Original Article

Factors associated with coverage of iodine deficiency disorders by control programs in an endemic area in West Sumatra, Indonesia

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In order to ascertain the coverage and to identify factors determining the success of an iodine deficiency disorders (IDD) control program in West Sumatra, Indonesia, a cross-sectional study among 495 school children aged 6–15 years in a subdistrict of an endemic goitre area was conducted. Coverage of iodine capsule distribution was 27%. Forty-eight percent of the households used iodized salt with an appropriate concentration (≥ 40 p.p.m.). Factors associated with not taking idodine capsules among children were: mother's lack of knowledge about the iodine capsule (OR 13.3, 95% CI 7.4–24.1) and mother's education level (OR 1.89, 95% CI 1.05–3.39). For unsatisfactory use of iodized salt in a household, the only predictor was family monthly income. Odds ratios and 95% CI for moderate and high family income were 2.42 (1.39–4.21) and 2.22 (1.4–3.54), respectively. We concluded that for coverage in an IDD control program, supplementation and fortification alone were not enough. Education had an impact on coverage of the supplementation. Furthermore, iodization of salt needs further improvement in relation to quality control. Finally, the program neglected high-income groups. These pitfalls should be corrected.

Key words: iodine deficiency disorders, iodine capsules, iodized salt, risk factors, West Sumatra, Indonesia.

Introduction

Nutritional deficiency is one of the main public health problems in many countries, including Indonesia.[1] Iodine deficiency disorders (IDD) are still highly prevalent throughout the entire country.[2] The effects of IDD constitute some of the most serious problems encountered during the human life cycle, including cretinism and mental retardation. Iodine deficiency disorders are not merely public health and nutrition issues, but also a major obstacle to human and economic development.[3,4]

According to a national report, the total goitre rate (TGR) in the endemic area in West Sumatra was 34% and the population at risk was 74%.[5] The main strategy in IDD control in this area has been to focus on supplementation with yearly iodine capsules in addition to fortification of kitchen salt, which commenced in 1977.[3,4] The reason for shifting from iodized injection to iodized oil capsules was mainly a lack of adequate personnel to cover the target group.[2]

There have been several studies examining the coverage of distribution of iodine capsules. These showed coverage among school children of 60 and 48.3%.[6] However, these studies did not include the coverage of iodized salt and did not identify risk factors for not being covered. The aims of this study were, therefore, to document in detail the coverage of both iodine capsules and iodized salt among school children. In addition, the study aimed to identify risk factors not addressed by the IDD control program in West Sumatra.

Materials and methods

A cross-sectional sample of 495 school children aged 6–15 years was drawn randomly from the list of pupils at the education office (51 schools) in one subdistrict of West Sumatra with high IDD prevalence (TGR > 30%), from June to September 1995. A questionnaire-based interview was undertaken by trained interviewers with the mother or guardian of each child to obtain information on socio-economic status, and availability of iodine supplementation and fortification. The questions assessing knowledge were of the yes-no type, and covered knowledge of the mother on causes of IDD (eight questions), prevention of IDD (five questions), effects of IDD (five questions), supplementation (two questions) and fortification (two questions).

A salt sample was taken from each household and assessed for iodate concentration with a rapid kit test (iodine kit, produced by Kimia Farma PLC, Jakarta, Indonesia).

Statistical analysis

The total number of correct answers for knowledge assessment was used as a knowledge score. Scores lower than four were classified as low and scores of four and above were classified as high.

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Data entry and validation were undertaken using Epi Info 5.[8] Statistical analysis was carried out with a Stata package (Stata Corporation, TX, USA).[9] Descriptive statistics and cross-tabulation were initially used. Taking school as the cluster variable, design effect and intracluster correlation were computed in estimating the level of coverage and its 95% confidence interval. The level of design effect and intracluster correlation reflects how the coverage was 'clustered' at the school level. Logistic regression[10] was then used to identify factors having an independent association with outcome. The modelling strategy followed a backward elimination procedure.

