given in each village using the iron pot. The participating households were visited at 3, 6, 11 and 20 weeks after pot distribution by a fieldworker who interviewed the householder responsible for cooking and completed a questionnaire. The questionnaire included questions on acceptability and cooking characteristics. At 11 and 20 weeks of pot use additional information was sought (Tables 2 and 3, below). The frequency of oil use in the villages was assessed after 11 weeks of pot use since this could be a factor influencing the occurrence of rusting in iron pots. Questions were open and not pre-formulated.

The acceptability score (range 1 to 20) was determined using a beads method. Participants were asked how good the cooking pots were; one bead represented the worst possible cooking pot and 20 beads the ideal cooking pot. This method was used because of the high illiteracy rate (approximately 70%) amongst women[9]. The replacement value of the iron and aluminium pots was set at 100 Kwacha (approximately US$ 1.5), because this was an average price for a cooking pot in the area. This cost was used as an economic indicator of the willingness to buy an iron cooking pot for a 'normal' price.

Inclusion and exclusion criteria

Inclusion criteria were households that gave their consent, who were willing to participate in a trial to study the effect of the consumption of food prepared in iron pots on haemoglobin and who had their residence in Meja or Tsamba village. There were no exclusion criteria.

Sample size and statistical methods

This paper reports on pot acceptability as a component of a randomised controlled trial to study the effect of eating foods prepared in iron pots on the level of haemoglobin. The sample size was calculated to detect a difference in haemoglobin level of $10\,g\,l^{-1}$ between the two groups at 6-week follow-up. This required a sample size of 41 households per study arm, with an average of four individuals per household, to be able to detect this difference with 95% confidence and 80% power. We assumed that the difference in acceptability between the two groups (aluminium or iron pot users) would be greater than the increase in haemoglobin given the popularity of the aluminium pots and the unfamiliarity of the people with using iron pots.

Statistical analysis was based on intention to treat (whether participants had received a pot or not). We compared the two groups by use of the Wilcoxon two-sample test, Fisher's exact test and χ^2 tests.

Ethical approval was obtained from the Ethics Committee of the Liverpool School of Tropical Medicine, Liverpool, UK and the Health and Science Research Committee of the College of Medicine in Blantyre, Malawi.

Results

Of the 132 households eligible for the study, 52 households received an iron pot and 61 an aluminium pot; eight householders were not present during the distribution and were not enrolled. Eleven households refused to participate. The results of the questionnaire after 3 and 20 weeks of pot use showed that several questions with regard to acceptability differed significantly between the two groups on both occasions (Table 1).

The mean number of daily meals prepared per household per week in households using aluminium pots decreased significantly from an initial value of 3.1 to 2.5 over 17 weeks ($P = 0.01$). In the households using iron cooking pots there was no significant decrease. In the aluminium pot group the mean acceptability score of 19.9 (range 19–20) did not change significantly with time, although there was a significant increase in the mean days of use per week from an initial value of 6.5 to 6.9 (range 5–7) ($P = 0.04$). In the iron pot group the mean acceptability score decreased significantly between 3 and 20 weeks, from a initial value of 13.7 to 11.4 (range 1–20) ($P = 0.01$). This was not accompanied by a significant decrease in the mean days of use per week, which changed from an initial value of 3.4 to 3.1 (range 0–7). The percentage of households that judged the iron pots to be of good quality decreased significantly from 63% to 40% between 3 and 20 weeks ($P = 0.04$).

Answers to questions concerning cooking characteristics showed that at 3 weeks the aluminium pot already scored better (Table 1). In the aluminium group no significant changes occurred with time for answers to questions on cooking characteristics, whereas in the iron group a number of answers differed significantly with time ($P < 0.05$) (Table 1).

The additional information obtained after 11 weeks from the households that received an iron cooking pot is shown in Table 2. When asked to name the three greatest problems with iron pots there were 109 responses, of which 106 (97.2%) reported problems. Of these, 31 were not related to the characteristics of cast iron. When requested to name three positive aspects of the iron pot there were 89 responses, of which 79 reported a positive aspect. Of these 79 responses, 57 reported favourable comments related to the cooking characteristics of the pot. Several responses related to a requirement for less firewood. Many people also mentioned that iron pots quickly became hot, also implying a requirement for less firewood. The most important advantages of the iron pots were: gets hot very fast, food being easily prepared and durability. The most important problems were rusting, heaviness and the 'three legs'. Rusting was perceived as a problem significantly more frequently by aluminium pot users (56.9%) than by iron pot users (16.3%).