Results

Out of 495 subjects, 133 (27%) received iodine capsules within the past 6 months and 235 (48%) had appropriately iodized salt. There was a positive association between getting iodine capsules and having appropriately iodized salt (Table 1). Children having appropriate salt at home had a significantly higher rate of receiving iodine capsules in the past 6 months.

Among those who had received iodine capsules, 48% had received them at school, 19% at the Integrated Health Post Service in the village, 17% during a home visit of the cadre and the remainder at the health centre. The design effect of school on the coverage of iodine capsules was 7.7 with intracluster correlation within school of 0.331. However, as expected, iodized salt coverage was much less clustered (design effect = 1.8, intracluster correlation within school = 0.041).

Table 1. Association between coverage of iodine supplementation and fortification

Getting capsule in the past 6 months	Level of iodate in salt		
	≥ 40 p.p.m.	< 40 p.p.m.	Total
Yes	78 (33%)	55 (21%)	133 (27%)
No	157 (67%)	203 (79%)	360 (73%)
Total	235 (100%)	258 (100%)	493 (100%)

Pearson Chi^2 (1) = 8.8014, P = 0.003.

Breakdown of the coverage of the iodine capsule supplementation program is shown in Table 2 and that of appropriate salt in the kitchen is shown in Table 3. There was no difference in the coverage of supplementation between boys and girls nor among different age groups. The lower income group had the highest coverage whereas the middle income group had the lowest. Education of the parents was strongly associated with supplementation. Those with higher education had higher coverage. The association in the coverage of supplementation with family income was similar. The lower income group had the highest percentage of appropriate salt in the kitchen and the middle income group had the lowest. In contrast to the finding with supplementation, there was no association between education of the parent and availability of iodized salt in the kitchen.

Logistic regression analysis (Table 4) shows that knowledge regarding iodine capsules and mother's education were highly and significantly associated with children taking iodine capsules. Children whose mothers had low knowledge about iodine capsules were more likely not to have taken iodine capsules. In contrast, mothers' knowledge of the causes and effects of IDD had a significant negative association with child supplementation. Iodine deficiency disorder knowledge and socio-economic status did not show a statistically significant association with supplementation. Level of education of the mother was a significant determinant, even after adjustment for all groups of knowledge.

Regarding the coverage of appropriate salt, knowledge and education were not found to play a predictive role (Table 5). The only significant predictor was monthly income of the family. The lower income group was significantly better covered than the middle and high income groups.

Discussion

The enrolment rate of primary education in Sumatra has been higher than 80%. Thus, our sample was a fair representation of target children in this age group in the study area.

The coverage of the program reported in this study is not very different from that reported in previous years.[6,7] In general, the coverage has been low and needs improvement. The

Table 2. Coverage of iodine capsules by different socio-demographic variables

	Yes (%)	No (%)	Total	d.f.	Chi-squared test	*P*
Sex						
male	66 (25)	197 (75)	263	1	0.8984	0.343
female	67 (29)	165 (71)	232			
Age (years)						
< 9	33 (23)	110 (77)	143	2	1.6203	0.445
9– < 12	69 (28)	175 (72)	244			
≥ 12	30 (29)	72 (71)	102			
Family monthly income (1000 Rupiahs)						
≤ 100	54 (42)	76 (58)	130	2	22.0405	< 0.001
100–149	21 (16)	108 (84)	129			
≥ 150	57 (25)	173 (75)	230			
Mother's education						
Illiterate – primary	28 (15)	165 (85)	193	1	24.5984	< 0.001
Secondary school	105 (35)	197 (65)	302			
Father's education						
Illiterate – primary	22 (14)	137 (86)	159	1	21.3781	< 0.001
Secondary school	110 (34)	216 (66)	326			

d.f., degrees of freedom; *P*, probability.