The percentage of households that would buy an iron pot was 17.6% for the aluminium group, and 30.2% for the

Table 1 Questionnaire answers after 3 and 20 weeks

	After 3 weeks		After 20 weeks	
Question	Aluminium	Iron	Aluminium	Iron
Response rate	60/61 (98.4)	49/52 (94.2)	52/61 (85.2)	45/52 (86.5)
Absent	1/61 (1.6)	3/52 (5.8)	9/61 (14.7)	5/52 (9.6)
Refusal to answer	0 (0)	0 (0)	0 (0)	2/52 (3.8)
General				
Can the person who cooks read a simple sentence?	5 (8.5)	5 (10.2)	3 (5.0)	4 (8.9)
Mean number of people who eat from the pot	5.7	5.0	5.6	5.0
Acceptability				
Was food prepared every day in the pot?	50 (84.7)*	17 (34.7)	50 (96.2)*	14 (31.1)
Mean number of days used last week	6.5*	3.4	6.9	3.0
Mean number of different meals prepared last week	3.1*	1.6	2.5	1.4
One kind of meal prepared in the pot	13.3*	60.5	20.8	73.1
Not good to cook in	1 (1.7)*	12 (26.7)	0 (0)*	19 (42.2)
Too heavy	1 (1.7)*	47 (100)	0 (0)*	41 (93.2)
Don't like the three legs	–	26 (55.3)	–	29 (64.4)
Would buy a replacement pot	53 (91.4)*	18 (37.5)	50 (98.0)*	15 (33.3)
Quality of the pot is good	59 (100)*	29 (63)	100	18 (40)
Size of the pot is good	44 (74.6)*	26 (57.8)	30 (57.7)	28 (63.6)
Shape of the pot is not good	1 (1.7)*	13 (28.3)	0 (0)*	21 (47.7)
There is a problem with rusting	0 (0)*	38 (84.4)	0 (0)*	36 (81.8)
Mean acceptability score	20*	13.7	19.9*	11.4
Cooking characteristics				
Takes too long before the cooking pot gets hot	1 (1.7)	5 (11.4)	0 (0)	0 (0)
Food is easily prepared in the cooking pot	59 (100)	43 (100)	52 (100)	44 (97.8)
Need too much wood to cook	0 (0)*	7 (15.9)	0 (0)	1 (2.2)
Food prepared in the cooking pot does not look good	0 (0)*	10 (23.8)	0 (0)*	4 (8.9)
Food prepared in the pot tastes good	59 (100)*	14 (33.3)	52 (100)*	35 (77.8)

Values in parentheses are percentages.
* $P < 0.05$ for difference between aluminium and iron pots.

Table 2 Information obtained on usage of iron pots at 11 weeks

Question	Most important	Moderate importance	Least important
What are the three biggest problems with the pot, in order of importance?			
Not shiny	0 (0)	1 (2.50)	2 (9.1)
Rusting	19 (40.4)	7 (17.5)	4 (18.2)
Too heavy	11 (23.4)	17 (42.5)	8 (36.4)
Three legs	8 (17.0)	5 (12.5)	3 (13.6)
Round bottom	1 (2.1)	2 (5.0)	0 (0)
Other*	5 (10.6)	8 (20)	5 (22.7)
There is no problem with the pot	3 (6.4)	0 (0)	0 (0)
Total number of responses	47 (100)	40 (100)	22 (100)
Response rate: 47/52 (90.4)			
Absent: 3/52 (5.8)			
Refusal to answer: 2/52 (3.8)			
Can you name three good things about the pot, in order of importance?			
Gets hot very fast	14 (29.2)	11 (35.5)	2 (20)
Durable	8 (16.7)	12 (38.7)	1 (10)
There is nothing good about the pot	10 (20.8)	0 (0)	0 (0)
Requires less firewood	1 (2.1)	2 (6.5)	5 (50)
The food is easily prepared in the pot	14 (29.2)	4 (12.9)	2 (20)
Other	1 (2.1)	2 (6.5)	0 (0)
Total number of responses	48 (100)	31 (100)	10 (100)
Response rate: 48/52 (92.3)			
Absent: 2/52 (3.8)			
Refusal to answer: 2/52 (3.8)			

Values in parentheses are percentages.
* Twelve of these responses were not related to cast iron characteristics.

Table 3 Additional information on the quality of the pots

	Aluminium pots	Iron pots
The quality of the pot is good because:		
Food is easily prepared	16 (31.4)	3 (16.7)
Pot is rust-free	9 (17.6)	–
Pot is durable	8 (15.7)*	10 (55.6)
Pot has a flat bottom	3 (5.9)	–
Pot gets hot faster	4 (7.8)	2 (11.1)
Pot stays hot longer	0 (0)*	3 (16.7)
Other	11 (21.6)	–
Quality of the pot is bad because:		
Design with three legs	–	1 (12)
Rusting	–	21 (84)
Other	0 (0)*	3 (12)
Response rate	51/61 (83.6)	43/52 (82.7)
Absent	10/61 (16.4)	9/52 (17.3)
The main reason why I would not buy an iron pot is because:		
Design with three legs	6 (11.8)	4 (9.3)
Too heavy	6 (11.8)	10 (23.3)
Round bottom	1 (2)	1 (2.3)
Rusting	29 (56.9)*	7 (16.3)
Other	0 (0)*	8 (18.6)
Would buy the pot	9 (17.6)	13 (30.2)
Response rate	51/61 (83.6)	43/52 (82.7)
Absent	10/61 (16.4)	9/52 (17.3)
A heavy cooking pot is not good because:		
Difficult to clean	10 (18.2)	16 (34)
Children can't use the pot	7 (12.7)	5 (10.6)
Difficult to transport	1 (1.8)	3 (6.4)
It is not a problem	37 (67.3)	23 (48.9)
Response rate	55/61 (90.2)	47/52 (90.4)
Absent	6/61 (9.8)	5/52 (9.6)