Table 3. Coverage of appropriate iodized salt by different socio-demographic variables

	≥ 40 p.p.m. (%)	< 40 p.p.m. (%)	Total	d.f.	Chi-squared test	*P*
Family monthly income (1000 Rupiahs)						
≤ 100	81 (62)	49 (38)	130	2	14.4792	< 0.0001
100–149	54 (42)	74 (58)	128			
≥ 150	99 (48)	130 (52)	229			
Mother's education						
Illiterate – primary	91 (47)	101 (53)	192	1	0.0093	0.923
Secondary school	144 (48)	157 (52)	301			
Father's education						
Illiterate – primary	75 (47)	83 (53)	158	1	0.0300	0.862
Secondary school	157 (48)	168 (52)	325			

d.f., degrees of freedom; *P*, probability.

Table 4. Predictors for not taking iodine capsules from logistic regression

Factors	No. taking	No. not taking	Adjusted OR 95% CI[a]
Knowledge of IDD prevention			
High (≥ 4)	59	75	1
Low (< 4)	74	287	1.54 (0.76–3.14)
Knowledge of IDD causes			
High (≥ 4)	74	150	1
Low (< 4)	59	209	0.39 (0.19–0.80)**
Knowledge of IDD effect			
High (≥ 4)	5	16	1
Low (< 4)	127	346	0.27 (0.08–0.88)**
Knowledge of iodine capsules			
High (≥4)	88	56	1
Low (< 4)	43	304	13.3 (7.40–24.1) **
Mother's education			
High	105	197	1
Low	28	165	1.89 (1.05–3.39) *
Family monthly income			
Low	54	76	1
Moderate	21	108	1.76 (0.85–3.65)
High	57	173	1.02 (0.56–1.83)
Sex			
Male	66	197	1
Female	67	165	0.9 (0.5–1.5)

IDD, iodine deficiency disorder; [a]not taking vs taking; *$P < 0.05$; **$P < 0.01$. CI, confidence interval.

association between the two types of coverage may be due to their linkage with the level of activities of health personnel, which varied from one community to another. It is worrying to see that approximately 40% of the subjects were not covered by any preventive method.

Iodine capsule usage depends on the recall of the mother and the children. Iodine capsules are meant to be taken by the subject every 6 months, which is actually not a common event. Recall error might be expected to be minimal. If such an error took place at random, it would tend to bias the result toward no association.

The high design effect of iodine capsule distribution by school suggests that there are remarkable differences of coverage among schools. It is therefore necessary to focus the distribution process on the 'captive audience' at school, where quality control should be assured more easily.

The association between mother's knowledge of iodine capsules and coverage of this supplementation may be explained by recall of the mother. The independent association between education of the mother and coverage of supplementation may be explained by better access to written media by the literate mother. However, the negative association between knowledge about causes and effects of IDD with coverage of supplementation remains unexplained.

The second method of reducing IDD is to increase the availability of iodized salt in the kitchen. However, there are other sources of salt in the cooking process, such as fish sauce and soy sauce, which are not iodized. Kitchen salt is relatively cheap compared to these sauces and is likely to be more often consumed by the lower economic group. Measurement by kitchen salt sampling may underestimate fortification among the higher income groups to a greater extent than among the lower income group. Moreover, a high percentage of salt samples had low iodate content even though iodization of salt is a legal requirement in the country. The pitfalls may be in the production process, which is not fully controlled, and/or in the storage time, which may be too long to keep the iodate at the protective level.

Similar to coverage of supplementation, the lower income group had a higher percentage of having appropriate salt in

Table 5. Predictors for using non-iodized salt (< 40 p.p.m.) from logistic regression

Factors	≥ 40 p.p.m.	< 40 p.p.m.	Adjusted OR 95% CI[a]
Knowledge of IDD prevention			
High (≥ 4)	69	65	1
Low (< 4)	166	193	1.10 (0.64–1.91)
Knowledge of IDD causes			
High (≥ 4)	106	117	1
Low (< 4)	128	139	0.83 (0.51–1.35)
Knowledge of IDD effect			
High (≥ 4)	11	10	1
Low (< 4)	223	248	1.03 (0.40–2.67)
Knowledge of iodine capsule			
High (≥ 4)	116	114	1
Low (< 4)	116	142	1.11 (0.73–1.68)
Mother's education			
High	144	157	1
Low	91	101	0.81 (0.53–1.25)
Monthly income			
Low	81	49	1
Moderate	54	74	2.42 (1.39–4.21)*
High	99	130	2.22 (1.40–3.54)**
Sex			
Male	122	139	1
Female	113	119	0.86 (0.61–1.25)