Values in parentheses are percentages.
* $P < 0.05$ for difference between aluminium and iron pot groups.

iron group. Reasons for not buying an iron pot were unrelated to cast iron characteristics for 16.7% of responses for the aluminium group and for 36.7% of responses for the iron group. For the aluminium group 1.7% always and 28.8% sometimes used oil in cooking, whereas for the iron group 1.7% always and 39.6% sometimes used oil in cooking. This difference in use of oil between households in the two groups was not significant. Oil use was not associated with pot acceptability scores or with rusting. Results related to information obtained at 20 weeks are summarised in Table 3.

Discussion

The conclusion that seems most warranted on the basis of this analysis is that the iron pots used were not an appropriate intervention as a strategy to reduce iron-deficiency anaemia in rural Malawian households due to their low acceptability.

One of the main problems related to lower acceptability was rusting. Participants mentioned this as an important obstacle to use and it was the most important reason for judging the iron pot of poor quality. In contrast, iron cooking pots are used widely in Zimbabwe and South Africa, where rusting apparently is not perceived as such a significant problem. The use of cooking oil, which might reduce rusting, did not influence acceptability score values

or the frequency with which rusting was perceived as a problem.

A potential problem related to lower acceptability of iron pots is their weight. Despite this characteristic, only 11.8% of aluminium pot users and 23.3% of iron pot users indicated that they would not buy an iron pot because of its weight. A factor that may have influenced increased acceptability of aluminium pots in this study was the good manufacturing quality, as the aluminium pots normally used in these villages were of inferior quality compared with those distributed in the study. The very high acceptability score for the study aluminium pots supports this conclusion. Some households that had received iron pots were disappointed because they had not received the perceived better-quality aluminium pot. This may have evoked a negative attitude towards the iron pots. During the initial distribution this was also noticed, as some villagers commented that iron pots were 'bad pots' so as to indicate their preference for an aluminium pot. Despite this preference people were willing to use iron pots and almost a third indicated they were willing to purchase them.

Certain customs may have influenced acceptability. For example, iron pots were sometimes soaked in water for a prolonged time after use in order to make them easier to clean. This is likely to have increased the problem of rusting. Often people left their food in the pot overnight to eat the following morning. This caused some change in colour and taste, especially of vegetables, and this was experienced as a problem. During the preliminary cooking demonstrations customary foods were prepared in the pot and there was agreement that their colour and taste were unaffected.

A number of positive conclusions can be drawn. Altogether 14 of 45 households continued to use iron pots daily after 20 weeks, despite the fact that they continued to have access to their usual aluminium pot. This rate of daily use did not change significantly over time for these consistent users. This suggests that some households, when convinced about daily pot use, are likely to maintain consistent use at least over four to five months. The observation that the iron pots required less firewood for cooking could be important since that is a key economic factor in resource-poor areas with limited firewood accessibility. It is probable that it takes some time for people to learn how best to utilise the cast iron pot in order to achieve economic use for cooking.

Altogether 17.6% of households using aluminium pots and 30.2% of those using iron pots indicated that they would purchase an iron pot at a cost of US$ 1.5. Many reasons for not buying an iron pot were unrelated to the characteristics of cast iron, suggesting that changes in iron pot design could improve utilisation. Rusting itself was mentioned significantly less frequently as the reason for not purchasing an iron pot in the iron group, suggesting that the experience of using the pot may modify perceptions on rusting and/or attitudes towards iron pot use.

To increase the acceptability of the iron pots a number of actions could be considered. The introduction of pots should be done in the absence of the parallel introduction of aluminium pots in order to reduce selection preference. Design features are critical to improve acceptability and a flat-bottomed design with no legs would be preferred. This may also require less wood as fuel. Iron pots should be introduced with clear instructions on best practice for pot use and with emphasis on their useful qualities and economic aspects. For example, their durability and the requirement of less firewood as a result of better heat retention, which could be an important marketing aspect.

This study reports for the first time on the acceptability of iron pots for cooking in rural households in a developing country. In areas where iron-deficiency anaemia is severe and where prolonged iron supplementation is impractical, more attention should be given to this iron supplementation strategy and to ways of optimising pot design for practical usage. In developing countries where contaminant iron contributes significantly to iron intake, the range of bioavailability of non-haem iron consumed can vary by more than 15-fold[10]. Because of this, the variation in efficacy will remain uncertain until the exchangeability of this form of contaminant iron is determined[10]. However, the approach may be a useful, low-cost and sustainable adjunct to the prevention and control of iron-deficiency anaemia.

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