IDD, iodine deficiency disorder; [a],< 40 p.p.m. vs ≥ 40 p.p.m.; *P < 0.01; **P < 0.001. CI, confidence interval.

the kitchen. Combining this fact with the expectation that this group tends to use cooking salt more often than do the higher income groups, difference in the actual coverage may be greater than that calculated. This reverse relationship between income and use of iodized salt can also be explained by the lack of an economic barrier to obtain the appropriate salt and, perhaps, the tendency of the health system to focus its nutrition programs on the poor.

We recommend that the control program should be reviewed. Supplementation through school should be further improved. Quality control of iodization of salt and knowledge of the target population should be imposed. Although the coverage among the lower income group was higher than among other groups, it was still low and more effort should be put into obtaining universal coverage in this highly endemic area.

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FAKTOR-FAKTOR YANG BERKAITAN DENGAN CAKUPAN PROGRAM PENGENDALIAN GANGGUAN AKIBAT KURANG YODIUM (GAKY) PADA SEBUAH DAERAH ENDEMIK DI SUMATERA BARAT INDONESIA

Abstrak

Telah dilakukan sebuah study cross-sectional terhadap 495 murid sekolah dengan usia 6-15 tahun, pada sebuah daerah endemik goiter, untuk memastikan cakupan dan identifikasi terhadap faktor-faktor penentu dari program pengendalian GAKY di Sumatera Barat, Indonesia.

Cakupan distribusi kapsul yodium 27%. Empat puluh delapan persen rumah tangga menggunakan yodium dengan konsentrasi yang memadai ($\geq$ 40ppm). Faktor-faktor yang berkaitan dengan tidak memakai kapsul yodium pada anak-anak: rendahnya pengetahuan ibu mengenai kapsul yodium (OR 13.3, 95% CI 7.4 - 24.1) dan tingkat pendidikan ibu (OR 1.89, 95% CI 1.05 - 3.39). Ketidak puasan dalam memakai garam yodium di rumah tangga, sebagai satu-satunya prediktor adalah pendapatan bulanan keluarga. Odds rasio dan 95% CI terhadap pendapatan menengah dan tinggi adalah 2.42 (1.39-4.21) dan 2.22 (1.4-3.54).

Kami menyimpulkan bahwa untuk meningkatkan cakupan dalam program pengendalian GAKY, suplementasi dan fortifikasi saja tidak cukup. Pendidikan juga mempunyai dampak yang besar terhadap cakupan suplementasi. Juga, diperlukan pengendalian kualitas yodisasi garam dapur yang baik. Akhirnya diakui bahwa program mengabaikan kelompok dengan tingkat pendapatan yang tinggi. Kekurangan ini harus diperbaiki.

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在印度尼西亞的Sumatra 西部缺碘症流行地區控制碘缺乏症措施的普及率和有關的因素

摘要

爲了查明 Sumatra 西部控制缺碘症措施的普及率和促使控制缺碘症措施成功的有關因素，我們在甲狀腺腫大流行區 調查了495名學齡兒童(6-15歲)。

碘膠囊的分發率是27%，有48%的家庭使用含有適當碘濃度(>=40ppm)的碘鹽。兒童没能服用碘膠囊的原因是: 母親對碘膠囊的認識不足(OR=13.3, 95% CI: 7.4-24.1)和母親的受教育水平低(OR=1.89, 95% CI: 10.5-3.39)。家庭未能使用足夠的碘鹽的唯一指征是家庭的月收入。中等和高家庭月收入的OR和95% CI 分別爲: 2.24(1.39-4.21) 和 2.22 (1.4-3.54)。

我們認爲控制缺碘症措施的普及率，碘補充和强化的實施在Sumatra 西部仍不足。教育對控制缺碘症措施的普及率有很大的影響。碘鹽化需要質量控制來改善。控制缺碘症措施 忽視了高收入家庭，這一缺陷應給與糾正。

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